The Coalition of Finance Ministers for Climate Action

Efforts by Uruguay's Ministry of Economy and Finance to mainstream climate in economic analysis

Uruguay—Ministry of Economy and Finance, and University of Montevideo

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Introduction

Uruguay took a pivotal step in 2020, putting into law the intention of the Executive Branch to incorporate the national climate change adaptation and mitigation objectives into the analysis and the design of its economic policy and its planning of public finances.[1] This intention called on the Ministry of Economy and Finance (MEF) to play a role in the design, evaluation, and implementation of public policies on climate change.

As part of this process, one of the fundamental objectives of the MEF was to work with the Ministry of the Environment and other sectorial Ministries to study the macroeconomic impact and cost-effectiveness of the measures included in the first Nationally Determined Contribution (NDC) and those new measures proposed during the process of the second NDC.

Macroeconomic analysis to inform climate change policies

Since 2020, climate change national policies have strongly advanced in Uruguay, and macroeconomic analysis accompanied that advance. From the physical risk perspective, the work done by the World Bank (Giuliano et al., 2024) and the IMF (Clevy and Evans, 2025) must be highlighted. From the transition risk perspective, a number of important exercises should be mentioned, including the work done by the Uruguayan Central Bank (Barón and Rodríguez, 2024) and the work, funded by ECLAC, by Rosas (2025). Two exercises with a greater impact on economic policies and the implementation of climate change policies are the application of a dynamic stochastic general equilibrium (DSGE) model and the estimation of greenhouse gas abatement costs curves, both to inform NDC2.

A DSGE model to inform the second NDC

In 2022, Uruguay developed its second NDC, which established various national mitigation targets and measures for 2030. The process was coordinated by the Climate Change National Response System (SNRCC), an institution coordinated by the Ministry of the Environment, that includes Ministries and relevant offices. As a contribution to this process, and with the financial support of the World Bank, the MEF embarked on the development of a macroeconomic tool that would inform the SNRCC, for the first time, about the economic impacts of climate policies aimed at mitigating greenhouse gas emissions.

This tool consisted of a DSGE model, which represents the characteristics of the country's main economic agents—households, the productive sector, the Government, and the rest of the world. It models households' intertemporal preferences, Government behavior, production functions, interactions between productive sectors, and patterns of exchange and international trade. The development, parametrization and calibration of the model was led by Dr. Serafín Frache, a macroeconomist at the University of Montevideo with expertise in macroeconomic modeling.

This model was chosen as it was designed to provide intertemporal consistency over the short, medium, and long terms from the perspective of a small economy relative to the rest of the world. It is relatively simple to operate, well micro-founded, and robust to the Lucas critique. While more global structural models are often used for such analyses, they are significantly more complex to implement, and they adopt a global perspective that would be challenging to apply to the specific case of Uruguay, a country with limited relevance in the global greenhouse gas inventory. Another alternative considered was computable general equilibrium (CGE) models, but they are not well micro-founded. Although the model was primarily oriented to the short and medium term (a time horizon of five to ten years to assess mitigation policies and their impacts), it could be adjusted to extend the time horizon to the long term. The model was initially employed to evaluate 12 mitigation measures presented in the second NDC. All these measures comprise sectors that generate the largest proportion of greenhouse gas emissions. Most of the measures correspond to the two most relevant sectors of the economy in terms of emissions: land use, land use change, and forestry (LULUCF) and energy

1 Article 533 of the 2020–2024 Budget Law (Law No. 19,924, enacted on 18 December 2020). This law establishes the national budget for the corresponding Government period.

(according to the UNFCC National Inventory for greenhouse gases, 57% of the total emissions in 2019 originated from the LULUCF sector and 33% originated from the Energy sector).

To perform modeling exercises, simulations, and subsequent comparisons between a baseline scenario and scenarios with mitigation policies, it is necessary to have data that captures both the interrelationships between economic sectors and the operational and capital costs associated with implementing those measures. To capture the interrelations between the economic sectors the model used the data from the 2016 supply and demand matrix published by the Central Bank of Uruguay. To calculate the operational and capital costs associated with implementing those measures (OpEx and CapEx) the MEF worked closely with technicians from other relevant Uruguayan Ministries, and experts in Chile involved in a similar exercise for Chilean´s Long-Term Climate Strategy, to obtain detailed information on the investments and changes involved in each of the measures and its costs.

The modeling exercise consisted in comparing how key macroeconomic variables evolve in two scenarios with measures implemented with respect to a business-as-usual, no measures scenario. More specifically, the scenarios consisted in the following:

- Baseline scenario: Projections of the model based on observable data up to 2022 and GDP projections, along with demand components for the period 2023–2030, developed by the MEF.
- Low-investment scenario: Simulates the capital and operational expenditure required to implement a package of seven emission reduction measures: one for the LULUCF sector and six for the energy sector. Key measures include the use of low-emission nitrogen fertilizers, replacing fuel oil with natural gas, and increasing the fleet of electric buses. The cost of this package of measures is equivalent to 0.24% of the 2022 GDP.
- High-investment scenario: Simulates the capital and operational expenditure required to implement a package of 12 emission reduction measures: one for the LULUCF sector and eleven for the energy sector. This package includes the seven measures analyzed in the low investment scenario, along with additional, more ambitious measures such as the private acquisition of electric cars and utility vehicles (SUVs) or increasing the blending of biofuels, such as bioethanol in gasoline (0.7%) and biodiesel in diesel (7%). The cost of this package is equivalent to 1.21% of the 2022 GDP.

Overall, the high investment scenario achieves a 1.8% reduction in emissions compared with the baseline, while the low investment achieves a 0.67% reduction. While GDP initially decreases in the early years of policy implementation, it then increases above the baseline in both scenarios, and neither of the two scenarios show significant differences in terms of the country's economic growth among them. By 2030, it is estimated that GDP will grow at a rate of 2.66% under the low-investment scenario and 2.64% under the high-investment scenario, compared to 2.40% in the baseline. This indicates that by 2030, the projected GDP is expected to be 0.57% and 0.52% higher, respectively, if one of the policy packages is implemented, highlighting the positive economic impact of mitigation measures. After 2030, the GDP growth rate converges across all scenarios to the MEF's long-term rate of 2.45%.

As a preliminary tool, the model has its limitations. One such limitation may be the assumption that all financing comes from the private sector. Others may be overestimated electrification costs, or the discrete nature of CO_2 emission reductions attributed to each mitigation action, which overlooks secondary co-benefits (e.g., improved worker productivity due to better health from reduced air pollution). Nevertheless, the tool may assist the MEF, together with other tools, in drafting future strategic documents and economic development plans that incorporate climate change considerations.

Greenhouse gas abatement cost curves: a key tool for shaping NDC2 and climate policy

The more active role of the MEF in the SNRCC, the interministerial working panel on climate policy, and the coordinated work with the other Ministries that resulted from it, produced another important piece of information for the national climate policy: greenhouse gas abatement costs curves. These curves, while providing a partial perspective due to the absence of general equilibrium considerations, were developed as a practical tool to assess the feasibility and prioritization of mitigation measures based on their cost-effectiveness.

This was a groundbreaking task in several ways. Sectoral Ministries had not previously worked explicitly on CapEx and OpEx in a coordinated fashion at the SNRCC level. Consequently, it was a demanding task for the rather small climate team at MEF. In some cases, this team was in charge of producing this information, not just collecting it. The process required extensive collaboration through interviews with technical staff from various Ministries and Agencies to understand the proposed mitigation measures, their abatement potential, and their associated costs. However, challenges such as limited cost quantification and vague measure definitions highlighted the need for continuous analysis and updated studies to refine the data. A remarkable case was that of the costs involved in owning and operating an electric bus in comparison with a diesel-powered one. These calculations were a bedrock in the MEF-led proposal to reform the urban buses subsidy scheme, moving it from diesel-powered to electric buses. The reform was implemented in 2024.

Remarks

From a Ministry of Finance perspective, three remarks from the recent "climate-economic analysis" must be shared:

i) It is important to apply different economic exercises and tools in order to compare results considering the assumptions and characteristics of each exercise and tool; if the results go in the same direction, this is a key verification.

ii) Applying macroeconomic models is knowledge, time, and resource-demanding; research institutions and multilateral institutions need to work hand-in-hand with MoF teams to apply them.

iii) Considering the tight timeframe for public policy decisions, other economic tools need to be in the MoF's "tool box" in addition to macroeconomic models; MACCs and cost-benefit analysis have a relevant role to play.

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