



**The Coalition  
of Finance Ministers  
for Climate Action**

# **Fiscal risks of climate change: Quantitative Climate Change Risk Assessment Fiscal Tool (Q-CRAFT)**

**International Monetary Fund (IMF) Fiscal Affairs Department**

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**A contribution to the 'Compendium of Practice from a Global Community of Ministries of Finance and Leading Organizations: Economic analysis and modeling tools to assist Ministries of Finance in driving green and resilient transitions'**

**Topic:** Modeling tools relevant to Ministries of Finance

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**Access the full Compendium at [www.greenandresilienteconomics.org](http://www.greenandresilienteconomics.org)**

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## Overview

The Quantitative Climate Risk Assessment Fiscal Tool (Q-CRAFT) is an Excel-based tool created by the IMF's Fiscal Affairs Department to help governments worldwide to assess their long-term macroeconomic fiscal risks from climate change. It projects key economic and fiscal variables—such as GDP, fiscal deficit, and debt-to-GDP ratio—for over 170 economies through the end of the century. Utilizing state-of-the-art empirical data on the macroeconomic impacts of climate change, Q-CRAFT analyzes how these economic and fiscal variables may evolve under different IPCC emission scenarios and at different speeds of economic adaptation to temperature changes.<sup>1</sup> This transparent and flexible tool can be adapted to national circumstances, incorporating country-specific climate risks such as sea-level rise and natural disasters, and is applicable to countries at any development stage. Q-CRAFT has been used by countries including Armenia, Azerbaijan, Georgia, Jamaica, Kenya, Morocco, Rwanda, Seychelles, The Netherlands, and Uganda. Q-CRAFT will be available for countries through the IMF Fiscal Risk Toolkit.<sup>2</sup>

## Strengths and limitations

Q-CRAFT is a transparent, Excel-based tool designed to be adaptable to national circumstances and capacities, which uses state-of-the-art empirical data on the macroeconomic effects of climate change. Preloaded with public data and updatable with national data, it enables governments to analyze slow-building yet significant long-term economic impacts and fiscal risks from climate change. Supported by a User Guide, users can input assumptions for productivity growth, inflation, interest rates, and demographic growth. Q-CRAFT establishes baseline scenarios for key macrofiscal indicators such as GDP, fiscal deficit, and debt-to-GDP ratio. It then applies cross-country empirical estimates of temperature shifts on GDP per capita under different emission scenarios and for different speeds of economic adaptation to climate change, as available in the IMF's FAD Climate Policy Dataset<sup>3</sup> and generated according to the Kahn (2021) methodology.<sup>4</sup> Because the empirical dataset includes data for various emission scenarios and incorporates information from 30 different climate models, Q-CRAFT's analysis accounts for both uncertainty in future emissions (scenario uncertainty) and uncertainty in the climate system's response to those emissions (model uncertainty). Q-CRAFT presents its outputs in clear tables and charts, providing an accessible, comprehensive, quantitative overview of climate change fiscal risks, laying a foundational framework for further country-specific climate change risk analysis and publication in Government reports such as Fiscal Risk Statements.

Q-CRAFT is a partial equilibrium model using a production function and the IMF's public debt dynamic equation<sup>5</sup> to undertake a stylized assessment of the macroeconomic fiscal risks from climate change. The robustness of Q-CRAFT depends on the accuracy and quality of the input data and the assumptions made by the user. Additionally, its results are conservative as they do not explicitly account for tipping points, sea-level rise risks, non-market damages (e.g., mortality, conflicts, and food insecurity) and other environmental risks unless these elements are manually added by the user. Q-

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1 The IPCC emission scenarios analyzed include SSP1–2.6, SSP2–4.5, SSP3–7.0, and a variation of SSP3–7.0 that uses the 90th percentile of temperature increase across all climate models rather than the average temperature projection. Also, in climate models, adaptation speed is usually implied. However, Q-CRAFT allows users to set the period (m) of adaptation to new temperatures at 20, 30, or 50 years.

2 <https://www.imf.org/en/Topics/fiscal-policies/Fiscal-Risks/Fiscal-Risks-Toolkit>

3 IMF FADCP Climate Dataset (Massetti and Tagklis, 2023), using CRU data (Harris et al., 2020), and CMIP6 data (Copernicus Climate Change Service, Climate Data Store, 2021: CMIP6 climate projections).

4 Kahn (2021) analyzes the impact of warming on productivity by examining how deviations in temperature from historical norms affect labor productivity. Using this methodology and empirical data, Q-CRAFT analyzes how warming impacts labor productivity in a country, which subsequently negatively affects GDP growth. This decrease in GDP growth leads to a loss of Government revenue, an increase in the fiscal deficit, and a rise in public debt.

5 The public debt dynamic equation is a formula that models changes in a country's debt-to-GDP ratio over time, considering variables such as the primary fiscal balance, interest rates, economic growth, and inflation. It helps assess debt sustainability and the impact of external shocks on public debt levels. In Q-CRAFT, this equation is used to quantify how climate change might affect economic growth and, consequently, the country's public debt trajectory.

CRAFT can supplement but not replace other macroeconomic models, and its outputs are limited to aggregate country analysis, not specific sectors, e.g., agriculture or manufacturing.

## Relevance to Ministries of Finance

Q-CRAFT is very useful for Ministries of Finance due to its ability to provide comprehensive assessments of long-term macroeconomic fiscal risks from climate change, based on empirical data. It offers long-term baseline estimates, up to 2100, for key variables such as GDP growth, fiscal deficit, and debt-to-GDP ratio, helping MoFs assess economic growth and fiscal sustainability under various emission scenarios. By projecting these the evolution of these indicators', Q-CRAFT helps MoFs understand potential long-term economic impacts and identify slow-building climate change fiscal risks not immediately visible in the budget cycle or a medium-term fiscal framework. This enables MoFs to prepare for medium- and long-term fiscal challenges.

## Key policy/analytical questions addressed

Q-CRAFT supports the development of informed fiscal policies by offering a comprehensive overview of how different emission scenarios could affect key fiscal metrics, guiding policy adjustments to enhance resilience to climate change. It aids in budget preparation by highlighting future fiscal pressures and assists in debt management by predicting debt dynamics in the face of climate change. Additionally, Q-CRAFT's outputs can supplement other macroeconomic models, including long-term models that take into account the fiscal impacts of, for example, an aging population, by integrating climate risk analysis into broader fiscal planning and strategy development, enabling more comprehensive climate change risk management.

## Use in practice

Q-CRAFT is made available for countries through the IMF Fiscal Risk Toolkit.<sup>6</sup> The Q-CRAFT User Guide provides users with all the necessary information to operate the tool, including guidance on key assumptions that need to be made. Q-CRAFT does not contain any scripts or macros, making it compatible with any version of Excel.

Through its Capacity Development (CD) support for the implementation of Q-CRAFT, FADCP helps its member countries integrate climate considerations into their macroeconomic and fiscal frameworks. This support goes beyond just quantifying climate fiscal risks; it also strengthens a country's overall macrofiscal forecasting capacity in the context of climate change. CD activities have brought together economic, fiscal, and climate change forecasting experts, fostering stronger cross-government collaboration, and establishing dedicated working groups. Examples of CD applications include Armenia, Azerbaijan, Georgia, Jamaica, Kenya, Morocco, Rwanda, Seychelles, and Uganda.

## Lessons and challenges

By using Q-CRAFT, countries can learn to conduct quantitative long-term fiscal analysis under various climate change scenarios, a new type of analysis for many MoFs. Q-CRAFT can reveal that long-term debt dynamics may become unsustainable, with debt-to-GDP ratios rising to high levels by the end of the century. While this projection reflects the potential impact of climate change and is based on empirical data, communicating such messages can be politically challenging for some governments. Additionally, demographic changes, such as an aging population, can significantly increase the debt-to-GDP ratio even in a baseline scenario. However, Q-CRAFT also includes charts showing how debt-to-GDP might evolve compared with a fiscal rule, allowing governments to illustrate how debt levels could change if their baseline scenario adhered to a specific debt-to-GDP threshold.

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<sup>6</sup> <https://www.imf.org/en/Topics/fiscal-policies/Fiscal-Risks/Fiscal-Risks-Toolkit>

## Future work

Q-CRAFT provides an economic and fiscal model that allows governments to use empirical data to quantitatively assess the impact of climate change fiscal risks. The current dataset focuses on the macroeconomic effects of gradual warming. In the future, Q-CRAFT's framework will incorporate other empirical datasets as they become available, such as sea-level rise risks under different climate change scenarios or the impacts of long-term trends such as climate change-induced weather volatility.

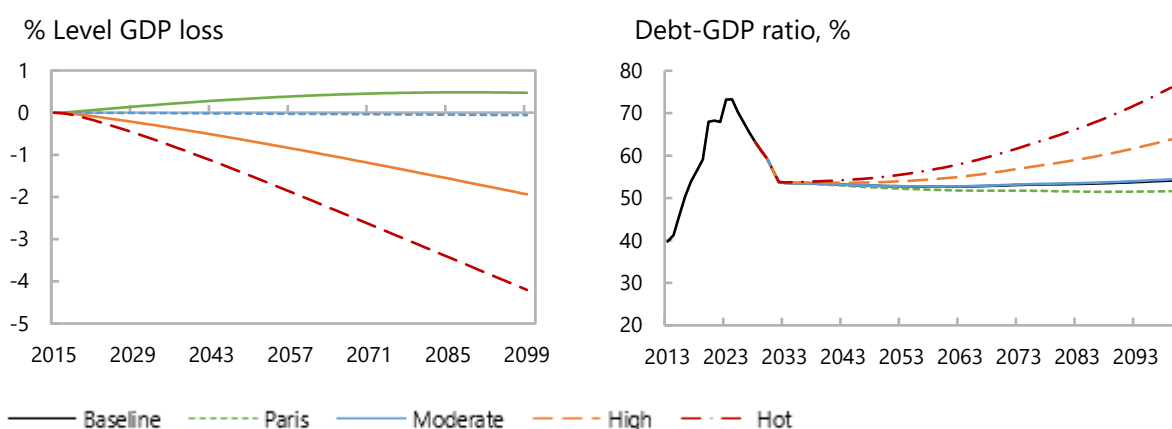
## Analysis in action

Below we present some examples of MoFs making use of Q-CRAFT.

### Use case: Kenya

The MoF in Kenya utilized Q-CRAFT to strengthen its analysis of climate change fiscal risks as part of the 2024 Budget Policy Statement (BPS) (Kenya, 2024). The BPS is a key document that outlines broad strategic priorities and policy goals, guiding both the national government and county governments in the preparation of their budgets for the upcoming financial year and the medium term. By integrating climate change risks into the BPS, the Kenyan authorities are proactively addressing the potential long-term economic impacts of climate change in their fiscal planning. Figure 1, from Kenya's Statement of Specific Fiscal Risks, illustrates the impact of climate change on GDP and the debt-to-GDP ratio, relative to the fiscal rule of maintaining debt at 55% of GDP. Under the hot scenario (SSP3-7.0 at the 90th percentile of temperature increase), GDP would be 4.2 percentage points lower than the baseline by the end of the century, and the debt-to-GDP ratio would rise by 22 percentage points, reaching 76%.

**Figure 1. Example charts from the Kenya 2024 statement of specific fiscal risks**



Source: Kenya (2024)

### Use case: Georgia

The MoF in Georgia used Q-CRAFT in its Fiscal Risk Statement, reflecting the country's commitment to openness and fiscal transparency as key components of strong public financial management. Over the years, Georgia has significantly enhanced its ability to analyze long-term fiscal risks from climate change. For instance, the 2023 Fiscal Risk Statement (Georgia, 2023) revealed that under the most extreme emission scenario tested, the debt-to-GDP ratio could be nearly 20 percentage points higher than the baseline scenario. This risk analysis prompted the Ministry to plan further studies on specific risk channels, such as how climate change risks could impact the Government budget through state-owned enterprises.

Q-CRAFT provides a foundational framework for climate change fiscal risk analysis, enabling governments to start identifying, quantifying, and analyzing country-specific fiscal risks from climate change. By doing so, they can identify key exposures of their budgets and balance sheets to the climate change risks, including those from more frequent and severe natural disasters that could affect state-owned enterprises, sub-national government finances, public-private partnerships, and power purchasing agreements. Subsequently, governments can reduce these risks by investing in climate-resilient infrastructure and adopting economic and regulatory policies to enhance adaptive capacity of its economy. Similar to CD on climate change fiscal risks, FAD supports governments on these efforts through, for example, a Climate Public Investment Management Assessment (C-PIMA), which helps improve public investment processes for building resilient infrastructure. More information on the C-PIMA can be found at the IMF Infrastructure Governance Portal.<sup>7</sup>

## Conclusions

Q-CRAFT is a practical and user-friendly Excel-based tool that enables governments to analyze the long-term macroeconomic and fiscal risks posed by climate change. Its use is expanding globally as more countries and MoFs recognize the importance of considering future fiscal policies in the context of climate change risks. Q-CRAFT provides an essential starting point for macrofiscal analysis. Governments can further enhance this analysis by examining specific vulnerabilities within their budgets and balance sheets to better understand and mitigate climate change risks.

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<sup>7</sup> <https://infrastructuregovern.imf.org/content/PIMA/Home/PimaTool/C-PIMA.html>