The Coalition of Finance Ministers for Climate Action

Finance Canada's approach to climate–economy modeling

Canada—Department of Finance

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: Specific analytical tools and approaches relevant to Ministries of Finance

June 2025

Access the full Compendium at www.greenandresilienteconomics.org

This contribution was prepared at the request of, and with guidance from, the Ministry of Finance of Denmark as Lead of the Coalition's Helsinki Principle 4 initiative 'Economic Analysis for Green and Resilient Transitions' and its Steering Group, with input from its Technical Advisory Group. The views, findings, interpretations, and conclusions expressed are those of the authors. While many Coalition members and partners may support the general thrust of the arguments, findings, and recommendations made in this contribution, it does not necessarily reflect the views of the Coalition, its members, or the affiliations of the authors, nor does it represent an endorsement of any of the views expressed herein by any individual member of the Coalition.

This is an edited extract from the following Compendium contribution: 'Finance Canada CGE model'.

Finance Canada has the lead role in macroeconomic analysis within the Government of Canada. To fulfill this obligation the organization has developed and maintains a suite of economic models for macroeconomic analysis. These include the following.

- A small, open-economy New Keynesian dynamic stochastic general equilibrium model (DSGE) used for simulating the macroeconomic consequences of industrial and social policies, as well as prospective policy responses to macroeconomic conditions (e.g., inflation, recessions).
- A forward-looking multi-country, multi-sector computable general equilibrium (CGE) model with a finite time horizon and limited dynamics for analysis when sectoral or regional detail is important (e.g., trade agreements, industrial policy).
- The Heterogeneous Agent New Keynesian (HANK) model, which combines incomplete markets with idiosyncratic risk to generate an endogenous and continuous wealth distribution for making quantitative statements about the equity implications of monetary and fiscal policy (e.g., employment insurance take-up, progressive taxation).
- A semi-structural econometric forecasting model for medium-term economic and fiscal analysis.

Finance Canada uses these general-purpose economic models to analyze and quantify the potential economic impacts of a wide variety of different scenarios. It is seldom the case that there is enough lead time or policy specific knowledge to build the ideal model to explicitly capture the sector/policy being analyzed. For many projects, discussions between modelers and subject matter experts lead to decisions about how best to approximate the scenario within the existing structure of the models rather than building a new purpose-built model.

In the early 2000s it was determined that Finance Canada would increasingly need to model the climate mitigation policies necessary for Canada to achieve its pledged emissions reduction targets. Environment and Climate Change Canada (ECCC) takes the lead on policies related to climate change and maintains its own suite of models. The investment to build a climate variant of the Department's CGE model was, however, deemed necessary because of the magnitude of the potential economic and fiscal impacts, the likelihood that a climate-specific model would be used repeatedly, and the absence of key variables (emissions) in existing models.

The climate CGE variant tracks combustion emissions associated with the intermediate and final uses of fossil fuels as well as the process emissions associated with production. It has been a useful tool to quickly examine the economic channels through which climate mitigation policies might impact the Canadian economy. A key strength of the model is that since it was developed internally and is not overly complex, it can be customized quickly. For example, when studying alternative revenue recycling arrangements, it was possible to add a large final emitter system where allowances are related to output. The model can also be calibrated to a Global Trade Analysis Project (GTAP) aggregation or directly to a specific baseline provided by ECCC. Thus, when Finance Canada is supporting ECCC policy development, Finance Canada can align the model to match the ECCC baseline assumptions.

The original analytical structure for Finance Canada's multi-sector, multi-region CGE models was developed within the organization with the involvement of Jean Mercenier, a Visiting Professor at the University of Ottawa. This has meant expertise has been available to quickly adapt the model to provide analysis on a diverse set of topics. Ensuring this institutional expertise is maintained—and that the next generation of modelers gain knowledge of CGE modeling—requires that resources are allocated for senior modelers to train new modelers. This is especially important because fewer students are graduating with CGE modeling experience, apparently due to the declining popularity of this method.

The climate CGE model has provided Finance Canada with numerous insights about climate mitigation policies. However, it is not appropriate for every aspect of every climate-related question. Finance Canada's experience has been that acquiring the climate-specific expertise required to build a multi-country, multi-region CGE model that tracks emissions is within the capacity of a small team of experienced economic modelers. However, the climate science, engineering, and energy systems knowledge required to estimate all the parameters in such a model, or to build a more comprehensive climate-energy-economy model, would require dedicated resources with specialized expertise. For Ministries of Finance that do not have the lead in environmental policy, a multi-country, multi-region CGE model calibrated to external data will likely provide a good balance between Ministries' needs and the allocation of scarce modeling expertise and resources within the public service.