Anticipating the climate change risks for sovereign bonds

June 2021

AUTHORS

Nicolas Lancesseur, Ph.D.
Senior Sustainable Investment Manager – Head of Global Climate Research
+33 0 1 70 37 89 08
nicolas.lancesseur@lseg.com

Julien Moussavi, Ph.D.
Senior Manager, Sustainable Investment Economic Research
+33 0 1 87 44 88 94
julien.moussavi@lseg.com

Overview

In the run-up to COP 26, reconciling the competing national agendas towards the global climate crisis remains a challenge. Having some understanding of the potential economic and financial risks, in the event of a disorderly transition or no transition at all, could be useful.

In this condensed version of the *Anticipating the climate change risks for sovereign bonds* series, we estimate the economic and financial impacts of transition and physical risks in the 25 countries of the World Government Bond Index (WGBI) universe and find:

– The magnitude of the estimated economic impacts is very high, with tens of GDP percentage points at risk from both transition and physical risks by 2050 in the most vulnerable economies. Economically significant impact could become evident as early as 2030.

– Due to the divergence in fiscal capacity, countries that would most likely be affected economically by climate change would not necessarily be those that would incur the highest financial loss.

– Finally, the results highlight the benefits of an orderly transition to the development of sustainable economic and financial activities, and confirm that investors should take climate change consequences very seriously into account.

1. From climate-assessed scenarios to default risk

Sovereign bonds investors need to consider climate change risks into their asset allocation decisions. Climate change implies two main categories of risks for financial stakeholders, from (i) physical impacts, and (ii) transitioning to a carbon-neutral economy. A clear understanding of these risks is important to reallocate financial resources in a manner that is consistent with the Paris Agreement objectives. The latter seek to limit the likelihood of capital being destroyed by climate damages and investments turning into "stranded assets."

Our two-part study[1] is a first step toward the wider project of investigating the use of forward-looking analyses to assess climate change risks, as recommended by regulatory international institutions. Building on the Network for Greening the Financial System[2] (NGFS) approach, we explore two independent "worst-case" scenarios. The methodological framework enables a country-level assessment of the physical risk through the lens of a *hot house world scenario* and the transition risk via *a disorderly transition* scenario.

For the physical risks, our *hot house world* scenario follows the RCP 8.5 trajectory (a business-as-usual trajectory, without any additional mitigation efforts), which would lead to a global warming of about 4°C by 2100. The country assessment methodology relies on analysis from Burke and Tanutama (2019)[3] that establishes a relationship between productivity loss and temperature increase. Their study does not capture the impact of extreme weather events and the rise in sea levels.

Regarding the transition risk, a specific methodology is developed in the study to estimate the potential economic and financial shock of a very abrupt or *disorderly transition*. The approach assumes that the economies would make no further effort until the depletion of their "carbon budget" consistent with a 2°C target (determined with the CLAIM methodology[4]). Rather, they would use—in the final year—last resort technologies to respect their commitment to achieve the mitigation goal of the Paris Agreement.

Potential GDP losses in both scenarios are evaluated for the 25 constituent economies of the FTSE World Government Bond Index (WGBI) in comparison to a baseline (*i.e.*, no climate change impact in the case of the *hot house world* scenario and no mitigation efforts in the *disorderly transition* scenario). These estimated GDP losses should be then reflected in the debt dynamic for which the impacts of climate change are twofold:

– In the *hot house world* scenario, physical damage would increase the debt-to-GDP ratio since it lowers fiscal revenues as losses affecting infrastructures, employment, manufactured products, and services should reduce the tax base

– In the *disorderly transition* scenario, abatement costs are assumed to be fully funded by the government because investment in backstop technologies[5] is mainly a matter of public policy. It would, therefore, add to the budget balance and increase the debt-to-GDP ratio.

Then we build default probabilities, using a proprietary model that is based on an empirical calibration of default threshold[6]. Lastly, we simulate the potential fallout of climate change on sovereign bond yields and returns via a simple financial model.

---

1 Anticipating the climate change risks for sovereign bonds - Part 1: Insights on the macroeconomic impacts; FTSE Russell, March 2021. - Part 2: Insights on the financial impacts; FTSE Russell, June 2021.

2 The NGFS is a network of 87 central banks (ECB, BoJ, BoE, Fed, etc.) and 13 supervisors (IMF, WBG, BIS, etc.), launched at the One Planet Summit in 2017 in Paris, aiming at strengthening the global response required to meet the goals of the Paris agreement and to enhance the role of the financial system to manage climate change-related risks.

3 Burke, M., & Tanutama, V. (2019). Climatic constraints on aggregate economic output (No. w25779). National Bureau of Economic Research.

4 Climate Liabilities Assessment Integrated Methodology, see Giraud, G., Lantremange, H., Nicolas, E., & Rech, O. (2017). National carbon reduction commitments: Identifying the most consensual burden sharing, halshs-01673358, https://halshs.archives-ouvertes.fr/halshs-01673358/document.

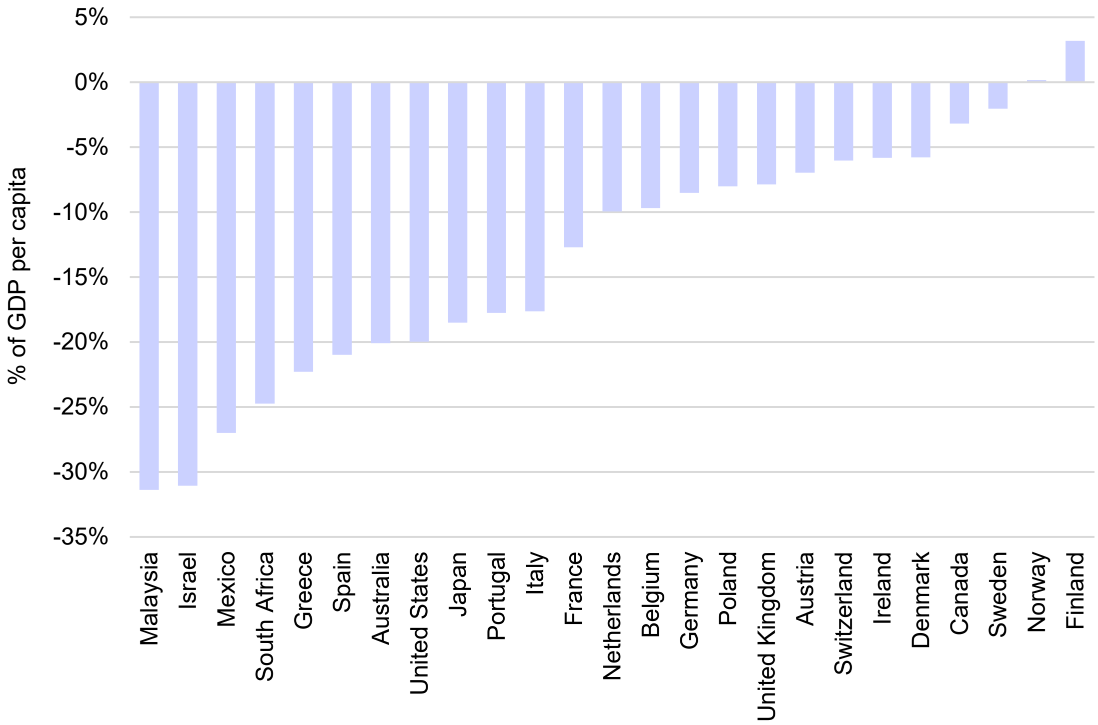
5 In our study, the climate change backstop technologies are carbon removal solutions, the last resort options when countries wait for 'the very last moment' to implement mitigation measures (see part one of the study for more details).

6 Collard, F. Habib M. & Rochet J.-C. (2015). Sovereign debt sustainability in advanced economies. Journal of the European economic association, 13(3), 381-420 and Collard, F. Habib M. & Rochet J.-C. (2016) The reluctant defaulter: a tale of high government debt. Swiss Finance Institute Research Paper Series 17-39.

2. Physical risks: from economic to financial impact

The differing effects on economies from temperature increases (see Chart 1) are driven by one main factor: the heterogeneity in their starting climate conditions. The higher starting average temperature around the equator will result in greater estimated damages from global warming in that region. Overall, most of the WGBI economies would suffer a negative impact from unmitigated global warming.

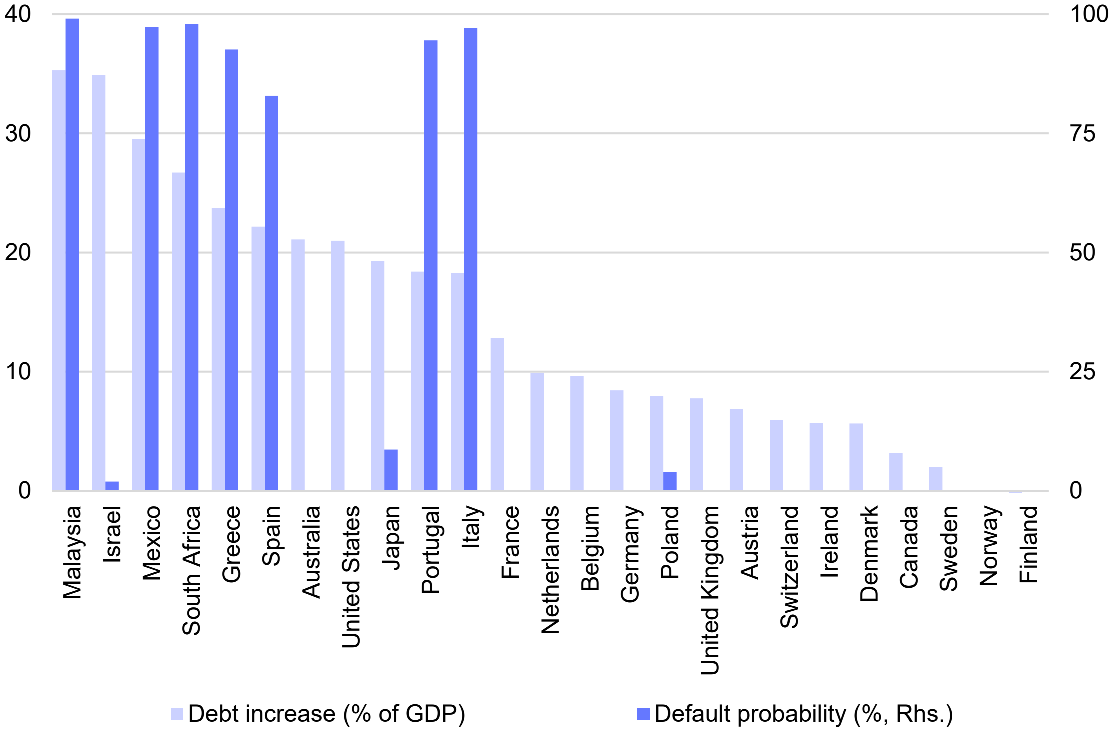
Chart 1. Change in GDP per capita in the hot house world scenario by 2050



Source: Beyond Ratings, based on Burke and Tanutama (2019) calibration and Burke et al. (2015) data for temperature at country level. Singapore is part of the WGBI but is not included in this physical risk analysis since Burke et al. did not include the country in their analysis.

Under the *hot house world* scenario (see Chart 2), only emerging markets economies (*i.e.*, Malaysia, South Africa, and Mexico) and Southern Europe economies (*i.e.*, Portugal, Italy, Greece, and Spain) could be expected to default by 2050. This highlights the various economic exposures to physical risks and the diverse financial resilience between countries. Proximity from the equator generally increases the potential economic impact resulting from the adaptation costs of climate change. While Australia and the United States are expected to incur a large increase in debt-to-GDP ratio (+21 percentage points for both), these economies still retain some fiscal capacity, given their large default threshold estimates.

Chart 2. Debt increase and default probability in the hot house world scenario by 2050

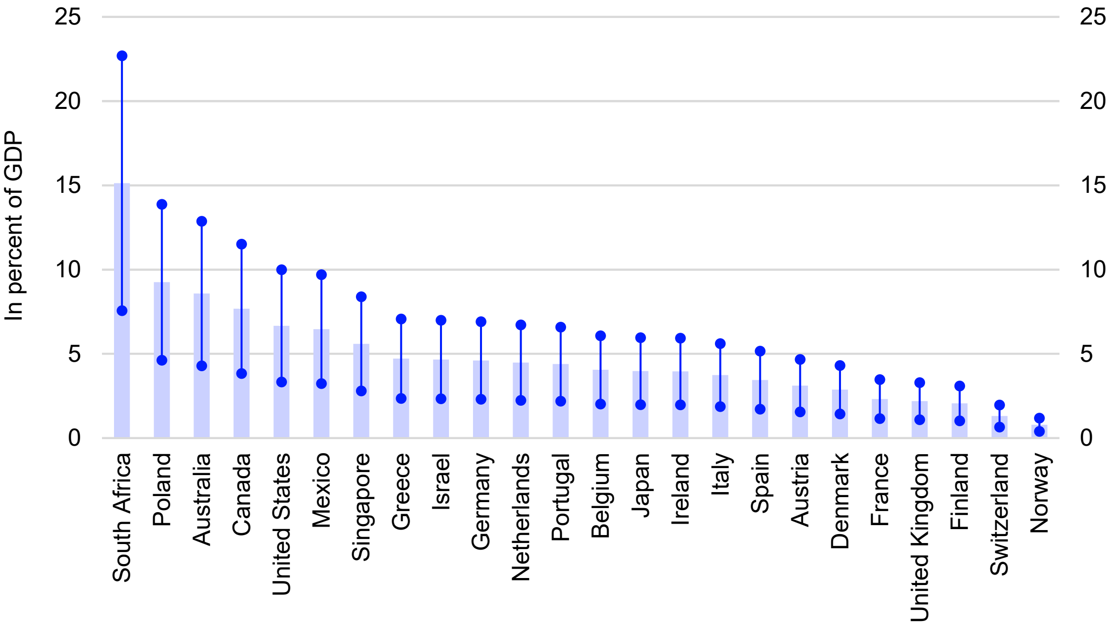


Source: Beyond Ratings.

3. Transition risks: from economic to financial impacts

Chart 3 shows the total abatement costs estimates (in terms of GDP) associated to the residual emissions after depletion of the carbon budgets. The total abatement costs of an economy are incurred from the depletion year and would continue every year as long as residual emissions remain at the same level. With the highest abatement costs-to-GDP ratio, South Africa, Mexico, Poland, the United States, Australia, and Canada are the most exposed to transition risks. The situation is all the more worrying for countries where the depletion year of their carbon budget is very close. This includes Australia, the United States, and Canada (respectively 2025, 2026 and 2026 vs 2031 for Poland and 2036 for South Africa).

Chart 3. Total abatement costs* incurred from the depletion year in the disorderly transition scenario by 2050



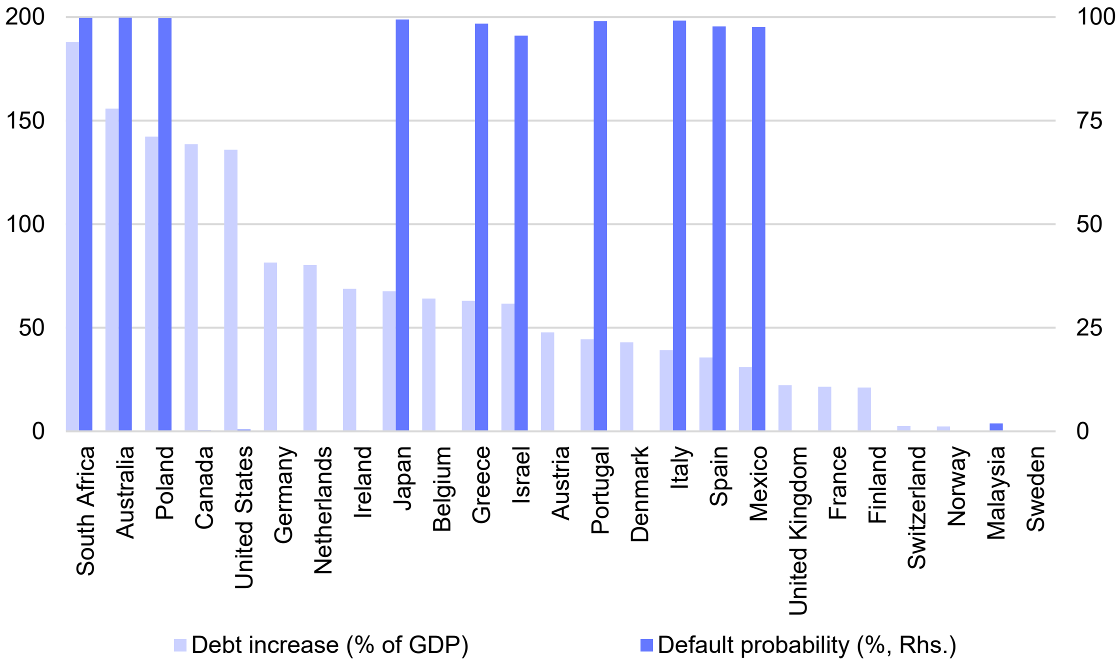
Source: Beyond Ratings.

* Note: the level of the impact represented by the histogram bars is calculated with a technology cost of 200$/tCO2 (reference) although the lower and the upper ends of the sensitivity bars are calculated respectively with a cost of 100$/tCO2 and 300$/tCO2 (range estimated by the IPCC for the direct air carbon capture and storage -DACCS- technology). Sweden and Malaysia do not appear in the graph since their budgets are not depleted before 2050 (their depletion rate is very low thanks mainly to carbon sinks, accounted in their LULUCF (Land Use and Land Use Change & Forestry) sector.

Since the WGBI universe is predominantly made up of advanced economies, which seem to be the most exposed to the risks of a *disorderly* transition (they have used up a lot of their carbon budget already and the magnitude of costs is higher in this scenario), the number of defaulting economies is higher than under a *hot house world* scenario (see Chart 4). Overall, up to 10 economies could experience episodes of financial stress (*i.e.*, South Africa, Australia, Poland, Japan, Italy, Portugal, Greece, Spain, Mexico, and Israel).

Like for the *hot house world* scenario, there are differences in financial resilience. Even if most economies in the WGBI universe are expected to experience a large increase in their debt-to-GDP ratio, some would still have enough fiscal capacity due to their large default threshold estimates. For Italy, it appears that, despite a smaller increase in its indebtedness from financing the transition to a decarbonized economy (+39 percentage points, compared for instance to Germany’s 82), its limited access to fiscal support would be leading the country to experience episodes of high sovereign credit stress within just a few decades.

Chart 4. Debt increase and default probability in the disorderly transition scenario by 2050



Source: Beyond Ratings.

According to our financial modelling, while physical risks could start to impact bond returns as early as 2030 (followed by transition risks a few years later), by 2050 the projected declines in returns are globally comparable in both the *hot house world* and *disorderly transition* scenarios[7].

[7] More information on the impacts of climate change on sovereign bond yields and returns is available in the following paper: Anticipating the climate change risks for sovereign bonds - Part 2: Insights on the financial impacts; FTSE Russell, June 2021.

ABOUT FTSE RUSSELL

FTSE Russell is a leading global provider of index and benchmark solutions, spanning diverse asset classes and investment objectives. As a trusted investment partner, we help investors make better-informed investment decisions, manage risk, and seize opportunities.

Market participants look to us for our expertise in developing and managing global index solutions across asset classes. Asset owners, asset managers, ETF providers, and investment banks choose FTSE Russell solutions to benchmark their investment performance and create investment funds, ETFs, structured products, and index-based derivatives. Our clients use our solutions for asset allocation, investment strategy analysis, and risk management, and value us for our robust governance process and operational integrity.

For over 35 years we have been at the forefront of driving change for the investor, always innovating to shape the next generation of benchmarks and investment solutions that open up new opportunities for the global investment community.

CONTACT US

To learn more, visit lseg.com/ftse-russell; email info@ftserussell.com; or call your regional Client Service team office:

EMEA +44 (0) 20 7866 1810

North America +1 877 503 6437

Asia-Pacific

Hong Kong +852 2164 3333

Tokyo +81 3 6441 1430

Sydney +61 (0) 2 7228 5659

Disclaimer

FTSE RUSSELL
An LSEG Business