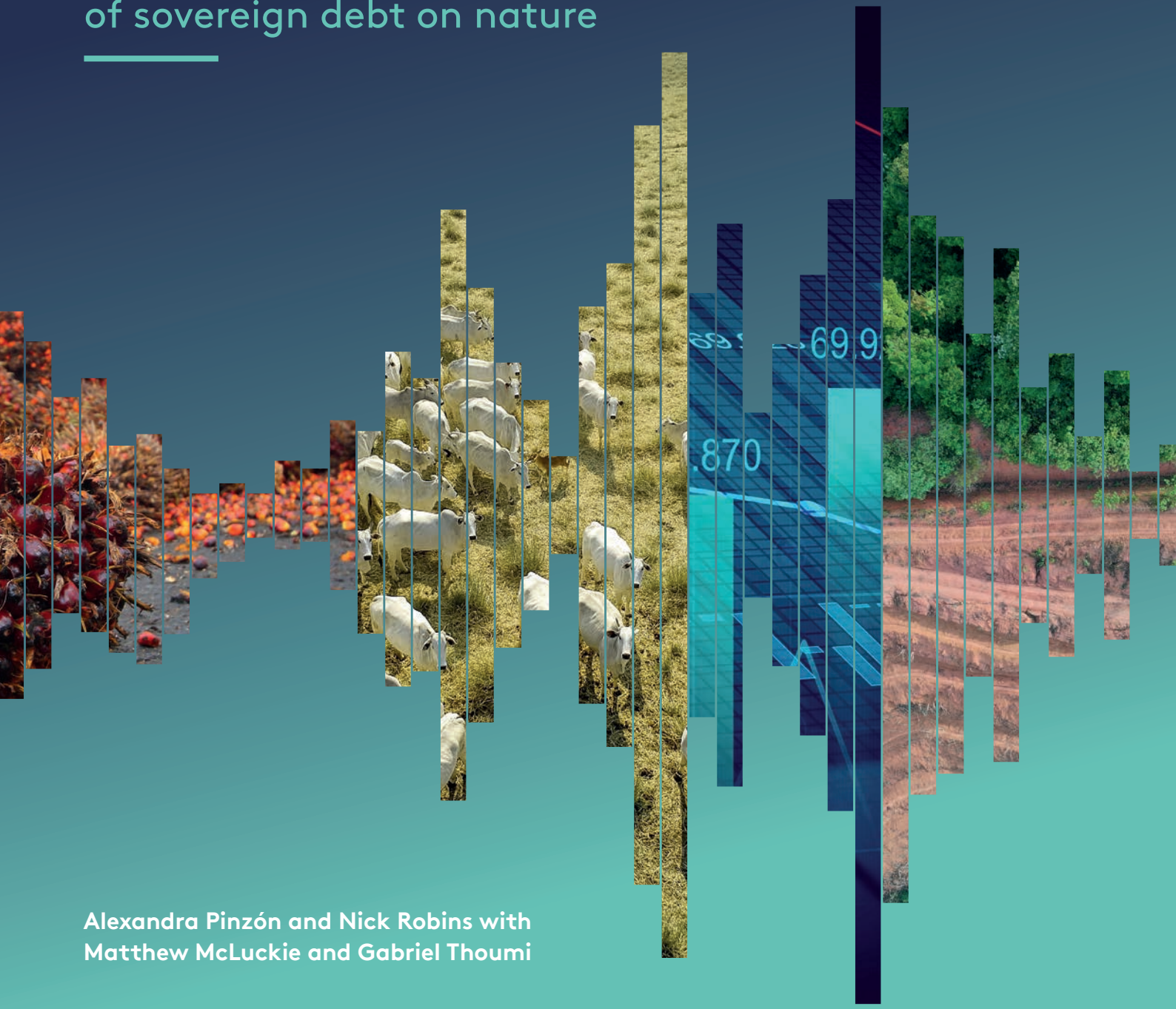
The sovereign transition to sustainability

Understanding the dependence of sovereign debt on nature



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Contents

Executive summary

KEY MESSAGES

- In the 2020s sovereign bonds will face the strategic challenge of achieving alignment with the Sustainable Development Goals.
- Agriculture and the soft commodity trade are heavily linked to natural capital, as drivers of depletion and as processes reliant on a secure stream of ecosystem services.
- The value of sovereign bonds relies in part on the management of natural capital by the countries concerned. However, this dependency is still largely ignored or mispriced in sovereign bond markets.
- Pressures to achieve alignment between sovereign bonds and environmental sustainability are set to intensify in the decade ahead, with increasing focus on sovereign bonds as an asset class which connects macro-economic performance and capital markets.
- To enable analysts to integrate the value of natural capital into the issuance, analysis and stewardship of sovereign bonds, we have developed a new research framework. This identifies Argentina and Brazil as the G20 countries most dependent on natural capital for their exports.
- We estimate that 28 per cent of Argentina's sovereign bonds and 34 per cent of Brazil's sovereign bonds will be exposed to an anticipated tightening of climate and anti-deforestation policy in the 2020s, while 44 per cent and 22 per cent of their sovereign bonds, respectively, are exposed to changes in policy after 2030.
- Sovereign bond issuers face a choice: either following a High Road scenario where countries actively protect and enhance the benefits of natural capital and reinforce the environmental fundamentals of sovereign bonds, or a Low Road scenario where business-as-usual undermines flows of ecosystem services, increases vulnerability to natural disasters and intensifies market risks.
- For sovereign bonds to develop the required resilience in the disruptive decade that lies ahead, decisive action is needed from issuers, investors, credit rating agencies and international institutions, as well as researchers and civil society, to ensure the full value of nature is incorporated.

The 2020s: a decisive decade for sovereign bonds and sustainability

Sovereign bonds are one of the largest asset classes with an outstanding global value of US$66 trillion. They are also one of the most systemic asset classes: sovereign bonds capture a range of macro-economic factors, influence broader capital market pricing and system stability and are core holdings for financial institutions. Institutional investors and credit rating agencies are deepening their focus on the link between sovereign bond performance and environmental, social and governance (ESG) criteria. Academic literature is starting to highlight the key relationships between ESG considerations, climate policy and sovereign debt, and the market for sovereign *green* bonds is growing.

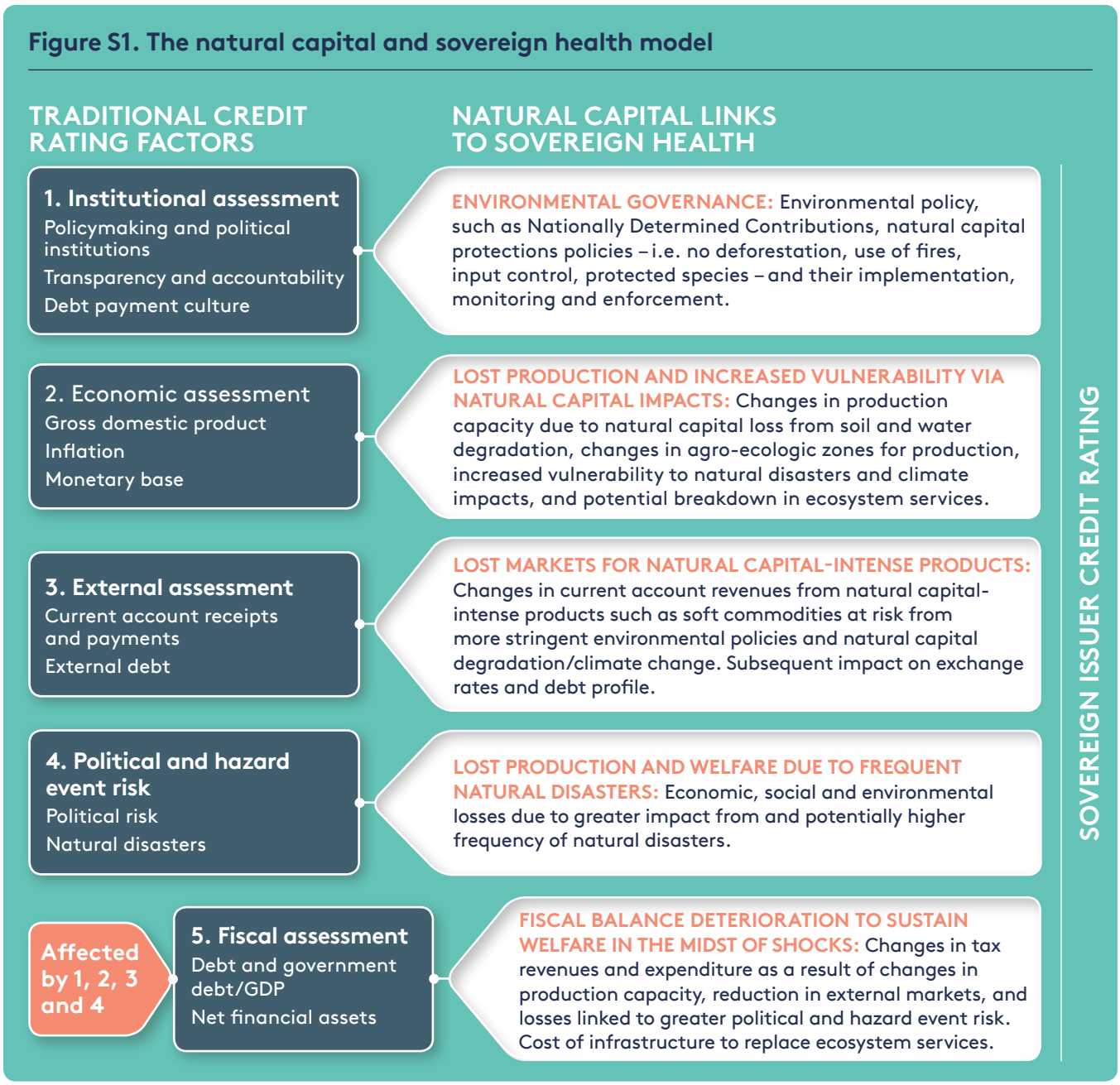
The consideration of ESG factors in sovereign bonds is set to experience a step-change in the coming decade. 2030 is the deadline for the achievement of the Sustainable Development Goals (SDGs), as well as for cutting global greenhouse gas emissions by 45 per cent from 2010 levels to meet the Paris Agreement temperature target. While private sector action is vital for reducing natural capital loss, companies and their investors alone cannot address these risks without active government support.

Governments will play a critical role in the transition to a sustainable economy, by setting whole-economy policy frameworks, and by deploying public finance, which is where the issuance of public debt through sovereign bonds becomes crucial. The task ahead is for countries to achieve 'sovereign health', which we define as their capacity to issue debt and repay it in a manner consistent with achieving the SDGs. This means recognising and valuing the fundamental dependencies of sovereign bonds on natural capital, which are currently

Sovereign health: *The capacity of countries to issue debt and repay it in a manner consistent with achieving the Sustainable Development Goals*

Natural capital: *The stock of renewable and non-renewable assets from which humans derive benefits through ecosystem services*

Figure S1. The natural capital and sovereign health model



Source: Authors

ignored and mispriced, thereby storing up instabilities in the future.

Focusing on the linkages between sovereign bonds and ecosystem services from land

To better understand the strategic case for the structural incorporation of natural capital into the issuance, assessment and stewardship of sovereign bonds, we focus on a hitherto ignored aspect: the importance for sovereign bonds of reliable flows of ecosystem services from land.

In the past, countries with abundant natural capital have often increased agricultural production at the expense of environmental quality (for example, through deforestation). This practice risks damaging the flow of vital ecosystem services such as clean water and flood regulation, increasing the vulnerability to climate risks and raising the likelihood of asset-stranding as a transition is made towards a sustainable economy. For sovereign bonds, the crystallisation of these risks could lead to higher borrowing costs, impairments in credit quality and reductions in their access to finance.

We expect the interconnectedness of the nature conservation and climate change agendas to gain increasing traction among sovereign bond investors. The investor-led Inevitable Policy Response (IPR) initiative, for example, forecasts an abrupt intensification of climate policies from the early 2020s onwards, and a range of new policies,

including effective carbon markets that incentivise ambitious policies that end deforestation by 2030.

Assessing natural capital and sovereign health linked to soft commodities in the G20

For sovereign bonds, the task is to understand how natural capital factors can be incorporated into core analytical models. We have done this by building on traditional credit rating frameworks used for evaluating sovereign bonds to identify the chain of impact between natural capital and five key types of factor: institutional, economic, external, political/hazard event risk and fiscal. The framework is set out in Figure S1 (p5), highlighting the potentially material natural capital elements.

We used this framework to assess the natural capital performance of G20 countries, focusing particularly on land and climate change. From this, we identify Argentina and Brazil as the two G20 countries most dependent on natural capital for their exports (see Table 1 for summary). It is estimated that between 2005 and 2013 cattle ranching drove 72 per cent and soy production 10 per cent of deforestation in Argentina; for Brazil cattle ranching drove 46 per cent and soy 33 per cent of deforestation.

Table S1. Sovereign health and natural capital assessment for Argentina and Brazil

	ARGENTINA	BRAZIL
1. Institutional assessment	**Environmental governance:** Yale Environmental Performance Index ranking of 74 out of 180, Climate Action Tracker defines NDC highly insufficient, native forest loss 3 million-plus hectares from 2007–17, with 24% deforestation in high and medium conservation value forest. Deforestation linked to cattle and soy.	**Environmental governance:** Environmental Performance Index ranking of 69 out of 180, Climate Action Tracker defines NDC as insufficient, Amazon deforestation of around 9 million hectares from 2007–18, Cerrado deforestation of 12 million-plus hectares. Deforestation linked to cattle and soy. Forest Code developed, full implementation needed.
2. Economic assessment	**Lost production via natural capital impacts:** 0.1% annual soybean production loss associated with soil degradation-induced yield reductions, equivalent to approx. US$13.7 million. Significantly higher at full agricultural level.	**Lost production via natural capital impacts:** Literature predicts a potential 33% reduction in soybean yield by 2050 and a potential 6% reduction in Mato Grosso's soybean production under ongoing deforestation scenarios. Between 0.06% and 0.1% of soy production value at risk from soil degradation.
3. External assessment	**Lost markets for natural-capital-intense products:** 4.8% of Argentina's soy exports and 0.18% of beef exports could be at risk from more stringent deforestation policy with a potential global market loss under deforestation bans.	**Lost markets for natural-capital-intense products:** Around 9% of Brazilian soy exports (by value) are at risk from the impacts of deforestation or other natural capital conversion.
4. Hazard event risk	**Lost production and welfare impacts due to frequent natural disasters:** US$3.9 billion harvest loss due to drought in 2017–18 season. Floods with a loss of US$1.7 billion in 2017 and US$2 billion in 2019. Drought in 2018 caused a reduction of 0.85% GDP.	**Lost production and welfare impacts due to frequent natural disasters:** 20% of gross agricultural production value under long-term droughts in the North East. Reduction in yields after floods. Losses of US$9 billion/year due to natural disasters.
5. Fiscal assessment	**Fiscal balance deterioration to sustain welfare in the midst of shocks:** US$1.7 billion government revenue estimated at risk under zero-deforestation international trade. US$1.7 billion in tax revenue lost due to 2018 drought.	**Fiscal balance deterioration to sustain welfare in the midst of shocks:** Agricultural production loss brings government revenues equivalent to 18% of production value, which can be lost proportionally with reduced production. Reduction of 33% in soybean yield in Mato Grosso (in a high deforestation scenario) could cause a loss equivalent to 0.1% of federal tax receipts.

Note: NDC = nationally determined contribution [to the Paris Agreement].
Source: Authors

As soy production follows and displaces cattle ranching, their related natural capital losses go hand in hand.

Ongoing natural capital depletion will bring production risks for these two countries. Deforestation and current management systems are expected to cause reductions in agricultural yield via changes in rainfall driven by both local land use change and global climate change, degradation of soil quality and fertility, reductions in biodiversity and increased exposure to natural disasters. These risks have economic and fiscal impacts that will affect the countries' risk profiles, cost of capital and access to international commodity and financial markets.

Preventing and reversing natural capital loss driven by the production of soft commodities (agricultural, forestry and fishery products) will benefit sovereign bond issuers through two channels: first, by maintaining and enhancing the flow of ecosystem services such as soil fertility, clean water and flood regulation, which sustain internal production capacity while increasing ecosystem resilience; and second, by positioning sovereign bond issuers to benefit from anticipated changes in international policy aiming to preserve natural capital. Both channels will improve the economic performance, credit profile and debt-paying capacity of these countries.

Countries dependent on natural capital face a strategic choice

Sovereign bond issuers dependent on natural capital, such as Argentina and Brazil, face two distinct choices:

1. *The first option is a 'High Road' scenario, where countries actively protect and enhance the benefits that natural capital brings to their economies*. This will underpin the long-term value of their sovereign bonds, building resilience against both the physical impacts of climate change and disruptive changes in policy and market preferences. Ultimately, such a transition will also secure long-term access to the finance these countries require to pursue their sustainable development goals.
2. *The second option is a 'Low Road' scenario, where a continuation with current practices undermines flows of ecosystem services, increases vulnerability to natural disasters and intensifies market risks*. Natural-capital-dependent countries that take this path would face reduced access to export markets that scrutinise environmental performance in terms of consumer preferences and trade policy. They could also miss out on significant opportunities from the shift to a sustainable global economy in terms of the prospect of international payments via carbon markets. These risks will be increasingly evaluated by sovereign bond investors and incorporated into pricing.

Recommendations for decisive action and next steps

This is a first framework for understanding the links between sovereign bonds and natural capital, focusing on the ecosystem services that support major soft commodity producers. Considerable further work is needed within affected countries and internationally. To realise the potential of the High Road scenario for sovereign bonds, the following key players need to take decisive action:

Governments/sovereign issuers

- *Governments should strengthen their institutional framework to align it with the management and regeneration of natural capital*. Policies should be accompanied by consistent monitoring and enforcement, as well as sufficient fiscal support.
- *Governments should issue green sovereign bonds that raise funds for investment in natural capital that endures over the long term*. There is currently unmet domestic and international investor demand for well-designed green sovereign bonds.

Investors

- *Investors should strengthen their analytical framework to better identify the relationships between sovereign issuers' natural capital and their future debt-paying capacity*. In particular, investors should recognise instances where incentives for economic performance today are jeopardising their future sovereign health.
- *Investors should enhance their stewardship role with regard to sovereign bonds in their portfolios, particularly those issued by high natural-capital-stock countries*. Engagement with the issuers of sovereign bonds on natural capital performance can help to signal the materiality of natural capital factors and identify the key data points requiring disclosure. In contrast to corporates, there is currently no consistent framework for sovereign issuers to report their climate or wider natural capital positioning or performance.

Credit rating agencies

- *Credit rating agencies should explicitly incorporate the links between the health of natural capital and the outlook for*

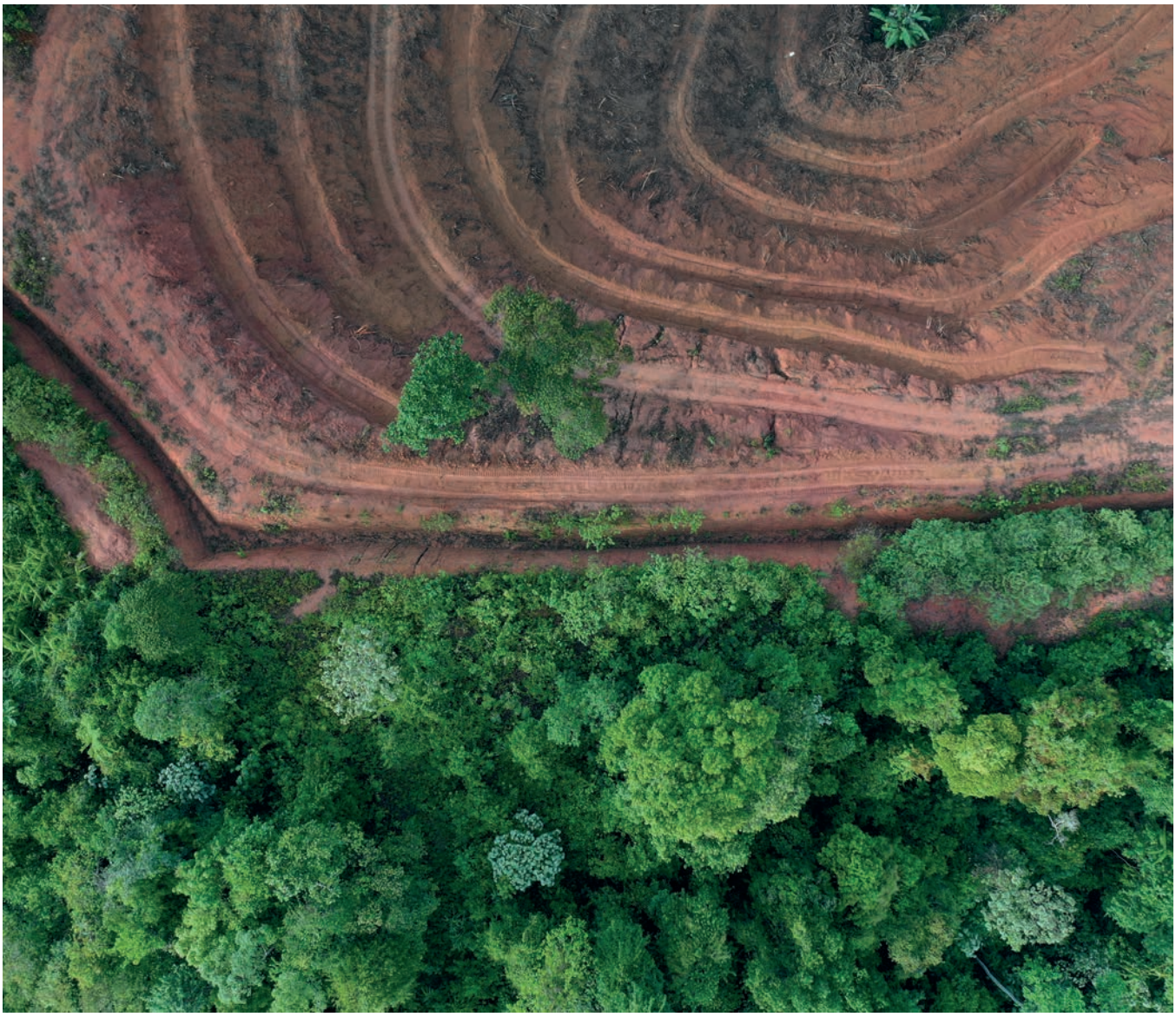
sovereign credit ratings. Incorporation of natural capital factors is of particular relevance given the increasing role that environmental sustainability will play in economic development, exports and fiscal performance.

International financial institutions and coalitions

- *Multilateral development banks (MDBs) should incorporate natural capital factors in their work, building on experience with the integration of climate change*. MDBs can be an important source of both finance and strategic expertise for natural-capital-dependent economies. They can provide finance for country-driven action to invest in natural capital, as well as technical assistance in the integration of natural capital factors in government budgeting and sovereign debt issuance.
- *International institutions charged with overseeing the stability and functioning of the financial system should broaden their scope to include natural capital factors*. The International Monetary Fund and Financial Stability Board have started work to evaluate the implications of climate change for their operations; this could be extended to the wider issues of biodiversity and natural capital. Coalitions such as the Network for Greening the Financial System could also explore the role of central banks and supervisors in incorporating natural capital in sovereign bond risk analysis, not least in their own portfolios.

Researchers

- *Researchers in government agencies, universities and civil society can build on the findings presented here to deepen the understanding of the dynamics between sovereign bonds and nature*. Within the rich agenda for future research there is a need to conduct analysis in other countries and examine other dimensions of the links between natural capital and sovereign bonds.



1. Introduction

The transition to sustainability is the strategic challenge sovereign bonds face in the 2020s. Overcoming this challenge requires that the financial system recognises the fundamental economic dependencies on nature, which are currently ignored and mispriced, storing up instabilities for the future.

Sovereign health: *The capacity of countries to issue debt and repay it in a manner consistent with achieving the Sustainable Development Goals*

Natural capital: *The stock of renewable and non-renewable assets from which humans derive benefits through ecosystem services*

Soft commodities: *Internationally traded agricultural and forestry products, such as soy, cotton, coffee, pulp and paper, beef and palm oil, that cannot be stored for long periods of time, unlike hard commodities such as gold, silver and aluminium*

This report examines the case for the structural inclusion of natural capital into the issuance, assessment and stewardship of sovereign bonds. We make this case by focusing on a hitherto overlooked aspect: the importance for sovereign bonds of reliable flows of ecosystem services from land. How successfully the world transitions to a sustainable economy will impact on countries that rely on land-based natural capital for their economy.

We provide an analytical framework for evaluating the chain of impact between natural capital factors and the health of sovereign bonds. This analytical framework helps support the case for urging key players in the sovereign bond space to look at these risks in more detail. We focus on the G20 and provide the case studies of Argentina and Brazil, as countries with high dependency on soft-commodity exports and high natural capital stocks.

The report is the first in a series that will aim to understand the relationship between natural capital and the future prospects for sovereign bonds. It is a *first step* in mapping areas of risk for sovereigns dependent on soft commodities for their economic success. It is not intended to be a final or detailed economic assessment of those risks or their interactions. We anticipate this report will encourage stakeholders in the sovereign bond market to analyse further alternatives to assess and incorporate natural capital into their decision-making.

Natural capital and sovereign debt investing – what are credit rating agencies and investor groups doing already?

Sovereign bonds are one of the largest asset classes in the financial system, with an outstanding value of US$66 trillion in international debt securities (PRI, 2019a). Sovereign debt securities operate as a benchmark for other issuers and, in some geographies, sovereign debt constitutes the most liquid security. These securities, particularly when issued by developed economies, are also a reference for safety in international capital markets.

The relationship between natural capital and the performance of sovereign bonds is rising rapidly up the investor agenda. From issuers through credit rating agencies to asset managers and asset owners, a range of strategies is being deployed to incorporate environmental, social and governance (ESG) factors into the analysis, selection and stewardship of sovereign bonds. To date, understanding the impact of environmental factors on the cost of sovereign debt has focused on the physical risks associated with climate change, highlighting that vulnerability to climate change has a positive and significant effect on sovereign bond yields.

Credit rating agencies

So far efforts from credit rating agencies have centred on the transmission channels between ESG factors and sovereign creditworthiness. Moody's, for example, has examined the physical climate risks for vulnerable nations and the transition risks for exporters of oil and gas (Moody's Investor Service, 2018). Credit rating agencies are starting to conduct ESG appraisals and outlooks at the country level. S&P Global has produced an ESG Risk Atlas that examines a broader set of factors at the country level (S&P Global, 2019). Furthermore, there are intensifying efforts to mainstream ESG analysis into sovereign credit ratings. However, these assessments have not yet addressed natural capital in a systematic way, particularly in terms of how ongoing natural capital loss and the transition to a sustainable economy will impact countries that rely on land-based natural capital for their prosperity. Exploring how to fill this gap is the focus of this report.

Investment managers and investors

A growing number of investment managers are also exploring the linkages. For example, Verisk Maplecroft and BlueBay Asset Management (2019) have published research highlighting that markets are not yet pricing environmental or climate change risks into sovereign bonds. In fact, they find, markets seem to incentivise economic expansion at the expense of natural capital in those countries with higher natural resource stocks (ibid). Hermes Asset Management has published analysis, aligning with existing literature, that points to the relevance of governance to explain sovereign credit default swap

Box 1.1. From the literature: Environmental, social and governance factors and sovereign risk

Below are examples of academic articles that assess the relationship between environmental, social and governance (ESG) considerations and sovereign debt or between climate policy and sovereign debt. This is a relatively recent area of research and for this reason the literature is currently limited.

Borrowing costs: Crifo et al. (2017) have examined if extra-financial performance matters for sovereign bonds markets across 23 OECD countries. They used rating and research agency Vigeo Eiris's sustainability country ratings as the main independent variable to try to identify the relationship between ESG factors and sovereign yields, plus control variables including economic and environmental indicators from the World Bank and from S&P's credit ratings. Their results show that high ESG ratings are associated with lower borrowing costs, but the effect of the ESG ratings on sovereign borrowing costs is about three times weaker than the effect of financial ratings. They conclude that while extra-financial information plays a role in investors' assessment of risk, they use it as a supplement to financial information.

Sovereign spreads: Capelle-Blancard et al. (2017) have analysed the extent to which ESG performance affects sovereign bond spreads for 20 OECD countries. They find that country ESG performance is significantly and negatively related to sovereign bond spreads, meaning that better ESG performance is associated with lower risk and borrowing costs. They conclude that the relationship between country ESG performance and long-term sovereign bonds spreads is stronger than between a country's ESG performance and short-term bonds spreads. When differentiating impact from various ESG dimensions, governance appears to have a stronger financial impact than social criteria, and environmental performance seems to have no impact.

Performance: Battiston and Monasterolo (2019) have presented a modular approach to the assessment of climate risks and opportunities and their impact on the default probability of investors' portfolios, focusing on the energy sector. They consider the impact of climate policy scenarios on countries' debt to GDP ratio, expected economic growth and the value of 10-year sovereign bond spreads and sovereign bond value. They apply their analysis to the sovereign bond portfolio of the Austrian central bank with securities issued by OECD countries. The largest negative shocks on individual sovereign bonds correspond to Australia and Norway, given the relevance of fossil fuels for their gross value added and the projections from climate models regarding the future participation of this sector. The greatest positive shocks correspond to Austria and Southern Europe due to their larger share of renewable energy in their gross value added and the forecast trends for this market under specific climate scenarios. Countries with a high share of nuclear energy do not show positive impacts due to the expected large contribution of nuclear under all climate policy forecasts considered. Latin American sovereign bond values would be negatively impacted by climate policy shocks, with the extent of the impact varying by issuer.

(CDS) spreads, while social and environmental factors are apparently not yet incorporated into market pricing of sovereign credit risk through the social (Reznick et al., 2019). Most recently, BlackRock published its proposed ESG analysis for sovereign debt, where extreme weather and natural capital depletion feature among the environmental indicators; and control of corruption, regulatory quality and rule of law are included among the governance indicators (BlackRock, 2019).

Investors have been exploring the links between credit, sustainability and investment for the past few years, notably under the leadership of the UN-backed Principles for Responsible Investment (PRI) and its credit risk and ratings initiative that aims to incorporate ESG factors into credit ratings. This work recognises that ESG factors and risks related to resource management can affect countries' tax levels, trade balance and foreign investment and highlights the commitment of credit rating agencies to evaluating the credit relevance of ESG factors for different issuers. The PRI has published rating agencies' views on the ways ESG factors are incorporated into credit ratings and updating this integration as their understanding evolves, maintaining resources to deliver high quality ratings, and participating in industry efforts to incorporate ESG factors into credit ratings and into dialogues with investors to identify the role of these factors in creditworthiness (PRI, 2019c).

The PRI has also issued a guide, building on the research described above, outlining the strategic agenda for the integration of ESG considerations into sovereign debt analysis (PRI, 2019a). In the guide, the PRI highlights the need for investors to consider time horizons and materiality as well as the resilience sovereign issuers may have to withstand environmental, social or other external shocks. It recommends that investors undertake in-house country-level research and develop materiality frameworks that can highlight red flags and define the need and process for engagement. While investors in sovereign bonds consider some ESG metrics in their research, ESG integration is yet to be systematically applied in investment analysis for this asset class (PRI, 2019a).

The World Bank recently launched its Sovereign ESG Data Portal to help investors align ESG analysis with sustainable development policy indicators, increase data transparency and support private

sector investments in emerging markets and developing countries (World Bank, 2019). The links between environmental performance and sovereign credit risks are emerging in the academic literature as well (see Box 1.1.), pointing to governance as an important factor to reduce sovereign bond risk.

Natural capital: an emerging interest for sovereign investors

The links between the state of natural capital and responsible investment are now highly visible, notably with investors' focus on the implications of deforestation. Following fires across the Amazon Rainforest in 2019, 246 investors representing approximately US$17.5 trillion in assets signed a statement on deforestation and forest fires (PRI, 2019b). The statement asks investee companies to increase their efforts in eliminating deforestation from their supply chains, including disclosure and implementation of zero-deforestation policies, assessing and minimising deforestation risks in their operations, establishing transparent monitoring systems and reporting on the management of their deforestation risk. Some investors such as Nordea have indicated that they will extend their focus on deforestation to their sovereign bond holdings by quarantining Brazilian government bond purchases and revising existing holdings.

Globally, the green bond market has been expanding strongly and by July 2019, 12 countries had issued green sovereign bonds. This market provides an important opportunity for issuers to raise funds that are specifically linked to their sustainability agenda.

Structure of the report

In Chapter 2 we set out how natural capital is related to the macroeconomic performance of sovereign issuers, which in turn contributes to sovereign debt repayment ability. We also provide an assessment of G20 countries, to identify countries with material exposure to land-based natural capital. Chapters 3 and 4 present case studies of Argentina and Brazil – the two G20 countries that have the most nature-dependent exports. Chapter 5 closes the report with conclusions and policy recommendations for stakeholders across the sovereign bond system. Data on natural capital in the G20 and risks that threaten its health are provided in the Appendix.

2. Natural capital and the sovereign health model

SUMMARY POINTS

- We present a 5-step model linking environmental factors to the components of sovereign credit risk assessments: governance, economic, external, political and hazard event risk, and fiscal assessments.
- While the production and trade of soft commodities bring significant global economic and social benefits, they are directly causing natural capital losses that will reduce countries' future internal capacity to produce soft commodities, with negative impacts on their economic performance and sovereign credit quality.
- Institutional, economic, external and hazard event risks can either promote or hinder sustainable development goals. These factors are also affected by natural capital and ecosystem services via demand shocks such as sustainable trade efforts, and production shocks such as reduction in water and soil quality and biodiversity.
- In the G20, Indonesia has the highest land use change emissions, followed by Brazil, then Argentina. Argentina has the highest natural capital export dependency, followed by Brazil, then Indonesia.

The impact of agriculture and soft commodity trading on natural capital

Natural capital is the stock of renewable and non-renewable resources that combine to yield a flow of benefits to people (Natural Capital Coalition, 2019). These benefits are known as ecosystem services. The Economics of Ecosystem Services and Biodiversity (TEEB) initiative defines four categories of these services: provisioning services (such as food and raw materials), regulating services (regulating local climate and air quality, for example), habitat or supporting services (providing habitats and maintaining genetic diversity), and cultural services (such as space for leisure). We exclude cultural ecosystem services from our analysis due to their less direct relationship with economic factors.

Agriculture is now one of the leading causes of natural capital deterioration. Around 73 per cent of deforestation in tropical and subtropical countries between 2000 and 2010 was associated with agriculture (FAO, 2016). While agricultural expansion can generate significant economic benefits, when unmanaged it comes with a huge environmental cost. Not least, deforestation is the second leading source of greenhouse gas emissions after fossil fuel combustion, releasing an estimated 20–24 per cent of global emissions in 2010 (FAO, 2018).

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, in its global assessment of biodiversity, highlights that 77 per cent of the land surface area has been significantly altered and more than 85 per cent of the wetlands area lost (IPBES, 2019). Biodiversity loss in agriculture is making agricultural systems less resilient to climate change, pests and pathogens. For terrestrial and freshwater ecosystems, land use is the largest driver of impact, with agricultural expansion being the most significant form of land-use change (ibid).

The agricultural sector has expanded alongside the trade of soft commodities. Countries whose economies are significantly reliant on soft commodities that are exposed to natural capital risks may face future reductions in soft commodity production capacity, with knock-on effects on exports, government revenues and employment. All these risks are captured by sovereign debt. In certain circumstances, a higher risk of natural hazard events may lead to an increase in government expenditure because of the need to absorb the consequent losses for citizens and for the economy. Furthermore, the link between natural capital deterioration and soft commodity production can affect countries' future access to markets as the transition to a sustainable global economy accelerates.

Domestic and macroeconomic impacts of the impairment of natural capital

It follows that natural capital deterioration should have impacts on the factors assessed by credit rating agencies. We focus on the soft commodities produced by the

agricultural sector, as their dependency on healthy natural capital is direct. Soft commodities are a direct outcome of provisioning services (raw materials), but their current and future production relies heavily on regulation services, such as climate and hydrological regulation, maintenance of soil fertility and pollination.

Examples of expected future impacts from natural capital deterioration at the sovereign level include changes in the location and extent of agro-ecological zones suitable for agricultural and soft commodity production, and reductions in yields due to worsening soil and climatic conditions, as well as increased frequency of natural disasters, such as floods and droughts. A weakened agricultural sector and soft commodity production and trade will impact the sovereign issuer's ability to produce soft commodities, affecting macroeconomic performance.

At the international level, changes in demand and more scrutiny of the environmental footprint of trade can restrict the sovereign issuer's access to external markets, with consequences for their current account performance and external debt profile. These factors could reduce the sovereign issuer's ability to produce and trade commodities, which reduces tax revenue. In some circumstances, these changes may even induce parallel increases in government expenditure to compensate for economic and social welfare losses.

Without strategies to manage risks emerging from further natural capital loss at the local and global levels, sovereign issuers' exposure to hazard event risks will be heightened. All of these shocks will then impact on production, growth and exports, with negative effects on government revenues and expenditure. Weakened fiscal performance will increase these countries' sovereign credit risk.

Balancing natural capital, agriculture and societal welfare

Notwithstanding the environmental risks and natural capital loss caused by agricultural expansion, the sector is vital to many countries across the world. Thus there are development trade-offs to consider, which are within the scope of a sovereign issuer's decision-making. Countries that are strongly endowed with natural capital are at a crossroads in their development journey. The issue of natural capital loss is hugely complex since international pressures to conserve natural capital emerge from its global relevance – take the example of the Amazon Rainforest and the impact of its destruction on global temperatures. The preservation of natural capital is increasingly being demonstrated as critical for the long-term welfare of societies within high natural-capital-stock countries too. Therefore this is not only an international issue; addressing risks to natural capital requires the proactive engagement of the governments in these countries as part of their mandate to prioritise the welfare of their people, with their citizens being the primary stakeholders.

National governments and international stakeholders must carry out further analysis of the implications of balancing the risks emerging from ongoing natural capital deterioration with the benefits of additional agricultural expansion. This understanding is critical for incentivising countries to take the best decisions for both domestic and global welfare purposes.

Assessing sovereign health: setting out the model

We define 'sovereign health' as the capacity of countries to issue debt and repay it in alignment with the Sustainable Development Goals (SDGs). Alignment with the SDGs benefits sovereign debt quality by enhancing countries' internal capacity to produce soft commodities in the long term by preserving locally important natural capital, and by enabling countries' capacity to trade in international markets that increasingly value globally relevant natural capital.

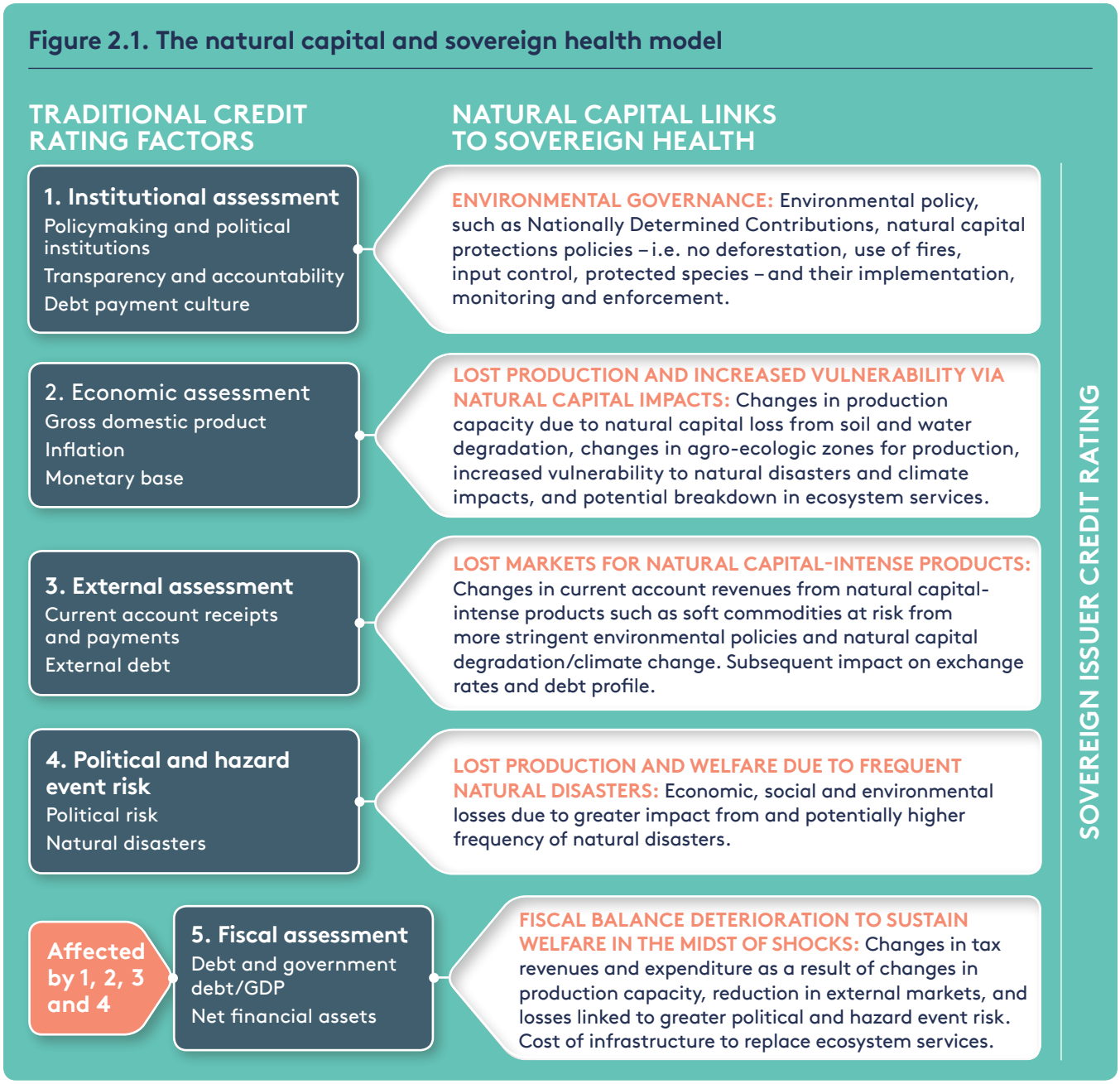
Sovereign credit risk has so far been gauged fundamentally on economic, institutional and political criteria, regardless of the state of the country's natural capital and the synergies as well as trade-offs between economic, environmental and social performance. Neglecting these dynamics is no longer viable for countries' economic and financial stability, their achievement of the SDGs or effective risk mitigation for investors. Furthermore, natural capital shocks affecting countries' internal long-term production capacity and access to international markets can lead to reallocation of capital from investors, changes in their credit ratings with consequences for their sovereign cost of capital, and reduced access to institutional investors (when below investment grade). Further, these shocks have knock-on effects in the domestic economy by affecting the cost of capital and access to certain investor pools by local firms (Almeida et al., 2016). These risks are particularly material for sovereign debt, which typically has maturities spanning decades.

To develop our model we have built on the standard sovereign credit risk assessment

"The issue of natural capital loss is hugely complex since international pressures to conserve natural capital emerge from its global relevance"

model, which considers the performance of sovereign issuers across institutional, economic, fiscal, external and political/hazard event risk factors. A country's sustainability in these areas defines its sovereign credit rating. The state of natural capital is relevant to each of these areas, as set out in Figure 2.1.

Figure 2.1. The natural capital and sovereign health model



Source: Authors

Stocktake of natural capital and risks in the G20

In this section, we map particular natural capital stocks and risks that are relevant for sovereign health performance, across the G20 countries. We identify the main institutional, economic and external sector risk factors, following our sovereign health model (see Figure 2.1 above).

Natural capital stocks in the G20

The G20 countries are the world's dominant economies, accounting for 86 per cent of global gross domestic product (GDP). They are also home to a considerable stock of natural capital, including globally significant forests, water sources and soil organic carbon. In addition to these three indicators we have looked at a further three: arable land, bird species and reptile species, with data provided by G20 country in Table A1 in the Appendix.

To summarise:

- The country with the highest stock of forest in the G20 is Russia, followed by Brazil, Canada and the United States, in descending order.

- The country with the highest percentage of renewable internal water resources is Brazil, followed by Russia, Canada, China and the United States, in descending order.
- More than 70 per cent of global soil organic carbon (SOC) stocks is held by 14 countries, nine of which are in the G20: Russia, Canada, the United States, China, Brazil, Indonesia, Australia, Argentina and India. Thirty-one per cent of the global stock is concentrated in the tropics and 63 per cent in forests, savannas and shrublands (FAO and ITPS, 2018).
- Brazil emerges as the G20 country with the highest concentration of natural capital in terms of renewable internal water resources, forest land, arable land, and species of birds and reptiles. Brazil is the only country in the G20 with a concentration of 10 per cent or more on four of the six indicators. Russia and the United States follow, featuring particularly in the water, forests and arable land indicators.

Next we look at the different risk factors for natural capital in the G20.

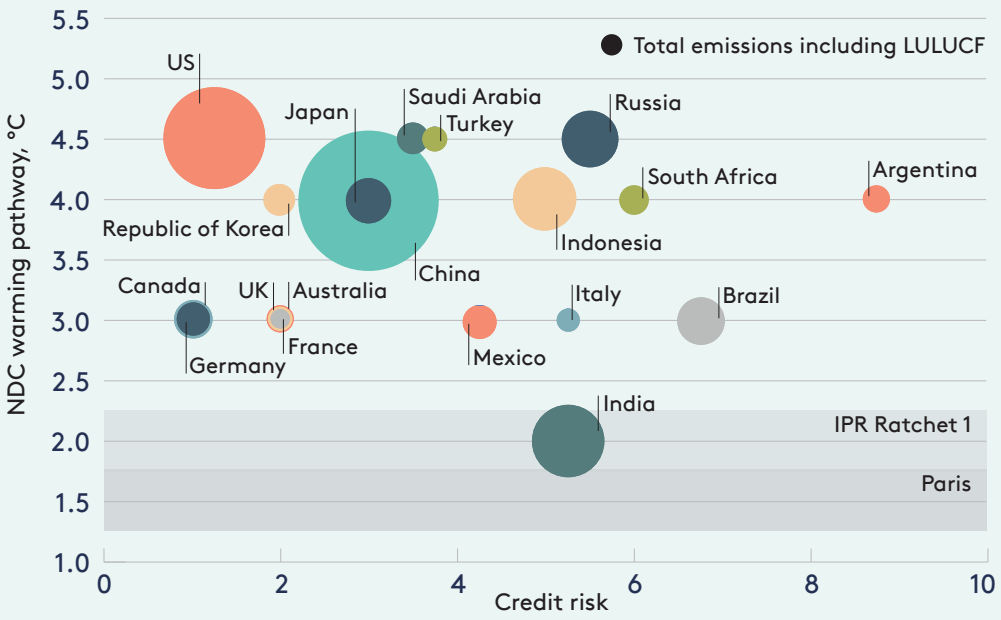
Inadequate governance as an institutional risk factor to natural capital

The Yale Center for Environmental Law and Policy produces and publishes the Environmental Performance Index, which ranks 180 countries on 24 performance indicators across 10 issue categories covering environmental health and ecosystem vitality, with governance being a key factor to balance the sustainability dimension. This index is a measure of how close these countries are to meeting environmental policy goals; a low ranking is positive. There is a wide variability in rankings within the G20, from France ranked number 2 to India ranked 177 in the world (Wendling et al., 2018).

Regulations and policies addressing environmental issues in the G20 countries focus especially on climate change and, within this area, on the energy sector. Climate actions that overlap with protecting natural capital more broadly are those related to improving water security and reducing deforestation. Within the G20 only Canada, Germany and Indonesia classify improving water security as one of their core climate actions (Climate Cation Tracker, 2019). All of the G20 countries participate in actions related to the removal of deforestation from supply chains, mostly through business-led initiatives.

Countries' nationally determined contributions (NDCs) to the Paris Agreement are another source of information regarding their climate commitments. The link between NDCs and natural capital is most evident in policies regarding the Agriculture, Forestry and Other Land Use (AFOLU) sector. However, none of the countries in the G20 has made a pledge for emissions mitigation

Figure 2.2. Greenhouse gas emissions (2014), nationally determined contributions (NDCs) and credit risk in the G20



Notes: 'IPR Ratchet 1' represents the climate warming aim behind the first international policy strengthening step under the Inevitable Policy Response (IPR) initiative, as implementation of commitments is assessed. 'Paris' highlights the climate warming objective under the Paris Agreement (to keep global temperature rise well under 2°C). LULUCF= land use, land use change and forestry. Size of bubble represents emissions. For more explanation of the graph, see p16. Source: Authors using data from CAIT WRI, Climate Action Tracker, S&P, Moody's, Fitch

"Brazil is the G20 country with the greatest number of risk factors associated with its use of natural capital"

action in this sector that is aligned with the Paris Agreement target. The largest contributor to the G20's total greenhouse gas emissions from land use is Indonesia, followed by Brazil, India, Canada and Argentina, in descending order.

Figure 2.2 presents G20 countries' total emissions in 2014 (size of the bubble), climate warming pathway of their NDCs (vertical axis) and their sovereign credit risk profile: countries that have a lower credit rating get a higher score (shown on the horizontal axis).

Across the G20 countries the extent to which the AFOLU sector represents a carbon sink or source varies. The sector constitutes a carbon sink in France, Germany, the UK and the United States. However, in Indonesia, Argentina and Brazil, the sector is a net source, contributing 68, 21 and 21 per cent of total greenhouse gas emissions respectively. In these cases, emissions derive from the conversion of natural habitats to other uses, usually to agriculture. These emissions cannot be abated unless deforestation is halted.

Economic risks emerging from natural capital depletion and risk aversion strategies

Brazil is the G20 country with the greatest number of risk factors associated with its use of natural capital. This use is causing harm in the form of high deforestation rates, significant threat to species survival, high emissions from land-use change, and ecological threats from cropland expansion and the associated high percentage of soft commodity exports, which we define as nature-dependent. (For details of natural capital depletion in Brazil and the other G20 countries see Table A2 in the Appendix.)

Indonesia follows Brazil in terms of the number of risk factors, also experiencing high deforestation rates, as well as the highest number of mammal species threatened within the G20, the highest land-use emissions, significant cropland expansion and significant reliance on nature-dependent exports. After Indonesia comes Argentina, due to high deforestation, land-use emissions, cropland expansion and the highest soft-commodity export dependency in the G20.

Deteriorating soil organic carbon and water quality and supply are two types of depletion causing economic risks.

Soil is a non-renewable resource; in the long term, unaddressed soil degradation has the potential to cause soil loss in absence of ameliorative measures. Soil organic carbon is a measure of the carbon content in soil by weight (used as a proxy for soil organic matter, which is difficult to measure directly) and a decrease in content is directly associated with a decrease in soil fertility. Deforestation and land management systems affect soil carbon content, but the specific impacts vary depending on the stressor and the area affected. For instance, soil carbon falls by around 25 per cent when tropical forests are converted to annual crops and by 30 per cent when they are converted to perennial crops. Peatlands store huge amounts of carbon that are released when the land is drained for agricultural use (FAO and ITPS, 2015). Within the G20, relatively low soil organic carbon poses a major nationwide risk to agricultural yields in Turkey, India, Saudi Arabia, Australia and South Africa. (For all of the G20 countries' soil organic carbon scores, see Table A3 in the Appendix.)

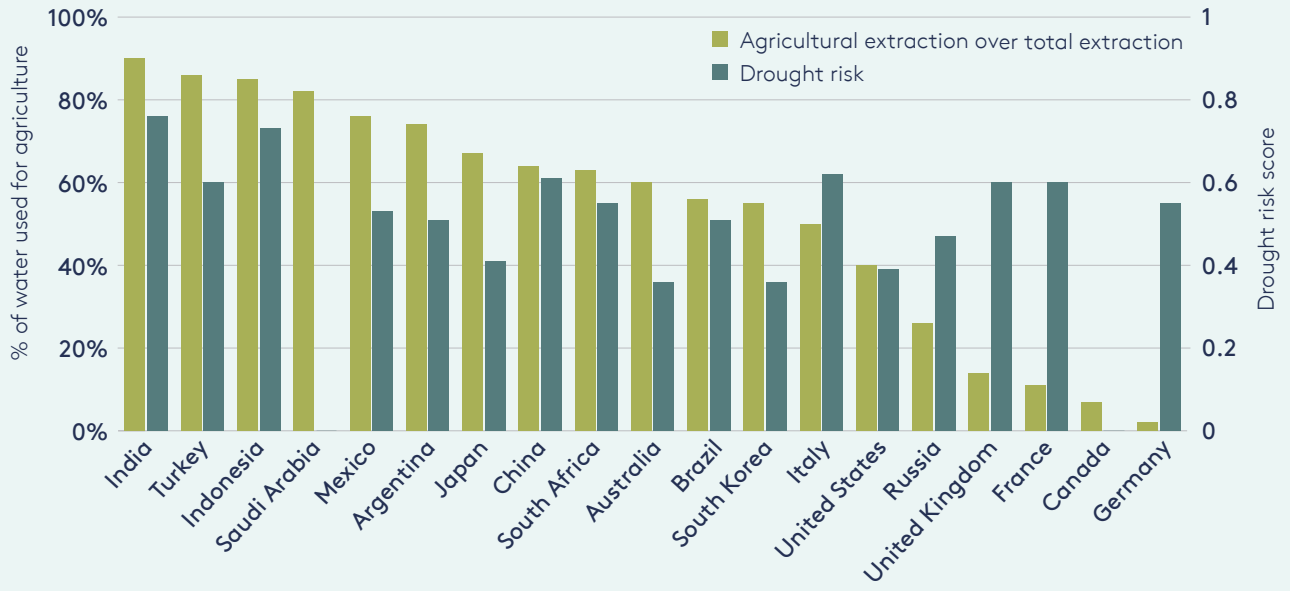
In addition, soil erosion caused by wind and water is likely to result in a reduction in agricultural yields. This is a problem for Argentina and Brazil, as discussed in Chapters 3 and 4. In extreme cases, soil can be completely lost, leading to total loss of production capacity over time. In the case of soy, for example, it is estimated that yields fall by 95kg per hectare for each centimetre of soil that is lost (Irurtia and Mon, 2000).

Vegetation regeneration is one way of helping to recover soil quantity, quality and soil water retention, particularly in previously naturally forested areas. In addition, improved agricultural practices that prioritise preservation of soil organic carbon can support the maintenance of soil biodiversity and nutrients. These strategies will need policy and financial incentives to be implemented.

Agriculture is a major user of water, threatening supply in places. As shown in Figure 2.3, on average the G20 countries use around half of their water withdrawals for agriculture but in some countries the proportion is much higher. Partly as a result of this usage (and largely in some countries – e.g. India), several of these countries are exposed to high or extremely high water stress, which relates water availability to water withdrawal (the higher the proportion of available water abstracted, the closer to water stress).

Drought risk, measured as the average length of time of dryness in the droughts occurring in a particular area, indicates the strength of a specific drought event. Measured in this way, drought risk can be high even for countries with significant water resources. Some countries that have low water stress due to significant availability of water, such as Argentina, Brazil and Indonesia, rank from medium to medium-

Figure 2.3. Water withdrawal for agriculture and drought risk in the G20, 2015



Note: 'Drought risk', calculated by WRI as a score out of 1, indicates the likelihood of occurrence of droughts, population vulnerability and assets exposed, with a higher value indicating a higher risk. Source: Authors using data from FAO Aquastat and WRI Aqueduct

high on the drought severity scale (Gassert et al., 2013). In countries with longer dry seasons and no drought risk management plans in place, agricultural production can be at risk, as evidenced in Argentina where a drought in the 2017–18 season caused a harvest loss costing US$3.9 billion (Universidad de Buenos Aires, 2019).

Improved irrigation and optimisation of water resources can boost productive capacity in regions prone to water scarcity. Altering planting seasons could be a viable alternative depending on local climate variations. As with the strategies to improve soil quality, these options will require policy incentives and finance if they are to be implemented.

Economic factor shocks via increased physical impacts and risks from natural hazards

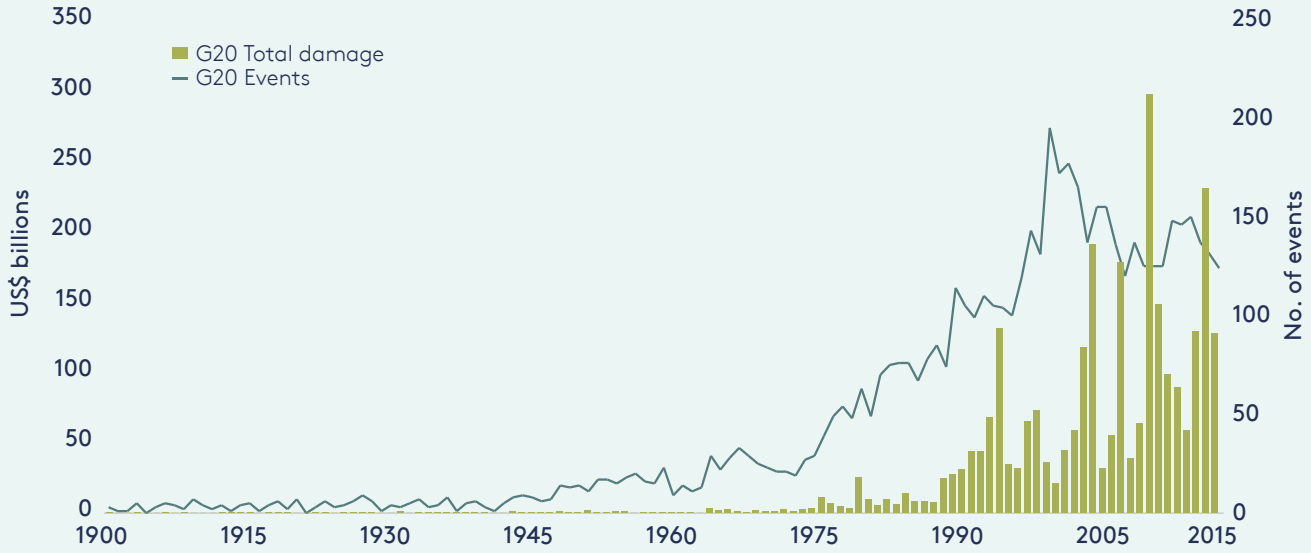
Climate change is increasing the frequency and economic cost of natural disaster and extreme weather events across the world, thus affecting the G20 (Figure 2.4). Between 2010 and 2018 an average of 135 natural hazard events occurred per year in total across the G20 countries, compared with 71 events per year between 1980 and 1988 (Catholic University of Louvain, 2019). These natural hazards include droughts, floods, heat waves, tropical storms and forest fires. Some of these events are exacerbated by natural capital loss (for example, due to a depleted water retention function). Conversely, healthier natural capital would help reduce risks of some of these events (for example, mangroves provide protection against storms).

Insurance group Munich Re has calculated natural catastrophes with global losses of US$177 billion on average per year [in 2018 values] between 2013 and 2018, with an average of US$63 billion of these losses being insured. Fifty-eight per cent of the losses in 2018 corresponded to meteorological events (such as tropical storms), 20 per cent to climatological events (such as extreme temperatures, droughts, forest fires), 14 per cent to hydrological events (such as floods and mass movements) and 8 per cent to geophysical events (Löw, 2019).

In the United States alone, the cost of extreme events each with an estimated loss of more than US$1 billion between 2008 and 2017 amounted to US$872 billion, with this figure being double that 10 years previously (NOAA National Centers for Environmental Information, 2019). In India, which is one of the most climate-vulnerable countries in the G20, extreme weather events caused losses estimated at US$45 billion between 2008 and 2017 (Singh, 2019).

Agriculture is particularly vulnerable to sudden changes in atmospheric conditions, with floods and droughts among the key weather- and climate-related risks. Understanding and management of these risks is vital for countries that are both highly dependent on agriculture and are experiencing an increased frequency of severe

Figure 2.4. Number and cost of extreme weather events in the G20, 1900–2015



Source: Authors using data from EM-DAT: The Emergency Events Database – Université Catholique de Louvain (2019)

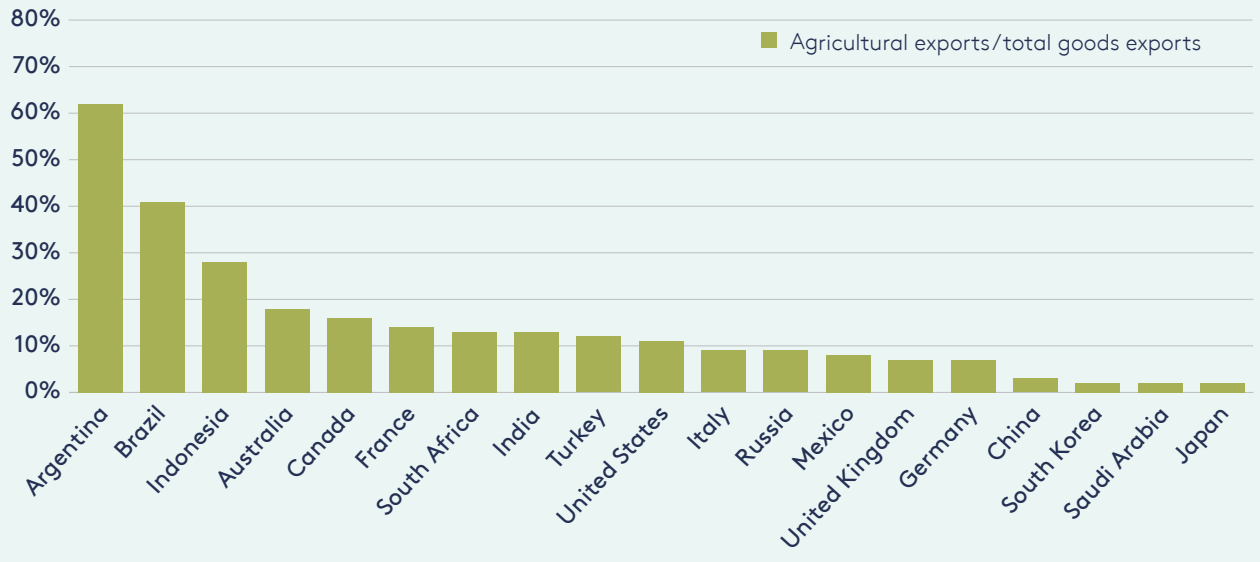
weather events. Natural capital preservation and ecosystem services play a key role in addressing these risks, as appropriate land use management with conservation of intact and well managed landscapes can help to reduce both the probability and impact of extreme climate events (Nel et al., 2014).

External risk factors: export dependency on natural capital

Three countries in the G20 show a high dependency on natural capital goods exports, with 'high' defined as more than 20 per cent of exported goods: Argentina, Brazil and Indonesia (see Figure 2.5). High dependency on agriculture for exports means a high dependency on agriculture for current account receipts (CAR) too. CAR is a key foreign currency revenue stream that pays for countries' imports and external debt obligations, with Foreign Direct Investment (FDI) providing another inflow of international currency. The majority of CAR corresponds to exports of goods. In turn, shocks to agricultural exports can significantly reduce the capacity of these countries to generate the CAR they need to meet their obligations, particularly when FDI is limited.

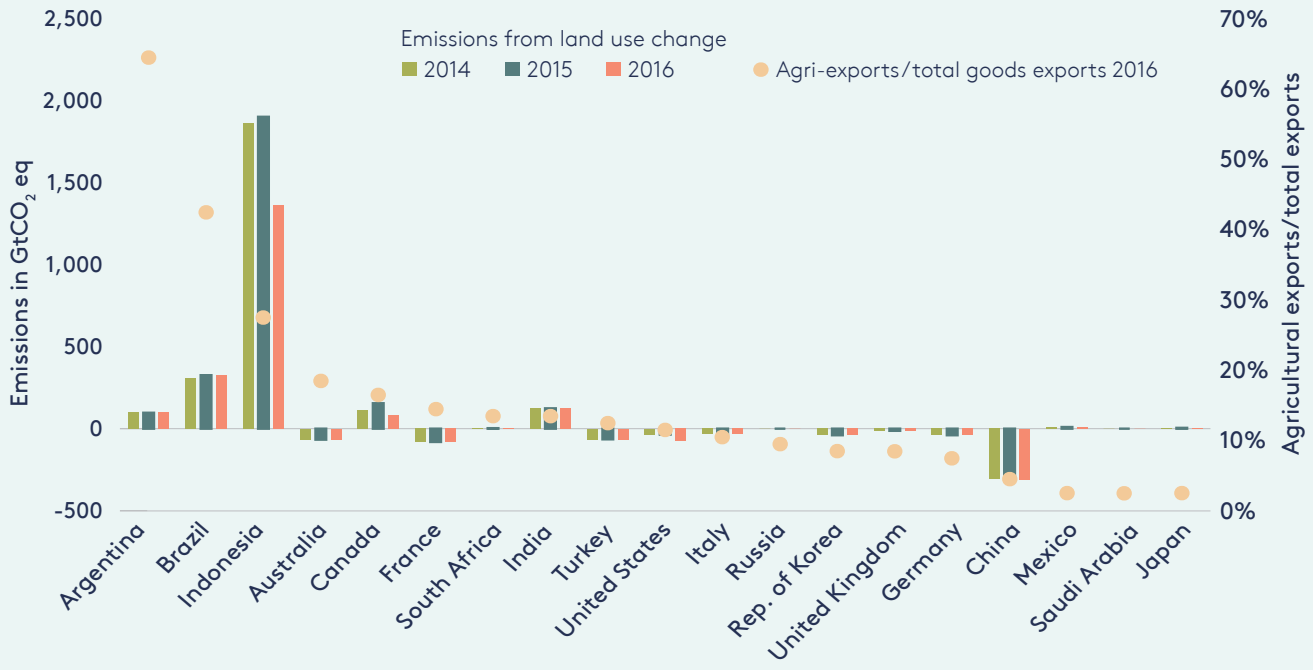
Countries with a high reliance on nature-dependent exports also show persistently high greenhouse gas emissions from land use, as shown in Figure 2.6. There is evidence of natural capital deterioration and high

Figure 2.5. Soft commodity export exposure in the G20, 2010–17



Source: Authors using data from the World Trade Organization and World Bank

Figure 2.6. Agricultural exports and emissions from land use change in the G20, 2014–16



Note: The circles show the percentage of agricultural exports within total goods exports and the bars show total land use emissions.
Source: Authors using data from FAOStat and the World Trade Organization

emissions linked to internationally-traded soft commodities such as soy, beef and palm oil. For countries where this is the case, production risks from natural capital loss might be compounded by reduced demand for soft commodities that have a high natural capital intensity. This would particularly be the case under a scenario of stricter international implementation of climate change commitments that included more stringent steps to curb deforestation. The accelerated implementation of climate change mitigation commitments in the face of increasing impacts is what is covered by the Inevitable Policy Response (IPR) (detailed further in Box 2.1, p21).

Deforestation threatens biomes of global importance, such as the Amazon Rainforest. Unabated forest conversion, in combination with widespread use of fire and climate change impacts might lead to a tipping point for the Amazon once 20–25 per cent of the biome has been deforested (to date between 15 and 17 per cent has been lost). Once the tipping point is reached, the rainforest will shift towards savanna (tropical grassland). This transformation will not only affect the water cycle and thus weather patterns in the region but will also have knock-on effects on the climate at the global level (Lovejoy and Nobre, 2018; Lawrence and Vandecar, 2015). The Amazon rainforest provides just one example of a tipping point within the biosphere boundaries, with ongoing climate warming threats triggering tipping points to sea ice, boreal forests, permafrost and Atlantic circulation, among others (Lenton et al., 2019).

For countries with high deforestation rates and high rates of converting forest to agricultural land, mitigating land use and land use change emissions and enhancing carbon sequestration capacity will be critical to protecting their long-term internal producing capacity, achieving their national climate commitments, and also to preparing for expected upcoming international policy shifts. Furthermore, delays by governments in implementing their climate change mitigation pledges will most likely lead to implementation happening abruptly in a way that the markets cannot foresee and thus price in.

Shifts in policy in response to the accumulating risks to natural capital

In response to the risks accumulating to natural capital, a number of safeguarding mechanisms are being put in place.

For example, the EU has new rules on indirect land use change (i.e. natural habitat conversion) related to biofuels, which aim to curb the embedded deforestation in biofuels used within the EU by restricting member states' use of agricultural biomass produced in areas with high biodiversity value and high carbon stocks. As a result, there could be limitations on the land used for food, crops and biofuels (European Commission,

2019d). Action to reduce the use of biofuels that pose a high indirect risk of causing land use change, as a result of the directive, is expected from 2023, with the goal of reaching zero by 2030.

Along the same lines, France as a nation has adopted a National Strategy to Combat Imported Deforestation, which aims to end imports of unsustainable forest and agricultural products by 2030. These efforts are echoed at the EU level with the communication on increasing EU action to protect and restore the world's forests (European Commission, 2019a). In the communication the EU reiterates the role of agricultural expansion in forest loss and highlights the role of weak governance as a driver of deforestation. It states the reduction of the EU consumption footprint as a priority, which leads to the aspiration for deforestation-free supply chains. While not regulation, it may well indicate a direction for future policy emerging from the EU to ban imported deforestation beyond biofuels.

In September 2019 the ratification of the free trade agreement between the EU and Mercosur (a trading bloc including Argentina, Brazil, Paraguay, Uruguay and Venezuela, the latter being currently suspended) was blocked by Austrian parliament members, partly due to environmental concerns (BBC, 2019).

The first stage in strengthening climate change and natural capital policy is envisioned by the Inevitable Policy Response to happen as soon as 2023–25 (see Box 2.1). The projected shifts will demand a ramp-up of efforts at country level to position national economies to thrive in a low-carbon scenario. Changes in the land use sector will be driven by increased flows of carbon finance, and restrictions on land use should stimulate investments in yield-enhancing technologies for the agricultural sector (PRI et al., 2019). Preservation of natural capital and biodiversity can bring enormous opportunities for countries with high natural capital stocks via discoveries that will enhance the pharmaceutical, food and energy sectors, generating significant flows of capital (Lewin et al., 2018).

At the local level the risks from unaddressed natural capital loss will expose countries to internal production shocks such as yield reductions due to localised climatic change, soil degradation, water stress and more frequent natural hazard events; these risks will combine with externally driven policy shifts. The combination of these risk factors in the face of inaction will most likely cause a reduction in revenues both at government level and in the private sector, as well as potential increases in government expenditure to compensate sectors of society for potential losses. If countries do not manage these risks early on, their access to international finance might be reduced, putting pressure on their cost of capital and potentially their credit rating.

The increasing recognition of the climate emergency could mean that the Inevitable Policy Response scenario will come to pass. In this scenario, countries with a high dependency on natural capital for their production and exports that opt for what we are calling the 'High Road' development scenario, which favours environmental/climate action (see Chapter 5, Figure 5.1) should start immediately to decouple their soft commodity production models from natural capital deterioration. For the land use sector, alternatives to models that deplete natural capital include increases in agricultural yield achieved in a sustainable way (for example, by implementing cattle ranching systems integrated with forests and crops), optimisation of agricultural land including recovery of degraded land, and prioritisation of already converted land for agricultural expansion. Other research, however, does not support the Inevitable Policy Response, suggesting that global emissions are not on track to peak by 2030 because the unprecedented levels of transition needed across society are considered unlikely to occur (World Meteorological Organization, 2019).

The Inevitable Policy Response highlights that the mechanisms that governments may start to use to tackle climate change and address natural capital risks are already emerging. This will have consequences for the sovereign health of G20 countries, with potential effects on their credit quality and cost of capital rippling towards the local private sector via the terms of access to finance. On the other hand, countries with high natural capital stocks aiming to achieve investment grade could face difficulties if their economic activity is not sustainable.

Sovereign issuers are left with a set of strategic choices. Under the Inevitable Policy Response forecast, the wide operationalisation of carbon markets by 2030 will provide incentives to recognise the value of natural capital by capital markets and sovereign bond investors (PRI et al., 2019). Sovereign issuers that are prepared for this marked shift in policy and resultant market expectations stand to win the most. Countries with significant dependency on a conventional growth model, which relies on depleting natural capital, could face rising costs of capital and economic volatility.

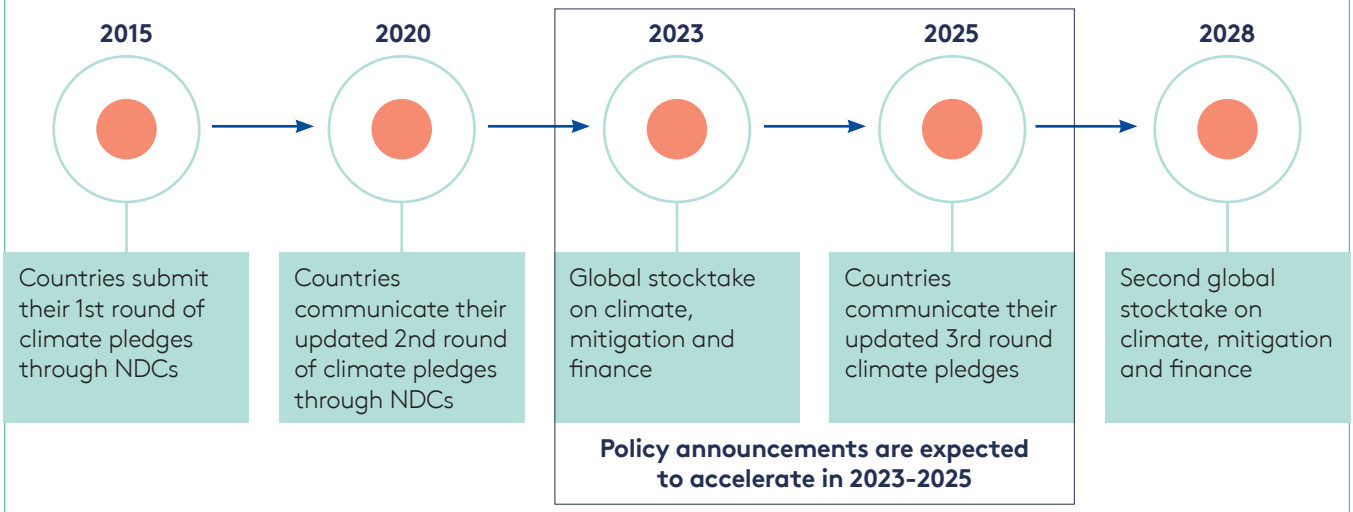
Box 2.1. The Inevitable Policy Response and its implications for nature and deforestation

The issue

Government action to tackle climate change as currently pledged in countries' Nationally Determined Contributions (NDCs) is insufficient to achieve the commitments under the Paris Agreement and it appears that markets assume there will be a continuation of limited action on climate policy (Climate Action Tracker, 2019). However, as the impacts of climate change become more evident, countries will be forced to act more decisively than they have so far. The question is not *if* governments will act, but *when*. The Inevitable Policy Response (IPR) aims to prepare investors for the decisive strengthening of climate-related policy.

Conclusions and implications of the Inevitable Policy Response

The IPR forecasts policy responses and implications for the energy sector and for land use and agriculture. The expected policy response includes the phase-in of carbon prices, bans on the sale of internal combustion engine cars and transport electrified within 20 years, zero-carbon power with the phase-out of coal by 2040, the elimination of deforestation by 2030 and the increase in agricultural yields and recovery of forest cover to 1995 levels between 2030 and 2035. The land use sector is also expected to play a key role in bio-energy production with carbon capture and storage (BECCS).

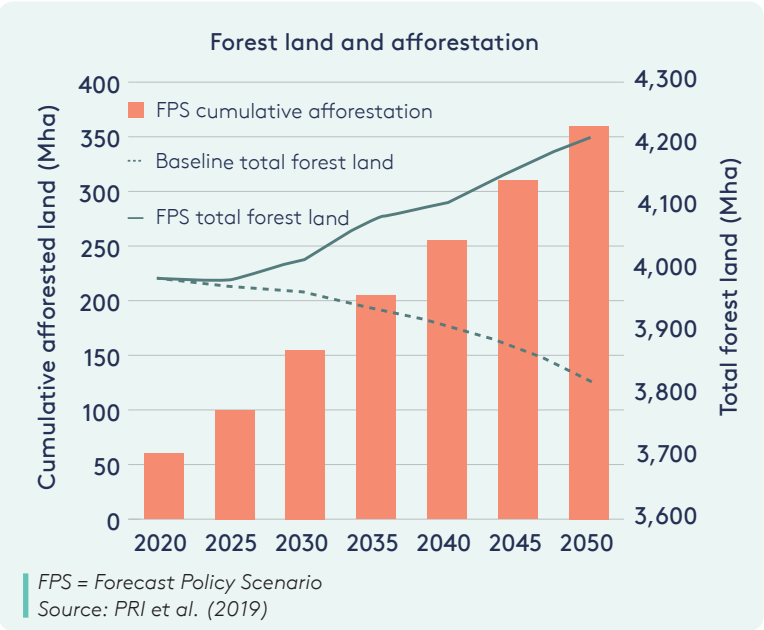


A carbon price of US$40–60/$tCO_2$ by 2030 for first movers will make it financially viable to halt deforestation and ramp up re/afforestation.

Land-use greenhouse gas emissions are expected to peak by 2025 and reduce thereafter, with forestry becoming a contributor to carbon emissions sequestration (i.e. a net sink) from 2040 onwards.

Policy shifts are expected to start from 2023. Sovereign debt will be one of the asset classes affected, with a potential repricing of carbon- and natural-capital-intense sectors that have seen no major impact so far.

The IPR is a collaboration between PRI, Vivid Economics and Energy Transition Advisors. See www.unpri.org/inevitable-policy-response/what-is-the-inevitable-policy-response/4787.article for more information.



FPS = Forecast Policy Scenario
Source: PRI et al. (2019)

3. Argentina: Natural capital and sovereign health

SUMMARY POINTS

- **Context:** Despite facing a complex economic situation, over the last few years Argentina has taken steps to strengthen its green finance agenda. The private sector and subnational governments have participated in these efforts. The right financial incentives have the potential to catalyse sustainable long-term improvements in the Argentinian economic model.
- **Environmental governance:** Argentina has been ranked 74th out of 180 for its environmental performance. On climate change, Argentina's nationally determined contribution to the Paris Agreement is considered highly insufficient. The country lost 3 million hectares of native forest from 2007–17. The agricultural sector is the main driver of natural capital conversion. The country has instituted a forest law and a financial compensation mechanism to preserve native forests but they require technical strengthening and stricter implementation and financing.
- **Economic assessment:** In Argentina the main threat to production that has an impact on GDP is the deterioration of soil. Soil erosion causes a production loss of over 54,000 tonnes of soy a year, equivalent to US$13.7m. The loss is greater if the broader agricultural sector is considered. Soil management needs to be incentivised across Argentinian agriculture.
- **External assessment:** 33 per cent of deforestation in Argentina between 2001 and 2014 was attributed to soybean production, most of which is exported. Ongoing conversion of natural capital and current management systems expose vast agricultural areas to the loss of soil fertility, water retention and climate regulation. Continued expansion of soft commodities at the expense of natural capital might affect market access for these soft commodities. 4.8 per cent of soybean exports could be at risk from zero-deforestation policies by companies and countries. The agricultural sector provides around 60 per cent of Argentina's goods exports; the country is increasingly reliant on exports that are dependent on natural capital but there will be further natural capital loss if the country prioritises economic over environmental performance. The best way to ensure that agriculture makes a sustainable contribution to Argentina's exports is to incorporate environmental criteria into production strategies.
- **Hazard event and fiscal assessment:** More frequent damaging drought events would have major impacts on government revenues via lost production and lost exports. The severe drought of 2017/18 cost Argentina 0.86 per cent of its GDP and around 1.4 per cent of tax receipts for 2018. The 4.8 per cent of soybean exports at risk would represent a loss of exporting retentions revenue for the Government equivalent to around US$1.7bn (a form of tax on the total exported value).
- **Actions:** Argentina needs to combine sustainable production with natural capital preservation and enhancement. Specifically it can: initiate the enforcement of zero-deforestation production policies, incentivise yield increases via sustainable intensification, identify non-forested areas suitable for agriculture and stimulate expansion in these areas, regenerate forest cover, improve the allocation of existing finance and incorporate sustainability criteria into any additional funding sources.

33%

of deforestation was attributed to soybean production from 2001–14

Context: Argentina's financial situation and sustainable finance agenda

Argentina faces a complex financial situation but it has also taken steps to advance its sustainable finance agenda.

In 2018 Argentina received a US$56.3 billion Stand-by Agreement from the International Monetary Fund to reduce its default risk. It has experienced credit rating downgrades to near default and explored alternatives for debt re-profiling with international investors. The government elected in October 2019 will need to engage in debt restructuring and implement significant economic and fiscal recovery measures.

Despite these upheavals, in 2018 Argentina launched an agenda for inclusive growth as

part of its presidency of the G20. The country has also been working to define greenhouse gas emission baselines at subnational level. At provincial level it has issued green bonds: of US$200 million by the province of La Rioja and of US$210 million by Jujuy. The private sector has also participated, with Galicia Bank issuing a green bond in 2018 of US$100 million, to fund an environmental efficiency programme.

In 2018 the Argentinian Bank for Investment and International Trade and the Inter-American Development Bank signed an agreement to issue a US$30 million sustainable bond, to contribute to achieving the Sustainable Development Goals (IDB Invest, 2018).

In 2019 a group of 18 banks in Argentina signed the sustainable finance protocol, aiming to encourage financial institutions to implement best practices integrating environmental, social and economic factors in the financial industry (IDB Invest, 2019). Earlier in the year, the National Stock Exchange published its guide to issue securities with environmental and social objectives (Comision Nacional de Valores, 2019). Argentina is also one of the founding members of the International Platform on Sustainable Finance, launched in October 2019, which aims to scale up green investment towards achieving the Paris Agreement and the SDGs (European Commission, 2019b, 2019c).

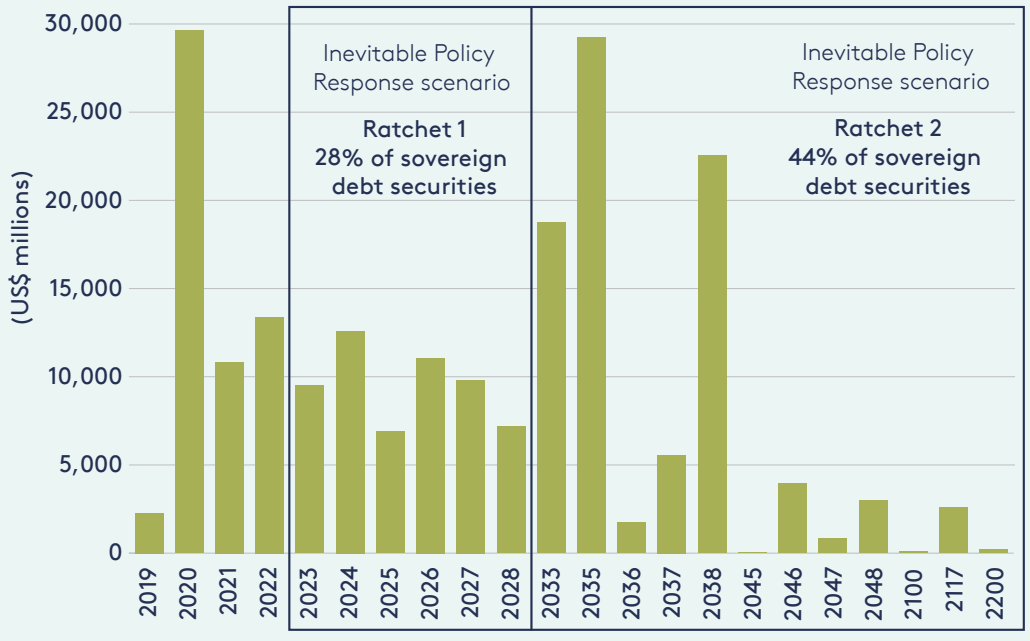
The transition to sustainability in Argentina also represents an investment opportunity. UN Environment's Inquiry into the Design of a Sustainable Financial System estimated the need for sustainable finance in Argentina between 2019 and 2030 to total US$51 billion per year; meanwhile, the current flow of sustainable finance in the country was calculated at US$14.1 billion in 2017. Most of the capital requirements would come from infrastructure-heavy sectors such as transport, housing, energy and communications. The UNEP Inquiry highlights that enabling policies designed to increase investment in economic, social and environmental welfare are one solution. These policies are crucial for a sustainable economy, especially if private sector efforts to achieve the SDGs are to be effective (Mancini and Baral, 2018).

Argentina's reliance on hard foreign currency debt securities and exports

Argentinian central government debt increased by 42 per cent from 2015 to mid-2019, and currently represents 99 per cent of GDP. The significant proportion of hard foreign currency debt implies that exchange rates are a critical point of concern for the government treasury. The proportion of Argentinian hard currency debt expressed in local currency multiplied by a factor of four over the same period due to a significant devaluation of the Argentinian peso.

Figure 3.1 presents the maturity profile of Argentinian sovereign debt securities, with around US$85 billion of the current US$202 billion maturing between 2019 and 2025. An important proportion of the debt securities in Argentina would be exposed to the Inevitable Policy Response scenario described in Chapter 2 – that is, to a ramp-up in international climate and environmental policy.

Figure 3.1. Maturity profile for Argentinian sovereign debt



Source: Authors using FactSet

With more than US$30 billion of sovereign debt securities maturing in 2019–2020, Argentina is struggling to place the new issuances needed to finance upcoming payments, and the capital controls make the payments to offshore investors significantly more difficult. The yield to maturity for a 10-year bond is estimated at 54 per cent (bonds prices and yields move in opposite directions), the highest across the G20 debt.

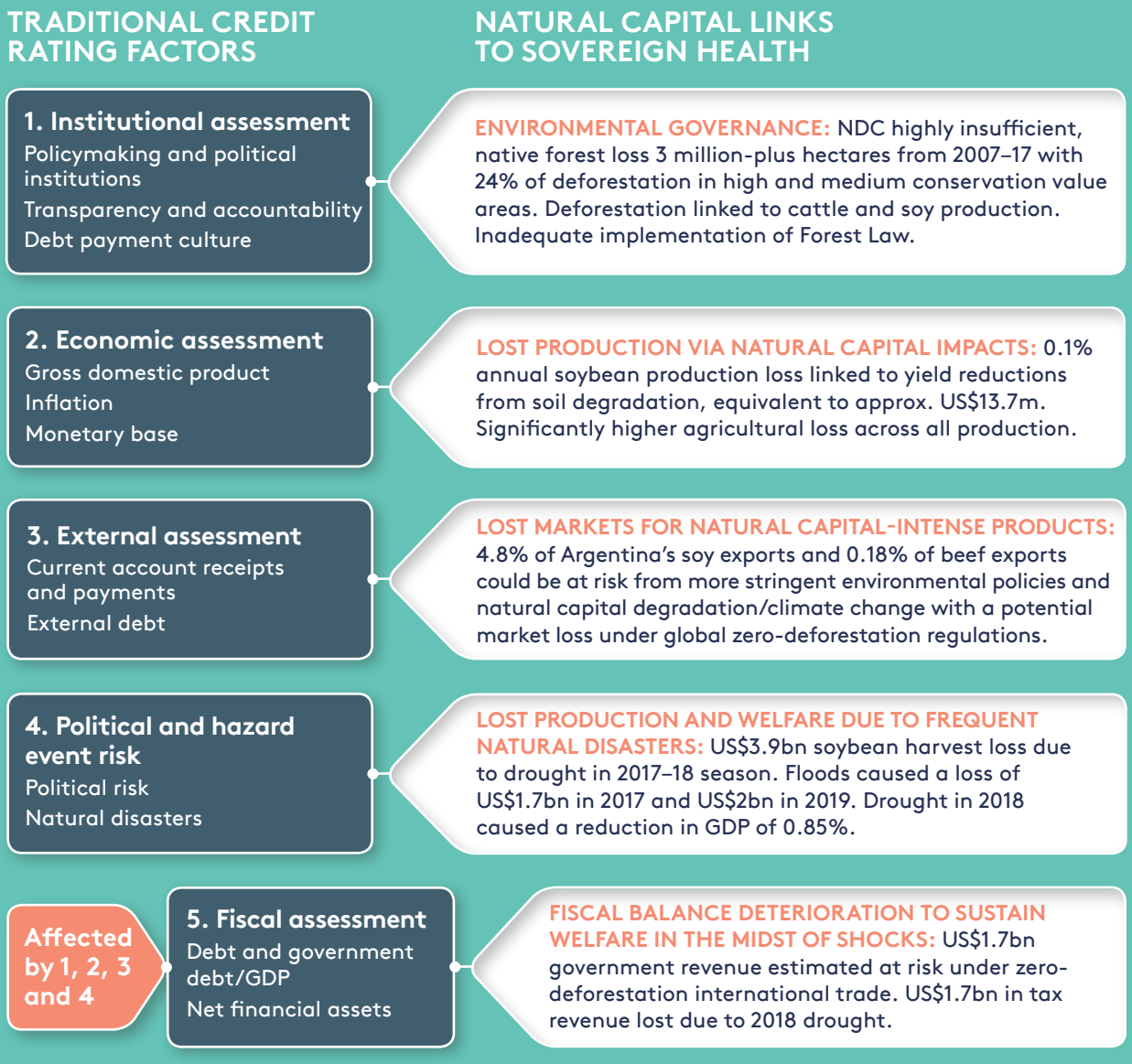
Argentina has a crucial need for ongoing revenues in foreign currency – in other words, exports. Meeting the country's obligations with international investors will require strong fiscal and economic performance, including from the external sector. Strong exports will be critical and notably they will rely on the agricultural sector, which represents around 60 per cent of its goods exports. For Argentina to rely increasingly on natural-capital-dependent exports while it battles for recovery presents another risk: that this export expansion will be accompanied by further natural capital loss by prioritising economic over environmental performance. Ensuring a sustainable contribution of the agricultural sector to Argentinian exports necessitates incorporation of environmental criteria in the production strategy.

The agricultural sector is not only a major contributor to current account receipts (CAR): agriculture, livestock, hunting and forestry contribute an average 8 per cent of GDP. If fishing and manufacturing of foods, beverages and tobacco are added, the sector's contribution has averaged 18 per cent of GDP since 2008.

Risks caused by natural capital deterioration will be transmitted via

Notes to Fig 3.2: Emerging risks mapped using most recent data, no projections are used. NDC = nationally determined contribution [to the Paris Agreement]. Source: Authors

Figure 3.2. Examples of emerging sovereign health risks in Argentina



domestic and external factors, such as shocks affecting production capacity, increased exposure to natural capital and climate risks and reduced international demand for Argentinian products that are associated with deforestation risk. These factors will impact on Argentina's future fiscal performance.

Emerging sovereign health risks in Argentina

Applying the model of sovereign health we presented in Chapter 2, we have scoped natural capital-related risks for external, economic and institutional factors that have impacts on Argentina's fiscal performance and negative effects on its debt sustainability. These emerging risks are presented in Figure 3.2 and described further below.

Institutional factors: example of the Forest Law

Institutional factors are traditionally those that refer to the rule of law, corruption or willingness of a government to pay its sovereign debt. Environmental governance is not explicitly considered as part of mainstream sovereign credit risk assessments. However, environmental governance – understood as policy and policy implementation aligned with the Sustainable Development Goals – is critical to achieving environmental and social targets.

Argentina is ranked 74th out of 180 in the Environmental Performance Index (Yale Center for Environmental Law and Policy, 2019). Argentina's NDC to the Paris Agreement has been classified as 'highly insufficient' (Climate Action Tracker, 2019). While Argentina has made advances in the policy arena through its 'Biofuels Law', 'Renewable Energy Law' and a carbon tax on fossil fuels, areas more directly focused on natural capital would welcome further work.

One prominent example of a gap in environmental governance is found in the issuance and implementation of the 'Forest Law'. This Law, officially named Law 26,331, was issued by Argentina in 2007 and regimented in 2009. It is the country's main policy instrument for protecting native forests. The Law defines forest land-use zoning based on the conservation value of forests. By design, it is implemented at subnational level, with important variations across provinces. Provinces define this zoning as part of a participatory process to delimit forests across three categories:

- *Category I*: Areas of very high conservation value that should be protected indefinitely
- *Category II*: Areas of high to medium conservation value that, while not for conversion, can be used for sustainable management, tourism, non-timber forest products collection and scientific research
- *Category III*: Areas of low conservation value that can be partially or completely converted to other use.

In parallel with the Forest Law, Argentina created the National Fund to Strengthen and Conserve Native Forests. This fund is a mechanism for payments for ecosystem services to jurisdictions supporting the implementation of the Law (Fundación Vida Silvestre, 2017). The Law also enables legal action to be taken against environmental damages with an obligation placed on the guilty party to recover the deforested area (Aguiar et al., 2018).

Implementation of the Forest Law is impeded in a number of ways. This includes the way in which the categories are identified: for example, there are cases where Category I forests have been defined as areas at lower risk of deforestation, lower agricultural potential and lower opportunity cost than areas in Category III (Aguiar et al., 2018). Often, the technical criteria to define these categories at province level are either unclear or unknown. The level of allowed transformation and the specific meaning of 'sustainable use' under Category II also varies significantly across provinces. In certain regions the zoning also allows for re-categorisation: an area of higher conservation value can be re-categorised to one of lower conservation value (ibid.).

Furthermore, while the National Fund accompanying the Law is financed, its budget has experienced successive reductions and does not meet the legal requirement. Nor does the way finance flows from the fund, while compensating forest holders, provide sufficient flexibility in the use of resources or consider the individual risks faced by each forest area.

Economic factors: production capacity impacts from soil erosion and depleted soil organic carbon

The Argentinian Secretary for the Environment and Sustainable Development estimated in 2018 that 38.5 per cent of the country's soil had some level of degradation (Secretaria de Ambiente y Desarrollo Sustentable, 2018).

Almost 30 per cent of Argentinian soils (around 72 million hectares) exhibit water erosion rates above tolerable levels. The average rate is estimated at 6.2 tonnes per year, equivalent to losing 0.5 millimetres of soil per year (Gaitan et al., 2017). Around 60 per cent of soils subject to low erosion rates in Argentina are located in areas of high

"One prominent example of a gap in environmental governance is found in the issuance and implementation of the 'Forest Law'"

vegetation cover: forests in the Chaco region and the Patagonian Andes region, the forests in Misionera and Yungas, and the natural grasslands in Corrientes, Rio Salado and the Parana delta. If this vegetation cover is removed, it is estimated that potential water erosion would reach 166 tonnes per year, equivalent to losing 1.5 centimetres of soil per year. Soil erosion leads to the depletion of soil organic carbon. Vegetation regeneration has remarkable potential as a way to protect and recover soil in Argentina.

In addition to water erosion, 33 per cent of Argentinian soils are estimated to have a high wind erosion rate of potentially more than 150 tonnes per year.

Gaitan et al. (2017) estimate soil loss of 3.91 tonnes of soy per hectare per year for Argentinian agricultural soils, which is equivalent to a loss of more than 54,000 tonnes of soy production per year – amounting to 0.1 per cent of Argentinian soybean production for 2018. At a current price of US$254/tonne, this is equivalent to US$13.7 million, just for soy.

External factors: natural-capital-dependent exports and deforestation

The Inevitable Policy Response anticipates a significant reduction in deforestation by 2030, with the transition starting in earnest from 2023–25 (see Box 2.1). Argentina has experienced significant historical deforestation and conversion of natural capital to agricultural land for the production of its internationally-traded soft commodities. If the country intends to pursue a 'High Road' scenario, decoupling its soft commodity production from its natural capital loss, it should start addressing this risk immediately.

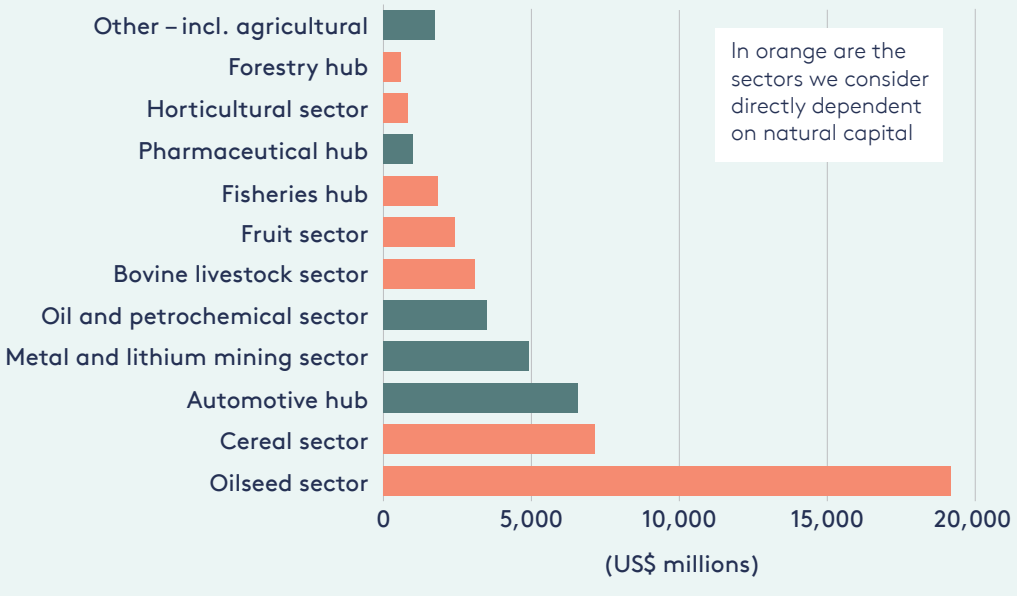
The agricultural sector is a net exporter and its nature-dependent exports are significant for the Argentinian current account receipts, representing 58 per cent of exported goods in 2018. Twenty-seven per cent of total exported goods came under the oilseed hub, the main exporting hub, within which soybean and its sub-products are the most significant contributors (Figure 3.3).

Soy sector exports represented US$15 billion in 2018. Around 61 per cent of soy exports are in the form of soybean flour and pellets, 19.7 per cent soybean oil, 9.7 per cent soybeans and 6.5 per cent biodiesel. Major export destinations vary by product, with China purchasing mostly soybeans, ASEAN and the EU importing soybean flour and pellets, and India soybean oil. In terms of export value, the main destinations are the ASEAN trade bloc, the EU, India and China. The beef hub exported just over US$3 billion, with 49 per cent of beef exports directed to China and 22 per cent to the EU (Instituto Nacional de Estadistica y Censos, 2019).

Estimated value of risks to Argentinian soy and beef exports

We calculated the potential production under risk from having caused deforestation and more stringent anti-deforestation policy for the four provinces within the Great Dry Chaco region of Argentina, where more than 80 per cent of deforestation is concentrated: Chaco, Formosa, Salta and Santiago del Estero. These

Figure 3.3. Argentinian exports by sector, average 2015–18



Source: Authors using data from the Argentinian National Statistics Institute (INDEC)

four provinces have represented an average of 23 per cent of the national soybean production in Argentina since 2008, and 41 per cent of the total soybean production in the season 2017/18. They also contained an average 13 per cent of the Argentinian cattle herd over this period. Soy and cattle ranching expansion are related in the case of Argentina: as cattle moves further into the agricultural frontier causing further deforestation, soybean plantations replace pastures.

Between 2005 and 2013, 46 per cent of deforestation in Argentina is estimated to have been caused by cattle ranching and 33 per cent by soybean production (Pendrill et al., 2019). We use these estimates to define the total potential deforestation attributed to soy as being, at the minimum, the area into which the soybean planted area has expanded and 33 per cent of the total deforestation in that region.

We have calculated the amount of soybean-related deforestation for every year since 2001. Between 2001 and 2017, soy-related deforestation amounted to a maximum 23.5 per cent of the total area currently under soy production for these four provinces, accumulated over the period. We calculate that this soy is likely to have caused deforestation and that this soy production could be affected by retroactive zero-deforestation policies. Assuming that cattle herd expansion leads to a proportional production area expansion, 3.7 per cent of the cattle herd is exposed to this risk in these provinces. The soybean at risk represents around 6 per cent of the national soybean production and the cattle herd at risk represents around 1 per cent of the total Argentinian cattle herd (note that for cattle we do not consider area directly, as expansion in area devoted to livestock is more complex to establish).

With 6 per cent of the total national soybean production at risk from zero-deforestation and zero forest-conversion policies and 80 per cent of soy produced in Argentina being exported, 4.8 per cent of all soy-related exports – from across the country – could be at risk under a zero-deforestation scenario for international soft commodities. If 1 per cent of the Argentinian cattle herd is exposed to this risk and Argentina exports 18 per cent of its beef, then the risk for Argentinian cattle exports would be 0.18 per cent.

Hazard event factors: droughts and floods

Climate change is expected to increase the frequency of extreme weather events including droughts. Argentina has experienced repeated drought events in the last decade and the effects have been strongly felt in the soybean producing sector. For example, the drought of 2009 caused an estimated US$4.6 billion loss for the sector, the drought of 2011–12 US$2.7 billion and that of 2017–18 US$3.9 billion (Universidad de Buenos Aires, 2019). The latter figure does not include the ramifications through the supply chain, so the final figure is likely to be much higher. The Cereal Stock Exchange estimated that this drought caused a reduction of 0.86 per cent in Argentinian GDP, with export losses estimated at US$5.3 billion for soybean and processed products, and a fiscal revenue loss of US$1.7 billion, due to lower revenue from both exporting rights and other taxes applied through the supply chain (Bolsa de Cereales Argentina, 2018a).

The floods in the third quarter of 2017 caused a US$1.7 billion economic loss, equal to 0.25 per cent of Argentina's GDP. This single event equalled almost all of the costs of similar events from 2008–16. These floods caused the Government of Argentina to lose US$241 million in revenues from income, export and value-added taxes. They destroyed 1.2 million hectares of crops, impacting both the soybean harvest and the cattle sector. Another major flood occurred in early 2019, affecting 2.4 million hectares of soybean fields in January alone (Buenos Aires Times, 2019). According to multiple news outlets quoting Coninagro, an intercooperative agricultural confederation, the floods of the first quarter of 2019 in the Great Dry Chaco region caused a decrease in Argentinian GDP of US$2 billion.

Fiscal factors that are transmitted from external, economic and hazard event factors

Most analysis of the impacts of commodity prices on fiscal performance focus on the oil and gas sector and hard commodities (such as minerals) (see for example Pyrkalo, 2018). However, a shock in the commodity markets might have a similar impact on revenues and expenditures when affecting a sector such as agriculture, which supports not only production and exports, but also significant employment so that shocks in the sector have an impact on social welfare.

There are a number of paths through which exports can affect fiscal performance and, hence, debt sustainability, described below. The risk transmissions can also overlap, with risks materialising simultaneously.

Zero-deforestation policies

Argentinian exports, including soy exports, are heavily taxed. A regulation issued in September 2018 established an export

"4.8 per cent of all soy-related exports – from across the country – could be at risk under a zero-deforestation scenario for international soft commodities"

"The mounting natural capital risks in Argentina highlight both domestic natural capital loss and international market factors as critical areas to manage"

retention[1] of 12 per cent on all products sold to external markets until December 2020. There is an additional payment of ARS4 (US$0.14) per dollar exported. Effectively this brings the exporting retention for soybeans and by-products to 28 per cent (Bolsa de Cereales Argentina, 2018a).

A global shift to a zero-deforestation economy might restrict the market for soft commodities other than those that can demonstrate their deforestation-free qualities. With 4.8 per cent of Argentinian soybean exports potentially at risk from zero-deforestation policies, this would represent around US$1.7 billion dollars.

Besides export losses and their tax impacts, Argentina's government might be inclined to increase expenditure to compensate the sector for a long-term shock, given the impacts on employment and other related economic impacts through the supply chain and interactions with other sectors in the economy.

Carbon offsetting

If carbon offsetting becomes a global economy-wide policy, supply chains would see increases to their economic cost caused by internalising the environmental impact through this policy. Argentina, by producing soft commodities with a high carbon content, could be less competitive than countries that have transitioned to sustainable production (if alternative major producers existed). This scenario would make regions with high environmental footprints more expensive for soybean production and trade, with a potential reduction in their exports.

Drought

More frequent drought events of the severity of that experienced in 2017–18 would have impacts on government revenues via lost production and lost exports. As described above, the 2017–18 drought caused an economic loss for the soy sector estimated at a minimum of US$3.9 billion, with total soy hub exports representing US$15 billion. The fiscal revenue loss amounted to 1.4 per cent of the Argentinian tax receipts for 2018. Adaptation measures such as drought-resistant crop varieties could reduce losses in water-restricted scenarios (Martino, 2019).

Soil degradation

Soil degradation builds up slowly over time and is already a problem in Argentina, as discussed above. Further soil degradation and loss could cause a production shock, reducing government revenue but also potentially increasing expenditure as the government attempts to ameliorate the impact of the shock.

Higher prices for soft commodities

Prices for soft commodities increase as demand rises and as the capacity for horizontal crop expansion is constrained due to a scarcity of available land. Normally, countries producing soft commodities would react to higher international prices by producing more. The effect of internalising the environmental cost of horizontal crop expansion on a producer's decision to expand needs to be better understood. Ideally, the farmer would have an incentive to improve yields on the same area rather than planting more area but the definition of the 'right' level of environmental cost – even for the purpose of carbon offsetting – remains elusive. On the other hand, higher prices for land-intensive soft commodities such as beef could unleash a faster transition to substitutes such as artificial protein (Tubb and Seba, 2019).

Argentina at a crossroads: what are its choices?

As Argentina puts its recovery plans in motion, the country faces a long-term choice between continuing its current agricultural production model with potential ongoing expansion into natural environments, and embarking on a transition to sustainable development. The mounting natural capital risks in Argentina highlight both domestic natural capital loss and international market factors as critical areas to manage. By addressing local natural capital loss Argentina would be poised to reduce the risks emerging on the production front while profiting from increasing international demand for sustainable soft commodities and investment opportunities.

To strengthen the natural capital foundations of its sovereign debt, Argentina should:

- *Initiate the enforcement of zero-deforestation production policies,* accompanied by the implementation of transparent land-use monitoring systems, noting that an important percentage of forest loss occurs in forests appropriate for conservation, according to Argentina's legislation.
- *Incentivise yield increases via sustainable intensification,* which would help farmers produce more soft commodities on the same land area. Agricultural intensification requires both training and financial services.
- *Identify non-forested areas suitable for agriculture* and stimulate any additional required agricultural expansion into these areas. This agricultural expansion needs to

1. Exporting retentions operate similarly to a tax on exports.

accommodate soil protection, and water and input management strategies that recover and preserve natural capital. In existing agricultural areas, sustainable yield improvements and transition to pro-nature management systems could be prioritised.

- *Regenerate forest cover,* particularly in areas that were naturally forested and are currently deforested. Forest cover regeneration could be pursued in combination with other sustainable economic alternatives. In addition, forest cover regeneration can bring financial flows through payments for nature-based solutions.
- *Improve the allocation of existing finance and additional resources,* providing investment opportunities for investors, to facilitate the transition to a sustainable land-use sector. The Government and the agricultural sector could work with local financial sectors to design and implement financial instruments prioritising high-yield, low-environmental-risk agricultural systems that preserve soil quality and adequately manage water resources, resilience and adaptation. The terms of these instruments could be linked to the environmental performance of the financed projects. Sustainable land-use financial instruments could also include sustainable forestry management. Additional capital needs for these instruments can be met through the issuance of securities tied to the performance of sustainability criteria or specific use of proceeds such as green or transition bonds.

These steps will require proactive government policy intervention in the form of adequate incentives. These incentives need to come from beyond the issuers' government. Any financial institution globally with a stake in Argentina's debt at national or international level needs to start considering the impacts of these improvements and their role in catalysing a transition to a sustainable economic model. The sector must align its decision-making with the outcomes being pursued (natural capital preservation, zero deforestation, sustainable increase of agricultural production), with the incentives to achieving these outcomes (the financial terms offered to finance the required interventions), and with its capital allocation.

4. Brazil: Natural capital and sovereign health

72%

of deforestation attributed to cattle ranching, 2005–13

10%

of deforestation attributed to soy production, 2005–13

SUMMARY POINTS

- **Context:** Brazil has exhibited regional leadership in environmental policies and commitments that should be maintained. The country is also leading Latin America's green finance agenda, with involvement of the Central Bank of Brazil and the private sector. Leveraging the existing landscape of policy and sustainable financing presents an enormous opportunity for Brazil's transition to a sustainable economy.
- **Environmental governance:** Brazil has been ranked 69th out of 180 for its environmental performance. On climate change, the country's nationally determined contribution to the Paris Agreement is considered insufficient. Since 2008 the Amazon has seen around 9 million hectares of deforestation and the Cerrado grasslands around 12 million hectares. The land use sector represents one-fifth of Brazil's greenhouse gas emissions. The Forest Code is an advanced piece of legislation to preserve native vegetation but its implementation needs to be strengthened and monitoring made more transparent.
- **Economic assessment:** Soybean yields could decline as the growth-promoting effects of increased carbon dioxide are offset by the effects of land use change (e.g. a reduction in rainfall following local deforestation). These effects could lead to a reduction of 33 per cent in the soybean yield of Mato Grosso, Brazil's main soybean-producing state. Currently Mato Grosso produces 27 per cent of Brazilian soybean and its tax contribution is 18 per cent of production value; the production loss due to a reduction in yield would represent a tax collection loss equivalent to 0.1 per cent of federal tax receipts. Also, more than 70 per cent of Brazilian pastures experience some level of soil degradation. Soil degradation associated with tillage, which is practised by half of Brazilian soy farms, causes a soybean production loss of 3.7kg/hectare, representing up to 127,000 tonnes, or 0.1 per cent of the total annual soybean production.
- **External assessment:** 72 per cent of deforestation in Brazil between 2005 and 2013 was attributed to cattle ranching and 10 per cent to soybean production. In 2017, 6 per cent of the total area planted with soybean in Brazil was at risk of having caused deforestation. Under an international shift to sustainable commodities, 9 per cent of Brazil's soybean exports would be affected. By area, 68 per cent of the soy produced between 2006 and 2017 on the 2 million hectares of plantations associated with causing deforestation was exported.
- **Hazard event risk assessment:** Between 2003 and 2013, Brazil was the Latin American country with the highest agricultural production losses related to natural hazards, with a loss equivalent to US$11 billion, representing 3 per cent of the projected value of production.
- **Fiscal assessment:** Emerging risks will have effects on fiscal performance, with the loss in government revenue equating to agricultural production loss multiplied by 18 per cent. A reduction of 33 per cent in soybean yield in Mato Grosso (in a high deforestation scenario causing decreased rainfall) could cause a 0.5 per cent government revenue loss.
- **Actions:** To support the mitigation of risks and to position the country to benefit from important upsides from international policy and market shifts towards sustainable production, Brazil can: close the implementation and enforcement gaps in the current Forest Code, stimulate agricultural expansion into already degraded lands, regenerate forest cover, and improve how it allocates finance.

Context: Environmental policy, green finance, debt and the importance of agribusiness in Brazil

Environmental leadership in jeopardy

The Yale Center for Environmental Law and Policy (2019) ranks Brazil 69th out of 180 countries evaluated for its Environmental Performance Index. In the past Brazil has shown leadership in Latin America in environmental regulation (Vaughan, 2019; Spring and Eisenhammer, 2019). Its Forest Code is an advanced piece of regulation aiming to protect sensitive biomes including the Amazon Rainforest. The country has established monitoring systems to bring natural capital loss under control, has incentivised the registration and mapping of private rural properties to help the identification of forest cover surpluses and shortfalls, and has established different mechanisms to recover or offset vegetation conversion over the allowed limits on private properties. It has committed to restoring 12 million hectares of forests for different uses, to increasing the scale of sustainable forestry management, to restoring more than 15 million hectares of degraded pastures and to increasing by 5 million hectares the cattle ranching area managed under integrated systems that combine cattle ranching, legumes and trees in rotational cycles (Observatório ABC, 2017b).

But currently Brazil's environmental leadership is compromised. In 2019 widespread fires in the Amazon sparked international concern and there is evidence that they were related to agriculture-driven deforestation (Finer and Mamani, 2019). The legality of the deforestation that preceded these fires is in question; the new Brazilian government's rhetoric about Amazon development is considered an enabler of increased deforestation in the region. This rhetoric has been accompanied by government actions resulting in the weakening of environmental monitoring and control agencies (Vaughan, 2019). The government has also requested external payments from developed countries to protect the Amazon as a result of international concerns about the fires.

Furthermore, Brazil's nationally determined contribution (NDC) to the Paris Agreement is considered insufficient (Climate Action Tracker, (2019). The NDC commits Brazil to reducing greenhouse gas emissions by 37 per cent below 2005 levels by 2025 and 43 per cent by 2030.

Enduring leadership on green finance

There are numerous examples of Brazil's interest and role in the agenda for sustainable finance in Latin America. In 2010 the Brazilian government implemented credit lines fostering low-carbon agriculture, with a total of BRL2.9 billion (US$794 million) allocated for the season 2016/17. However, actions are needed to improve uptake by farmers (Observatório ABC, 2017a). In 2011 the Brazilian Central Bank published Circular 3,547, which defined the procedures and parameters for capital adequacy. This circular requires banks to demonstrate how they consider their exposure to socio-environmental damages in their calculation of capital needs (UNEP Inquiry et al., 2014). In 2014 the Brazilian Central Bank issued Resolution No. 4,327, providing the guidelines by which banks need to abide for the design and implementation of their socio-environmental policies (Banco Central do Brasil, 2014).

In 2013 Brazil launched its credit line 'Inovagro', managed by the Brazilian development bank, BNDES (BNDES, 2017). This rural credit line funds investments required to implement technological innovations in rural properties, including implementation of alternative energy sources, equipment for precision agriculture and acquisition of genetic material (Banco do Brasil, 2019).

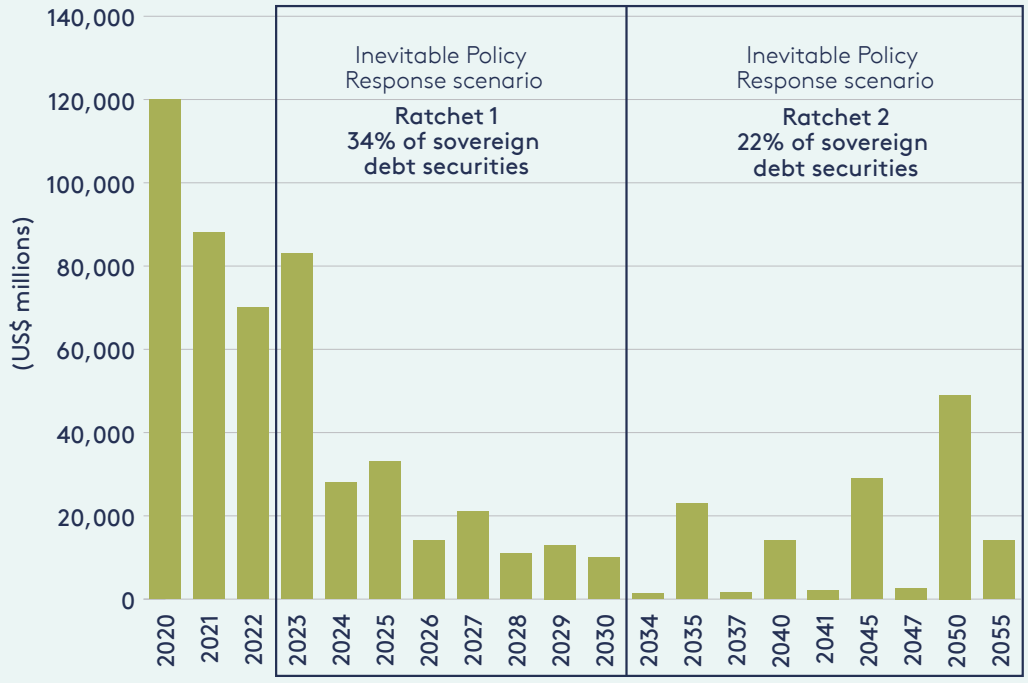
In its 2014 analysis of Brazil, the UNEP Inquiry into the Design of a Sustainable Financial System recommended tactical and operational improvements to Brazil's low-carbon agriculture credit programme; an increase in private sector participation in the provision of resources for the low-carbon agriculture credit programme; prioritisation of the Amazon and rehabilitation of pasturelands with a particular focus on control of fires, elimination of deforestation, and water conservation; expansion and acceleration of training and technical assistance programmes; financial monitoring of the low-carbon agriculture credit programme and advancement of the physical monitoring of carbon reductions achieved through it (UNEP Inquiry et al., 2014).

The green bond market in Brazil was worth US$5.3 billion by the first half of 2019, constituting 41 per cent of total regional issuance, making it the largest green bond issuer in Latin America (Climate Bonds Initiative, 2019). Three corporate green bonds issued in Brazil target the land-use sector specifically. The Brazilian Federation of Banks (FEBRABAN) actively supports its affiliates in the implementation of Brazil's guidelines for management of socio-environmental risk as well as alignment with international efforts such as the Task Force on Climate-related Financial Disclosures (TCFD) and the Principles for Responsible Banking.

"The new Brazilian government's rhetoric about Amazon development is considered an enabler of increased deforestation in the region"

Source: Authors using data from Bloomberg

Figure 4.1. Maturity profile for Brazilian sovereign debt



Debt in Brazil

Brazil's debt has increased significantly. Gross government debt doubled between 2013 and 2019, currently representing 88 per cent of GDP. Eighty-seven per cent of debt is issued in local currency.

As shown in Figure 4.1, 19 per cent of outstanding Brazilian debt matures between 2019 and 2020, with a sizeable portion of this debt exposed to the ramp-up in environmental policy envisaged under the Inevitable Policy Response scenario (see Chapter 2). The current yield for the Brazilian 10-year government bond is 6.6 per cent.

Importance of the agribusiness sector to GDP and exports

Between 2000 and 2018 the agribusiness sector contributed around 21 per cent of Brazilian GDP per year (Centro de Estudos Avançados em Economía Aplicada, 2019), including inputs, production, processing and services. It is also a net exporter, constituting an annual average of 38 per cent of total goods exported between 2010 and 2017 (ibid).

The soybean hub represented 53 per cent of the agribusiness sector's exports in 2018, followed by cereals and their by-products, forestry, and the sugar and alcohol hub, with between 12 and 13 per cent each. Most soybean-related exports are destined for Asia, their value amounting to more than US$32 billion in 2018, representing 82 per cent of the total soybean and soybean by-products exports, followed by 14 per cent to the EU, then small quantities to the Middle East and Latin America and the Caribbean (Agrostat-MAPA, 2019).

Emerging sovereign health risks in Brazil

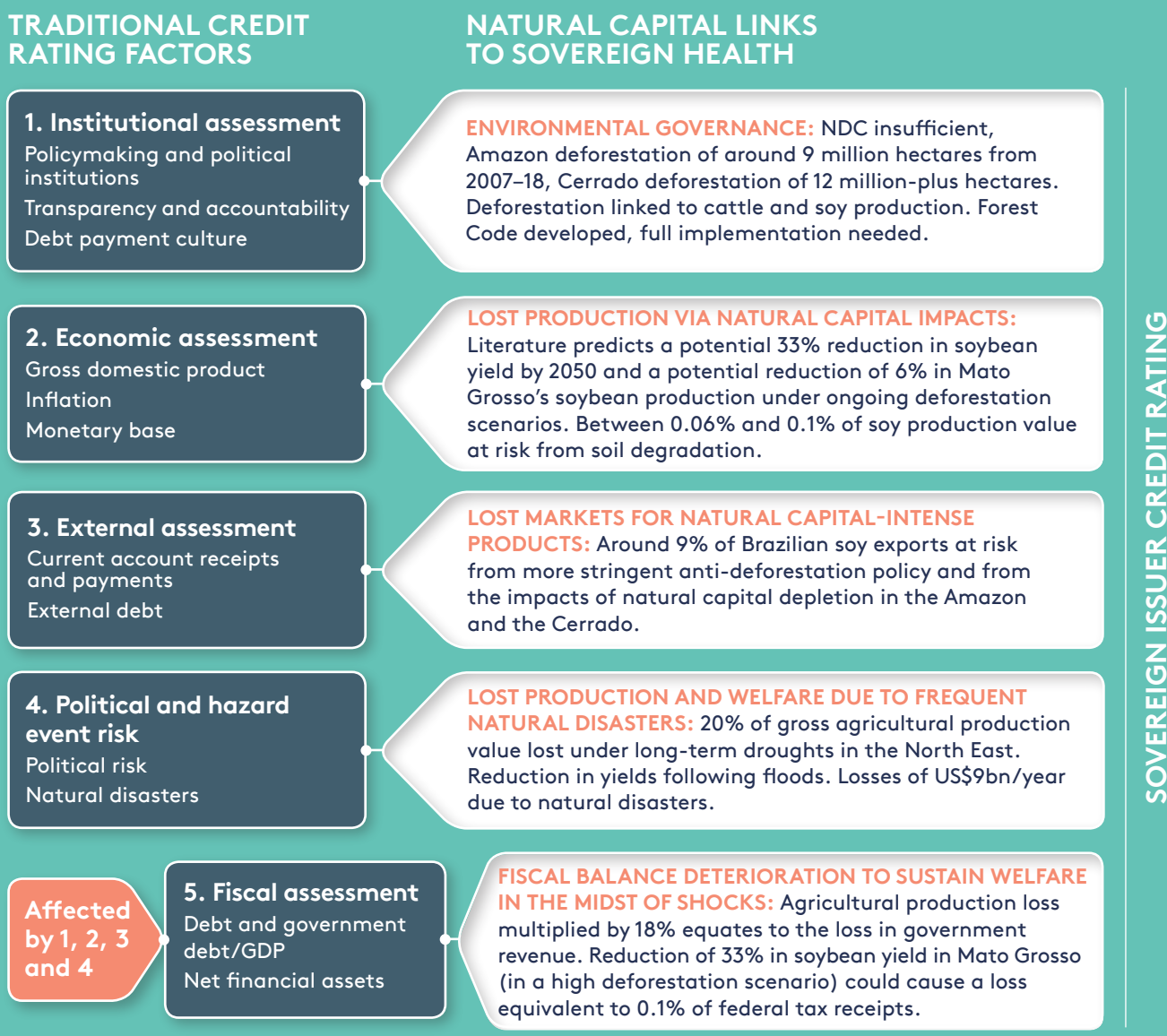
Applying the model of sovereign health we presented in Chapter 2, we scoped natural capital-related risks for institutional, economic, external, natural hazard risk and potential fiscal factors. These emerging risks could have negative impacts on Brazil's fiscal performance and debt sustainability. These identified emerging risks are set out in Figure 4.2 and described further below.

Institutional factors: example of the Forest Code

Brazil has made significant commitments towards a sustainable land-use sector, including on forests. The Forest Code is one of the key policy elements underpinning the advancement of Brazilian policy and land use targets in this area. Brazil has had a Forest Code in place since 1935, with reforms occurring over the intervening years. The most recent reform under the New Forest Code has been in force since 2012 under Law 12,651, and defines requirements for the land use and conservation of native vegetation in rural properties in Brazil.

The Forest Code has three main components: the first two are the Rural Environmental Registry, the main mechanism

Figure 4.2. Examples of emerging sovereign health risks in Brazil



Notes: Emerging risks mapped using most recent data, no projections used. NDC = nationally determined contribution [to the Paris Agreement].
Source: Authors

for implementation, which provides georeferenced information on properties; and designation of Permanent Preservation Areas that should be protected regardless of the presence of native vegetation, such as riparian areas. The third component is the designation of Legal Reserves, which are designed to protect vegetation within the property and with sizes varying according to the type of biome where the property is located and its ecological and economic zoning: for properties in the socio-geographic area defined as the Legal Amazon, the amount of property set aside for protection varies from 80 per cent for lands with rainforest, to 35 per cent for lands with Cerrado (tropical savanna grasslands) and 20 per cent for other lands. The Legal Reserve requirement is 20 per cent for the rest of Brazil.

To join the Rural Environmental Registry, landowners need to provide a map of their property identifying clear boundaries, native forest cover, riparian areas and productive areas. The Registry certificate identifies the property's land use and native vegetation shortfalls or surpluses. Where there are deficits, the Forest Code requires compensation or restoration plans, with opportunity costs where this leads to lost production and where benefits to farmers seem relatively low. Incentives to meet the Forest Code are reduced further due to a low risk of being fined for lack of compliance (Azevedo et al., 2017).

The incentives driving farmers to join the Rural Environmental Registry in the states of Mato Grosso and Para – from which other parts of Brazil can learn – include the reduced threat of being fined, given that the

Registry certificate is compulsory in these two states, and credit access: Resolution 3,545 of 2008 made it mandatory for farmers to present the Registry certificate when applying for public agricultural loans in the Amazon biome (Azevedo et al., 2017). A third incentive is to comply with cattle slaughterhouses, which require farmers in Para to have joined the Registry; cattle from ranches created through illegal deforestation is boycotted by most slaughterhouses. Despite these incentives, forest restoration efforts are still at an early stage in both states, in part because the opportunity costs of setting aside native vegetation areas – forgoing production there – and regenerating and compensating for shortfalls are viewed still to outweigh the benefits.

The observed weakening of environmental compliance in Brazil is contributing to the barriers preventing full compliance with the Forest Code. Funding for monitoring has been reduced and current government rhetoric is sending the message that the risk of being fined is lessening.

Economic factors: deforestation-induced reductions in soybean yield

Analysis exploring different scenarios of emissions predictions, CO_2 fertilisation (the speeding up of photosynthesis with an increase in CO_2) and national environmental legislation – including deforestation legislation – anticipates a significant reduction in soybean yields by 2050 in Brazil (Oliveira et al., 2013). The greatest yield reduction occurs under a combination of medium to high greenhouse gas emissions, the heightened radiative and physiological effects of CO_2 (more CO_2 can increase plant photosynthesis and growth but this is offset by reductions in rainfall) and a sovereign political stance leading to persistent deforestation. This scenario could lead to as much as 40 per cent deforestation in protected areas, with deforestation rates increasing to up to 85 per cent outside protected areas, triggering a 33 per cent reduction in soybean yields (ibid.). A reduction by one-third in the soybean yield would cause an equivalent reduction in soybean product and export capacity, risking further deforestation as the area under production is expanded to offset production losses.

Deforestation may lead to less rainfall in September, October and November (the months where the transition from dry to wet season happens) and, with further increases in deforestation, delays to the start of the rainy season. Continued forest loss will lead to further reduced rainfall and is expected to cause a loss in productivity and rental income averaging US$1.81 per hectare per year for soy bean and US$5.43 per hectare per year for livestock. With spatial variation, these losses could be as high as US$9 per hectare per year, with the highest losses estimated in northern Mato Grosso for soybean (Strand et al., 2018).

An assessment of different future deforestation scenarios for the Amazon – from 0 to 60 per cent further deforestation – along with their effects on soybean yields in Mato Grosso state, shows that impacts on soybean yield would vary with planting date (due to differing exposure to the rainy season), but in the worst-case scenario, output could be reduced by 2 million tonnes from the 2012 baseline – around 6 per cent of the state's soybean production (Cosme et al., 2017). A loss of 6 per cent of Mato Grosso's current soybean production would cause a 2 per cent reduction in total Brazilian production and a 1.2 per cent reduction in total soybean exports.

In the case of rain-fed soybean and maize double-cropping in southern Amazonia, land use changes have been found to exacerbate a shortening of the rainy season, affecting farmers' planting cycles and driving second-crop failures (Costa et al., 2019). Further expansion into natural vegetation will shorten the rainy season in the region even more, risking further expansion of the production area into natural vegetation to compensate for production losses (ibid.).

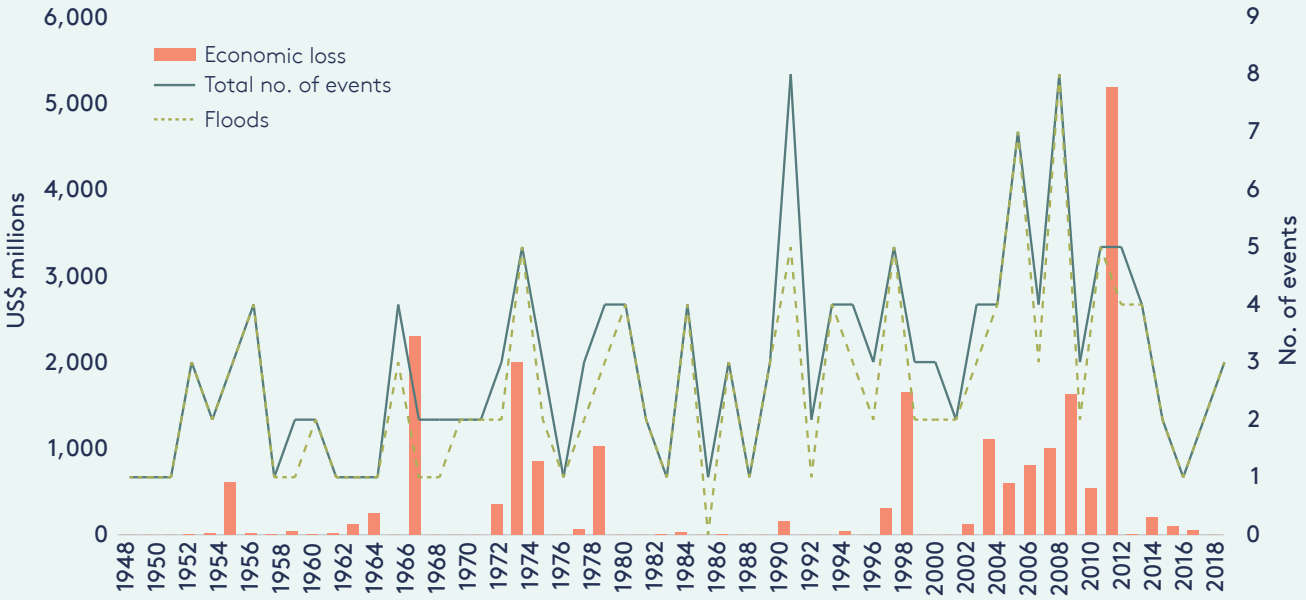
Production impacts from soil erosion

The expansion of agriculture into naturally forested areas, particularly in tropical forests, has significant negative impacts on soil quality. Ninety-three per cent of the Brazilian cattle herd is pasture-fed. Livestock rearing without pasture management leads to soil degradation. More than 70 per cent of Brazilian pastures have some degree of degradation. However, soil degradation can be reduced with adequate practices to manage pastures (Galdino et al., 2015).

For Brazilian soybean, it is estimated that the soil erosion rate under conventional tillage is equivalent to 6 tonnes per hectare, with a significantly lower erosion rate of 0.6 tonnes per hectare under a no-till system (Merten and Minella, 2013). For Latin America, the reduction in yield is estimated to be 0.6kg per hectare per mega-gram of soil erosion (den Biggelaar et al., 2014). Yield decreases at this rate would cause a loss of around 3.7kg per hectare in soybean yield in Brazil, representing more than 127,000 tonnes of soybean if all the planted area is assumed to face similar soil erosion rates.

"The observed weakening of environmental compliance in Brazil is contributing to the barriers preventing full compliance with the Forest Code"

Figure 4.3. Hazard event risks and economic losses in Brazil, 1948–2018



Source: Authors using data from EM-DAT: The Emergency Events Database – Catholic University of Louvain (2019)

This is equivalent to 0.1 per cent of the total soybean production per year.

External factors: deforestation and soft commodity production

We calculate that between 2006 and 2017 5.8 per cent of the soy planted area in 2017 could have caused deforestation. This is equivalent to 6.2 per cent of the total soy production in the same year. Nine per cent of Brazilian soybean exports are at risk of embedding deforestation. Ninety per cent of the soy-related deforestation in the period between 2006 and 2017 is associated with soy produced for consumption in Brazil and for export to nine countries.

Hazard event factors: natural hazards

Brazil is already experiencing the impacts of a changing climate, with associated economic losses (see Figure 4.3). Between 2003 and 2013, Brazil was the Latin American country with the highest agricultural production losses related to natural disasters, with a loss equivalent to US$11 billion, representing 3 per cent of the projected value of production. The Amazon and Northeast Brazil are the areas most vulnerable to extreme climate events. Between 2013 and 2016, natural disasters related to floods and droughts affected approximately a quarter of the Brazilian population, with estimated losses of around BRL9 billion (US$2.6 billion) per year (Borges, 2017).

In the Amazon basin, drought events are likely to increase in frequency and impact as a result of deforestation causing climate change. Droughts are already relatively frequent events in Northeast Brazil and it is estimated that long-term droughts have been associated with a loss of 20 per cent in the gross value of agricultural production in this region (Bastos, 2017). Drought also impacted corn production in Mato Grosso in 2018, with farmers losing an average of 10 per cent of their harvest (Bortolozo, 2019).

Flooding is also a costly hazard. The 2009 floods in the Northeast caused significant agricultural losses, while Brazilian coffee yields experienced a reduction of up to 10 per cent after flooding in 2007 (Bastos, 2017).

Fiscal factors that are transmitted from external, economic and hazard event factors

Brazilian export taxes do not affect soybean or beef, although there is a tax of 9 per cent on leathers and skins. The agribusiness sector contributed 21 per cent to Brazilian GDP in 2018 and the tax contribution of the sector amounted to around 3.6 per cent of GDP (Centro de Estudos Avançados em Economia Aplicada, 2019). On average, the tax contribution of the agribusiness sector represents around 18 per cent of the value of all agribusiness products.

Zero-deforestation policies

Between 2015 and 2018, 37 per cent of Brazilian soybean supply was consumed internally, with exports averaging 59 per cent of total supply – the remainder corresponds to final stocks. Thus, international markets are driving Brazilian soybean production and its trade brings a significant contribution from the sector to government revenues.

"One of the biggest risks for Brazil is related to a reduction in soybean yield and in double-cropping production as a result of rainfall reduction linked to natural capital loss"

More than 6 per cent of Brazilian soybean production could be exposed to risk from more stringent anti-deforestation policies, with a potential reduction in demand from companies, countries and investors aiming for zero-deforestation supply chains.

Carbon offsetting

As we argued in the case of Argentina, offsetting requirements for soybean causing deforestation might reduce the competitiveness of Brazilian regions at high risk from zero-deforestation policies in relation to locations with more sustainable production, if this is available. This scenario might warrant additional government subsidies with a potential increase in expenditure.

Reduced production leading to less tax revenue

One of the biggest risks for Brazil is related to a reduction in soybean yield and in double-cropping production as a result of rainfall reduction linked to natural capital loss. As an example, a 33 per cent reduction in Mato Grosso's yield (mentioned in the examples above), could represent a tax collection loss equivalent to 0.1 per cent of federal tax receipts, using current data. Effects in agricultural yield changes and production capacity remain to be understood in more detail for soy across the country, however.

To counteract some of these risks, soybean and cattle production could expand by bringing the abundant degraded lands back into use. Total production could be further increased via investments in yield improvements and biotechnology.

Brazil at a crossroads: what are its choices?

The risks described above are emerging, and their impact on the Brazilian economy will depend on its economic model. The materialisation of zero-deforestation international trade could benefit Brazil if the country has already put in place strategies to develop its agricultural sector while preserving and enhancing its natural capital. This strategy will promote biodiversity prospection opportunities and reduce risks from local natural capital loss, such as yield loss due to the climatic changes and soil degradation brought about by ongoing deforestation and unsustainable farming practices. Brazil already has advanced pieces of regulation that are a step in the right direction but a pro-nature development stance requires sustained and transparent monitoring and enforcement.

In particular, following the fires in the Brazilian Amazon in 2019, the legality of deforestation should be monitored by local and international stakeholders, including investors. Rule of law and institutional effectiveness are criteria for both credit rating scores and investor frameworks for evaluating sovereign bonds; they should encompass environmental governance.

If the significant amounts of capital already being deployed to the Brazilian agricultural sector are to be better used, the risks emerging from the current incentive structure linked to that finance must be analysed and addressed, and additional financial needs mapped. Emerging investment opportunities can be financed through a reallocation of existing resources under new policy and fiscal incentives and capital can be attracted via the increasing interest in transition bonds and verifiable green investments.

Investments in natural capital preservation could benefit from upcoming increases in the flow of finance for nature-based solutions. Investors need to show they would be willing to invest. It is estimated that Brazil will require US$2 billion per annum for its nature restoration targets, which seems small in comparison to the financial flows to agriculture in the country. To achieve these targets, investment vehicles such as enhanced bond structures are required, to invest commercially in forest restoration and sustainable agriculture (World Bank, 2017). Besides financial structures, investors need policy and market frameworks that enable investments that enhance environmental performance.

A complementary approach to the Brazilian government's requests for external payments from advanced economies to protect the Amazon would be for Brazil to issue a green sovereign bond, with the proceeds ring-fenced to curb illegal fires, halt deforestation and support sustainable development. In Latin America, Chile has set an example, recently issuing its own sovereign green bond and earning the lowest rate of interest in its history. For Brazil, a sovereign green bond focused on ending deforestation would mobilise capital markets behind positive action and ensure that the Brazilian government would have 'skin in the game'.

To strengthen the natural capital foundations for its sovereign debt, Brazil should:

- *Address implementation and enforcement gaps in the current Forest Code.*
- *Stimulate agricultural expansion into degraded land.* There are analyses pointing

to important amounts of land that has already been converted away from natural habitat to, for instance, pastures, and is currently degraded, which can provide a space for agricultural expansion (e.g. see WRI, 2018). The Brazilian government could actively stimulate extra agricultural expansion into these areas. This agricultural expansion needs to accommodate soil protection, and water and input management strategies that recover and preserve natural capital.

- *Regenerate forest cover,* particularly in areas that were naturally forested and are currently deforested. Forest cover regeneration could be pursued in combination with other sustainable economic alternatives. Efforts in this area would not only help mitigate production and trade risks stemming from natural capital losses: they would also position Brazil to benefit from financial flows for nature-based solutions, including carbon offsetting.
- *Improve allocation of finance*. The transition to a sustainable agricultural sector will require the improved allocation of existing finance and most likely additional resources, providing investment opportunities for fresh capital. Brazil could design and implement financial mechanisms prioritising high-yield, low-risk agricultural systems that preserve soil quality, adequately manage water resources, and promote resilience and adaptation to environmental and climate change. These mechanisms could also include forestry. Sovereign green bonds would be an important vehicle to link financial markets to Brazil's environmental performance.

These steps will require proactive government policy intervention in the form of adequate incentives. The designed incentives should come from the government and finance sector actors that have an interest in Brazilian government debt at the national and international levels. These key actors need to improve their understanding of the benefits of the transition to a sustainable economic model and align their decision-making with the impacts being pursued (natural capital preservation, zero deforestation, sustainable increase of agricultural production), with the incentives to achieving these outcomes (the financial terms offered to finance the required interventions), and with their capital allocation.

5. Conclusions and recommendations

This report has presented a first framework for understanding the links between sovereign bonds and natural capital, focusing on the ecosystem services that support major soft commodity producers. To deepen this understanding, considerable further work is needed, on both a national and international scale. In this concluding chapter we assess the strategic choices facing sovereign issues in the 2020s, outline an agenda for future research and make recommendations for decisive action.

Figure 5.1. Choices for sovereign bond issuers: High Road and Low Road scenarios for natural capital

Source: Authors

Strategic choices for sovereign issuers

Governments as issuers of sovereign debt face a set of strategic choices over how to manage natural capital to ensure a reliable flow of economic and social benefits that can underpin the pathways they take to development and their creditworthiness.

Traditionally, the relationship between natural capital and soft commodities has often been viewed as zero-sum, with the liquidation of natural capital viewed as an unfortunate but necessary stage in economic development. The domestic and global consequences of this approach are becoming increasingly clear. Proactive sovereign issuers that decouple their soft commodity production from natural capital deterioration would stand to benefit in a scenario where natural capital is integrated, valued and preserved as part of the production process. Benefits could include enhanced qualitative and quantitative ratings from investors who wish to see alignment across all asset classes with the Sustainable Development Goals and the Paris Agreement on climate change. Ultimately, this could translate into a lower and more stable cost of capital for sovereign issuers, with consequent implications for the cost of capital across the economy and governments' access to finance for their domestic development goals.

Two pathways for sovereign issuers

We see that sovereign bond issuers are now faced with two distinct choices, set out in Figure 5.1. The first option is a 'High Road' scenario, where countries actively protect and enhance the value that natural capital brings to their economies. This will underpin the long-term value of their sovereign bonds, building resilience against both the physical impacts of climate change and also disruptive changes in policy and market preferences. Ultimately, such a transition will also secure long-term access to the finance these countries require to pursue their sustainable development goals.

The second option is a 'Low Road' scenario, where a continuation with current practices undermines flows of ecosystem services, increases vulnerability to natural disasters and intensifies market risks. Countries with a high natural capital stock that take this path would miss significant opportunities from the shift to a sustainable global economy in terms of nature-based payments and also face a reduction in access to markets

scrutinising environmental performance. These downside risks will be increasingly evaluated by sovereign bond investors and incorporated into pricing.

The High Road scenario would include policies that incentivise the transition to a sustainable economy, with effective monitoring and enforcement mechanisms. This would contrast with the current situation in many countries with a high natural capital stock that currently inadequately implement their environmental protection policies. Environmental policies must be aligned with broader economic policies and incentives, such as taxes and subsidies, to get over the problem that economic and environmental policies are frequently at odds – for example, in some places environmental regulation is undermined by agricultural policies. Green accounting will help governments to quantify and track natural capital values and risks emerging from natural capital depletion for their economies. According to the UN System of Environmental and Economic Accounting (SEEA), in 2017 there were 69 countries with SEEA programmes, and the objective is to increase this number to 100 by 2020. However, besides implementing this discrete accounting system, this kind of accounting should also be an integrated tool in economic decision-making like traditional national accounts.

Natural capital protection and enhancement under a High Road scenario bring important risk mitigation opportunities and economic potential for natural-capital-dependent countries. Efforts to preserve and enhance natural capital and incorporate its value in economic decision-making will reduce the risks of agricultural yield reduction, soil degradation, biodiversity loss and increased exposure to extreme weather events, and potentially avoid some of them. From the external market's perspective, there is a risk of reducing access to markets should importers of soft commodities halt or reduce purchases from agricultural products driving natural capital loss. This risk can also be eliminated through a transition to sustainable management of nature.

Furthermore, there is a significant potential for high natural-capital-stock countries to benefit from the nature-based payments that are expected to materialise in the future and from the economic opportunities emerging from frontier sectors relying on nature, such as bio-prospection.

In the Low Road scenario, the materialisation of natural capital risks will inhibit countries' future ability to produce and export, with subsequent reductions in tax revenues, potential increases in government expenditure to support welfare

Building an agenda for further research

Critical areas for further research have emerged as a result of the analysis and stakeholder dialogue undertaken for this report. Opportunities for understanding the links between nature, economic development and sovereign debt include:

- Extending the analysis of soft-commodity-related natural capital risks to other countries, such as Indonesia.
- Examining the materiality of other natural capital stocks for sovereign health, such as the oceans.
- Incorporating natural capital factors in routine debt sustainability analysis.
- Quantifying the link between natural capital loss and the risk of sovereign debt default and credit rating.
- Deepening understanding of the quantitative relationship between achieving the SDGs and credit quality.
- Exploring the broader economic and social impacts (i.e. on labour markets) of both natural capital loss and transition in order to achieve a global just transition.
- Identifying the impacts of substitution risks for high natural-capital-dependent soft commodities (e.g. substitution of beef with artificial protein).
- Investigating the relationship between natural capital performance and sovereign bond metrics such as duration and yield.
- Examining the structuring of a sovereign green bond focused on funding sustainable land use.
- Outlining the role of soft-commodity consumer countries in supporting the transition to sustainability by soft-commodity producer countries.
- Unpacking the issue of fairness in allocating soft commodity emissions to sovereign issuers – should emissions be accounted where soft commodities are produced or where they are consumed?
- Clarifying the level of understanding that governments and investors have about the transition to sustainable land use and its implications for the economy and its debt.
- Evaluating the sensitivity of tax collection in soft-commodity producing countries and the impact on tax collection of reduced production and exports.
- Developing credible, equitable and attractive models for pricing natural capital, for example through international carbon markets.
- Assessing the role of developing countries' biodiversity in supporting the development pathways of advanced economies.
- Building alternative development pathways for high natural-capital-stock countries and evaluating their implications for sovereign bonds.
- Pinpointing the critical data points that investors need governments to disclose so that they can effectively assess the natural capital drivers of sovereign bond quality.

We look forward to working collaboratively with others on these and other priorities.

recovery, and a deterioration in fiscal performance. These events might also reduce investor appetite for countries' sovereign debt, increase their cost of capital and affect their capacity to pay their debt.

These sovereign issuers could decide to decouple their soft commodity production from natural capital deterioration now, to mitigate emerging domestic risks and prepare for upcoming global policy shifts. In order to achieve this decoupling, there are changes needed at the country governance and policy level that will trigger the need for better allocation of existing capital flows towards new production alternatives. In many cases, there will be a need for additional financial resources. Green sovereign bonds might be ideal vehicles to fund this process at country level, with emphasis on the land use sector.

Recommendations for immediate action

To realise the High Road scenario the following key players need to take decisive action now.

Governments/sovereign issuers

Building on the steps we have proposed for Argentina and Brazil as sovereign issuers:

- ***Governments should strengthen their institutional framework to align it with the management and regeneration of natural capital.*** Policies should be accompanied by consistent monitoring and enforcement, as well as sufficient fiscal support.
- ***Governments should issue green sovereign bonds that raise funds for investment in natural capital that endures over the long term.*** There is currently unmet domestic and international investor demand for well-designed green sovereign bonds.

Investors

- ***Investors should strengthen their analytical framework to better identify the relationships between sovereign issuers' natural capital and their future debt-paying capacity.*** In particular, investors should recognise instances where incentives for economic performance today are jeopardising their future sovereign health.
- ***Investors should enhance their stewardship role with regard to sovereign bonds in their portfolios, particularly those issued by high natural-capital-stock countries.*** Engagement with the issuers of sovereign bonds on natural capital performance can help to signal the materiality of natural capital factors and identify the key data points requiring disclosure. In contrast to corporates, there is currently no consistent framework for sovereign issuers to report their climate or wider natural capital positioning or performance.

Credit rating agencies

- ***Credit rating agencies should explicitly incorporate the links between the health of natural capital and the outlook for sovereign credit ratings.*** Incorporation of natural capital factors is of particular relevance given the increasing role that natural capital will play in economic development, exports and fiscal performance.

International financial institutions and coalitions

- ***Multilateral development banks (MDBs) should extend their integration of climate change to incorporate broader natural capital factors.*** MDBs can be an important source of both finance and strategic expertise for natural-capital-dependent economies. They can provide finance for country-driven action to invest in natural capital, as well as technical assistance in the integration of natural capital factors in government budgeting and sovereign debt issuance.
- ***International institutions charged with overseeing the stability and functioning of the financial system should broaden their scope to include natural capital factors.*** The International Monetary Fund (IMF) and Financial Stability Board (FSB) have started work to evaluate the implications of climate change for their operations; this could be broadened to the wider issues of biodiversity and natural capital. Coalitions such as the Network for Greening the Financial System could also explore the role of central banks and supervisors in incorporating natural capital in sovereign bond risk analysis, not least in their own portfolios.

Researchers

- ***Researchers in government agencies, universities and civil society can build on the findings presented here to deepen the understanding of the dynamics between sovereign bonds and nature.*** Within the rich agenda for future research there is a need to extend the analysis to other countries and other dimensions of natural capital.

Specific development pathways are clearly a choice made by national government. Nevertheless, international cooperation across the action areas identified here can help provide producers in the real economy as well as governments with the incentives and the arguments to pursue a 'High Road' to sustainable development. The current inclination to assess short-term economic performance in isolation from longer-term impacts needs to be reconsidered. The mainstreaming of natural capital considerations across economic and investment decision-making is a prerequisite to avoiding unnecessary risks to sovereign bonds and to realising the potential for long-term credit resilience.

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Appendix: Data on natural capital and natural hazard risks in the G20

Table A1. Natural capital stocks across the G20

Country	Renewable internal water resources (%)	Forest land (%)	Arable land (%)	Bird species (%)	Reptile species (%)	Topsoil carbon content (%)
Argentina	1.2	1.0	4.6	6.9	6.4	1.5
Australia	2.0	4.7	3.6	5.0	**15.4**	0.6
Brazil	**23.1**	**18.6**	6.5	**12.5**	**11.7**	1.2
Canada	**11.6**	**13.1**	4.5	3.6	0.8	4.3
China	**11.5**	7.9	**14.0**	8.9	7.0	–
France	0.8	0.6	2.2	2.5	2.7	1.4
Germany	0.4	0.4	1.4	2.1	0.2	3.0
India	5.9	2.7	**18.3**	8.3	9.9	0.9
Indonesia	8.2	3.4	3.1	**11.8**	**10.80**	5.2
Italy	0.7	0.4	0.8	2.4	0.9	1.1
Japan	1.8	0.9	0.5	3.1	1.4	2.3
Mexico	1.7	2.5	2.8	7.6	**13.7**	3.0
Russia	**17.6**	**30.8**	**14.3**	4.5	1.3	3.9
Saudi Arabia	0	0	0.4	2.7	1.5	0.7
South Africa	0.2	0.3	1.4	5.2	6.4	0.6
South Korea	0.3	0.2	0.2	2.5	0.2	1.3
Turkey	0.9	0.4	2.3	2.7	2.1	1.0
UK	0.6	0.1	0.7	1.8	0.1	7.0
USA	**11.5**	**11.7**	**18.5**	5.9	7.6	1.5

Notes: Percentages as a proportion of the G20 totals for each indicator. Cells shaded orange denote the countries that hold more than 10 per cent of that natural capital stock indicator within the G20.
Source: Authors using data from FAOStat, Aquastat and Mongabay based on BirdLife International and the Reptile Database

Table A2. Natural capital depletion soft commodity exports and gross domestic product in the G20

Country	Forest land change 2000–2017 (1,000 ha)	Water withdrawal/ total internal renewable water resources	Mammal species threatened	Land use emissions (Gigagrams)	Cropland expansion Avg 2000–2017 (1,000 ha)	GDP 2018 (US$ billion current)	Soft commodity exports/Total goods exports
Argentina	**0**	13%	38	**101,150**	**11,560**	519	**61%**
Australia	**-3,474**	3%	63	-66,146	**7,305**	1,420	**18%**
Brazil	**-29,704**	1%	**80**	**326,243**	**8,496**	1,868	**40%**
Canada	-826	1%	18	**81,660**	-2,786	1,712	**16%**
China	34,405	21%	**73**	-310,154	**5,670**	13,368	3%
France	1,926	15%	9	-80,518	-31	2,780	14%
Germany	69	**24%**	5	-40,033	-49	3,951	7%
India	5,649	**53%**	**93**	**125,612**	-667	2,719	13%
Indonesia	**-9,768**	11%	**191**	**1,360,761**	**15,300**	1,022	**29%**
Italy	1,036	19%	8	-34,190	-2,066	2,076	10%
Japan	79	20%	29	4,476	-386	4,972	2%
Mexico	**-1,999**	21%	**96**	11,041	1,196	1,222	8%
Russia	5,580	2%	34	-39,597	-2,989	1,657	10%
Saudi Arabia	0	**973%**	11	0	-173	787	2%
South Africa	0	35%	30	0	-1,784	368	13%
South Korea	-119	**45%**	12	1,016	-297	1,720	2%
Turkey	1,737	**26%**	19	-64,850	-2,995	771	11%
UK	224	6%	5	-12,768	203	2,829	7%
USA	7,109	16%	40	-76,851	-17,631	20,580	11%

Note: We have highlighted the five highest ranking countries for each risk indicator.
Source: Authors using data from WTO, FAOStat, FAO Aquastat, IMF and World Bank

Table A3. Soil, water and drought risks in the G20

Country	Soil organic carbon score [lower = better]	Water stress score [higher = worse]	Drought severity score [higher = worse]
Argentina	3	2	2
Australia	4	3	1
Brazil	3	1	2
Canada	1	1	–
France	3	3	3
Germany	2	3	2
India	4	5	3
Indonesia	1	3	3
Italy	3	4	3
Japan	2	2	2
Mexico	2	4	2
Republic of Korea	3	3	1
Russia	2	2	2
Saudi Arabia	4	5	–
South Africa	4	3	2
Turkey	4	4	3
UK	1	2	3
USA	3	2	1

Notes: Scores are out of 4 for soil organic carbon, water stress out of 5 and drought severity out of 3; the variation is because of the variability in data across the indicators. Source: Authors using data from FAOStat, WRI Aqueduct

The transition to sustainability is the strategic challenge sovereign bonds face in the 2020s. Overcoming this challenge requires that the financial system recognises the fundamental economic dependencies on nature, which are currently ignored and mispriced, storing up instabilities for the future.

This report examines the case for the structural inclusion of natural capital into the issuance, assessment and stewardship of sovereign bonds, with a particular focus on Argentina and Brazil. The authors focus on a hitherto overlooked aspect: the importance for sovereign bonds of reliable flows of ecosystem services from land. How successfully the world transitions to a sustainable economy will impact on countries that rely on land-based natural capital for their economy.

The report is the first in a series that will aim to understand the relationship between natural capital and the future prospects for sovereign bonds and it is anticipated that it will encourage stakeholders in the sovereign bond market to analyse further alternatives to assess and incorporate natural capital into their decision-making.

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