Modelling techniques in the Analytical Studies and Modelling Branch

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Statistics Canada

Delivering insight through data for a better Canada

What do we do?

INNOVATION AND EXPERTISE IN RESEARCH

Multi-disciplinary Programs of Research

In-depth, multi-disciplinary and horizontal research integrates economic, health and social themes and data sources, highlighting the value of Statistics Canada's data holdings to address relevant and complex policy issues.

Areas of research include:

Immigration • Jobs and employment • Education, Training and Skills • Environment • Well-being and life satisfaction • Early Learning and Child Care • Innovation and the New Economy • Global Competitiveness • Nutrition and Physical Measures • Child and Youth Health • Aging • Mental health

Analytical Modelling

Building on more than 30 years of experience, analytical models support evidence-based decision making by enabling users to conduct what-if scenarios to understand the impacts of policy options.

Microsimulation and economic models include:

Social Policy Simulation Database and Model (SPSD/M) • Population Health Model (POHEM) • OncoSim • Multifactor Productivity Model

Data Integration and New Measures

Data integration strengthens and expands Statistics Canada's data holdings and Canada's statistical infrastructure, bringing together a range of data sources to create new value-added data holdings to address complex issues.

Recent innovative data sources include:

Canadian Employer-Employee Dynamics Database (CEEDD) • Intergenerational Income Database (IID) • Longitudinal Worker File (LWF) • Interjurisdictional Employment (IJE) • Estimates of Business Openings and Closures • Robots! Database • Digital intensity indices • Canadian Census Health and Environment Cohorts (CanCHEC)

Many are available in Research Data Centres across Canada

Training and Capacity Building

A robust and responsive training program increases data literacy among internal and external stakeholders and partners on a range of topics including data gathering, quality, analysis, visualization and storytelling.

Popular courses include:

Data Literacy Training Initiative • Data Interpretation Workshop • Analysis101 • Survey Skills Exploration Course • Business Enterprise (BEST) • Data Navigator

DATA LITERACY TRAINING INITIATIVE

Secure access to StatCan microdata

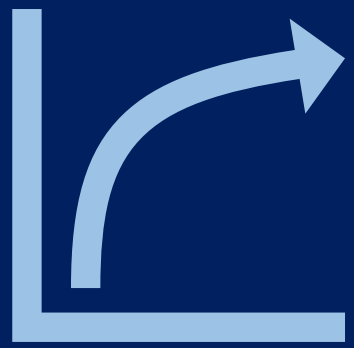
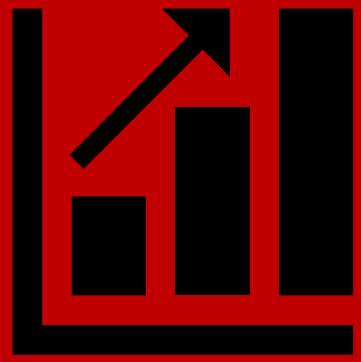
Modern access solutions to social, economic and Census data to support the research and policy needs of academic, government, non-government organization (NGO) and private sector researchers.

Access solutions include:

Public Use Microdata Files (PUMFs) • Self Serve Tabulation using Real time Remote Access (RTRA) • Confidential Microdata Files accessed in Research Data Centres (RDCs) located in 33 Centres across Canada; the Federal Research Data Centre (FRDC) located in Ottawa or through the virtual Data Lab (vDL) or virtual Research Data Centre (vRDC) to be launched in 2024

Access to microdata

How does modelling fit in the program process?

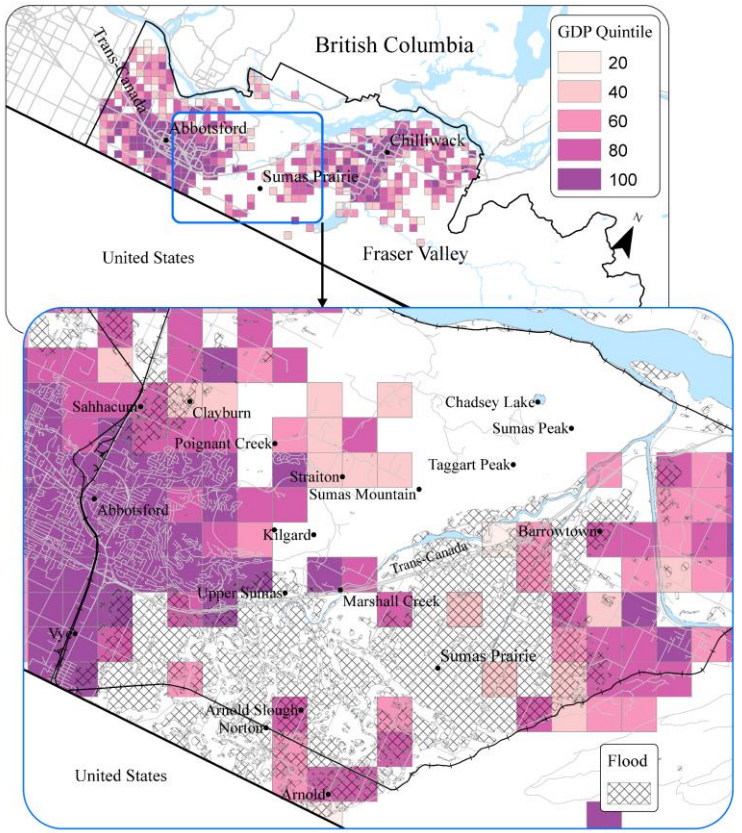
	Program Development	Program Implementation	Program Evaluation
	What if? 	Who & where? 	Impacts ? 
Types* of models	Microsimulation; DSGE models	Modelling for data development	Quantitative Impact Analysis

*not an exhaustive list

How can modelling contribute to data development?

- Modelling is used to support the development of disaggregate data
- Examples include:
  - Application of models to allocate firm-level output to operation locations and the spread of industry-level output to locations
  - Imputing missing information to develop key indicators
- Geographically fine-grained measures of output can be used to assess economic impacts across ***locations***
  - Potential question: what is the level of economic output potentially affected by climate events across places?
- Modelling can make it possible to assess economic impacts on ***specific groups***
  - Potential question: what is the impact of Covid-19 support programs on the survival of Indigenous-owned businesses?

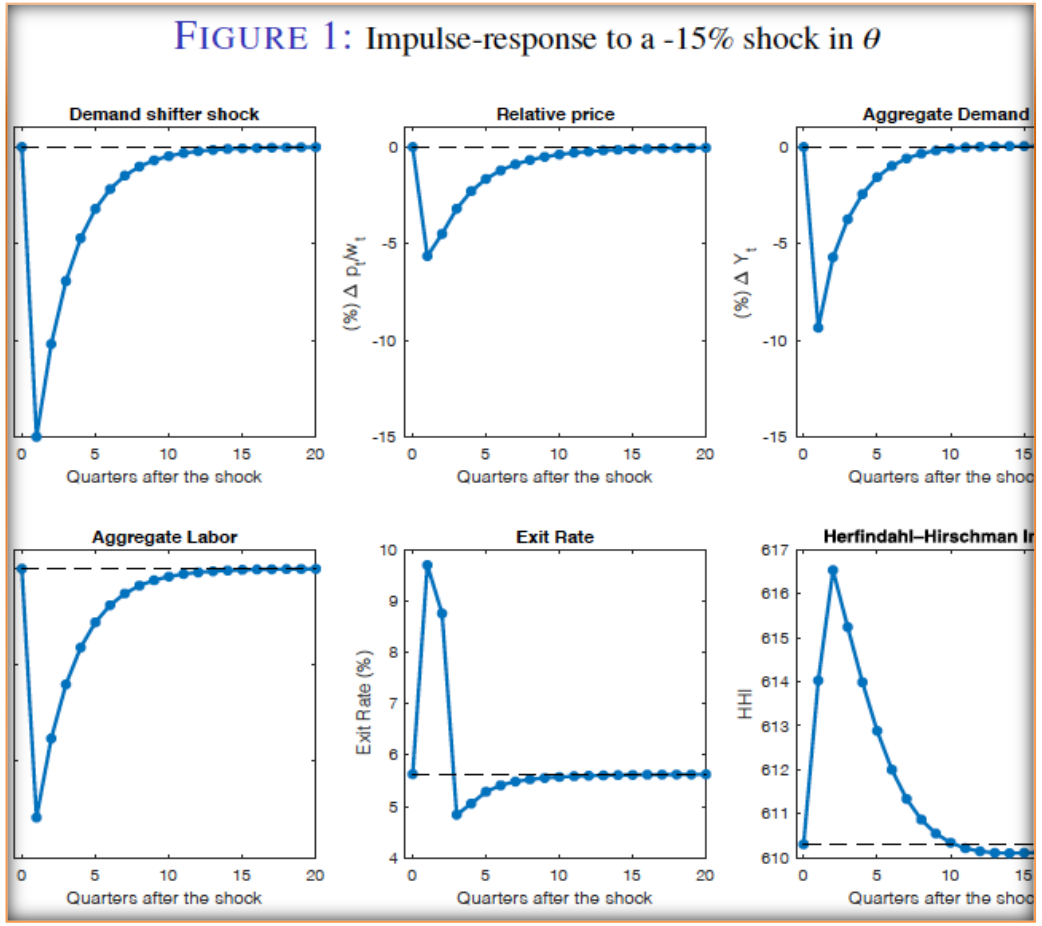
Estimates of the economic activity in and around flooded areas in British Columbia



Source: Bemrose, R. and R. Macdonald. 2022. Estimates of the economic activity in and around flooded areas in British Columbia. Economic and Social Reports. Statistics Canada

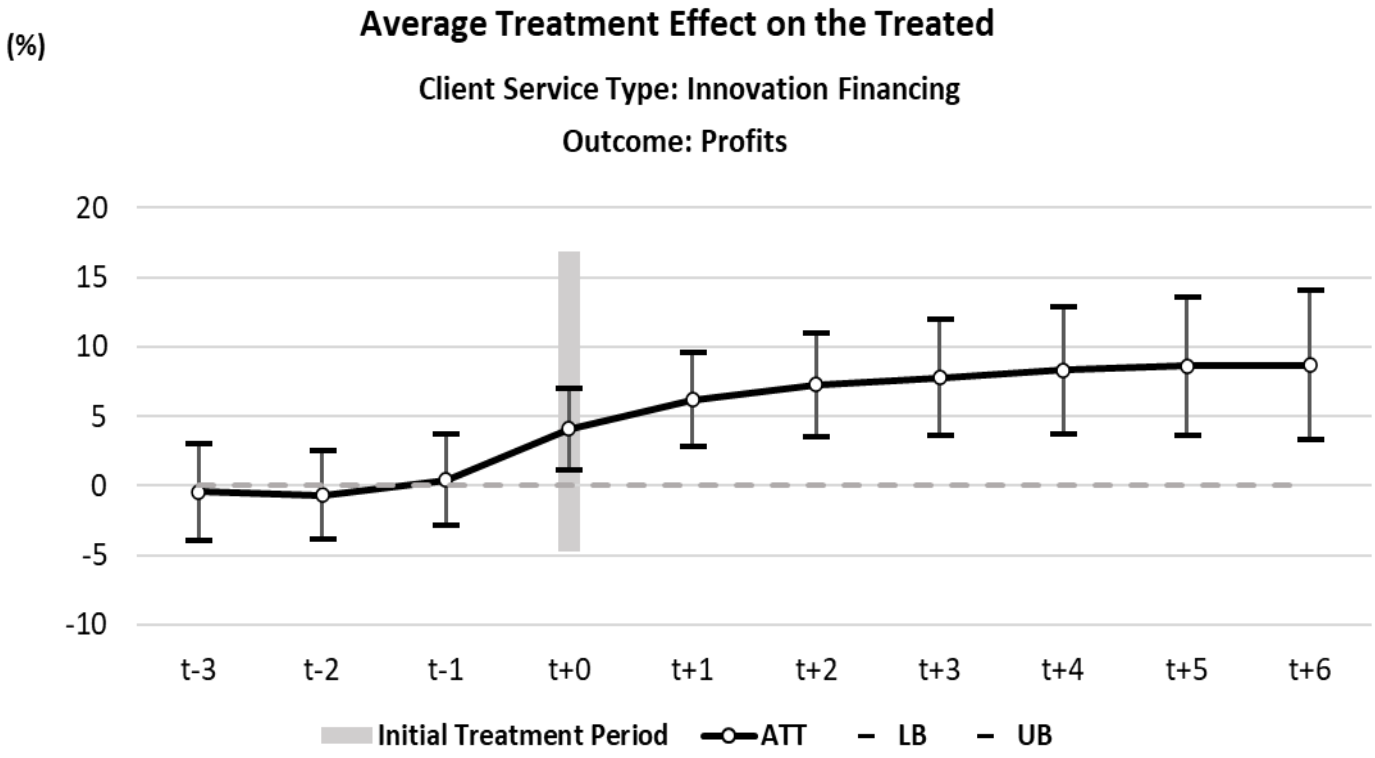
Dynamic stochastic general equilibrium (DSGE) models

- Can be used to determine how the economy adjusts to an economic shock (e.g., an unexpected downturn)
  - What if scenarios
    - Recovery time with and without government intervention
  - Expected structural change
    - E.g., concentration of output in fewer firms
- Potential questions
  - How long for an economy to recover?
  - How will different people (e.g., low income) and firms (e.g., small businesses) be affected?
  - How will policy interventions influence outcomes?
- Requires extensive firm-level microdata to train the model



Advanced Impact Analysis Methods for Standardized Results

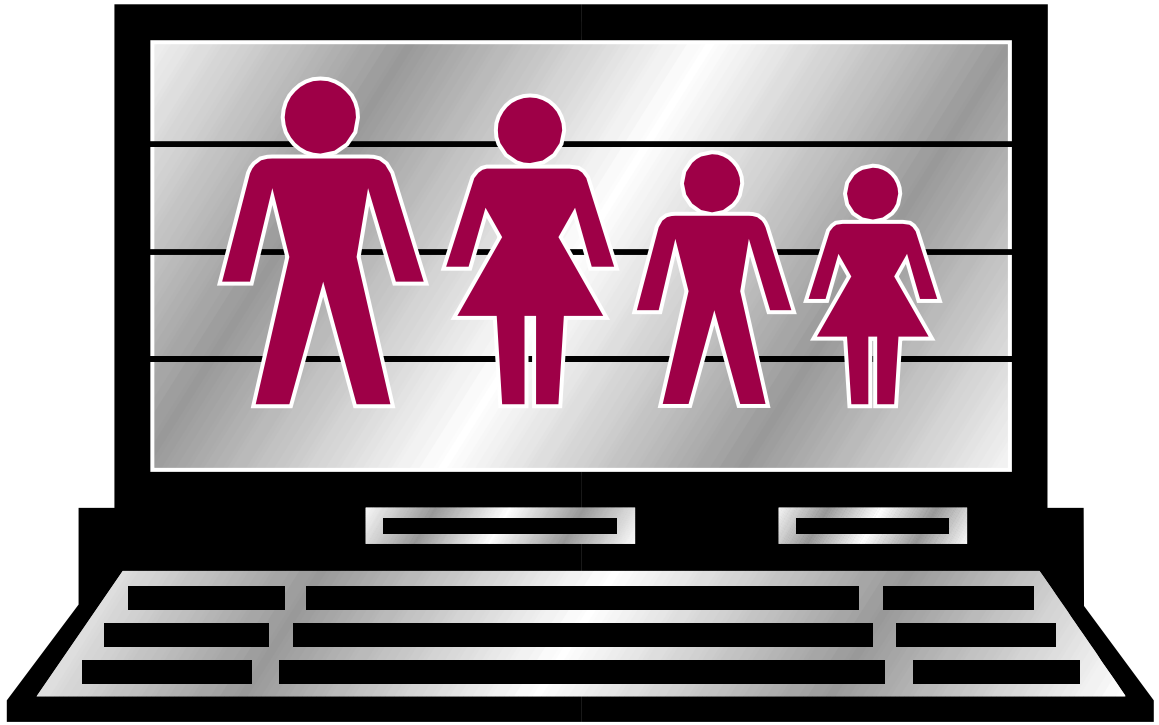
- There are many econometric models available to perform impact analysis
  - Examples include:
    - Difference-in-differences; regression discontinuity; event studies; marginal structural models; hierarchical models
- The choice of method depends on the research question, data availability, timelines, etc.
- Potential questions:
  - Did innovation financing lead to an increase in profits?
  - Did innovation subsidies lead to more R&D?



Input/Output model for impact assessment

- The Input/Output (I/O) model can be used to analyze the effects of a program on nominal GDP, tax revenues and expenditures, jobs, and the environment (such as greenhouse gas emissions) at the local level.
- I/O models, which describe the flow of goods and services between sectors in terms of demand and supply relationship, are available at the provincial or national levels.
- Potential questions:
  - What were the impacts of program funding on non-assisted businesses in the region?
  - Did a clean tech subsidy lead to fewer greenhouse gas emissions at the local level?

What is the SPSD/M?



- A computer-based tax and transfer microsimulation model
- To analyze financial interactions between governments and individuals
- The Social Policy Simulation Database and Model (SPSD/M) (statcan.gc.ca)
- spsdm@statcan.gc.ca

How is SPSD/M used in policymaking?

1. Policy Formulation – testing out various "**WHAT IF**" proposals

2. Evaluation – powerful tools in SPSD/M package helps policy analysis

Examples of Policy Formulations

[Ready Reckoner | Office of the Parliamentary Budget Officer]

[Costing Election Proposals for the 44th Canadian Federal Election]

[Backgrounder: Canada Carbon Rebate amounts for 2024-25 - Canada.ca]

Examples of Policy analysis

[How the Federal Tax and Transfer System Interacts with Income Inequality | Office of the Parliamentary Budget Officer]

[Distributional Analysis of Personal Effective Marginal Tax Rates | Department of Finance Canada]

[Report on Tax Expenditures in Ontario | Financial Accountability Office of Ontario]

[If Canada axed its carbon tax — and rebates — this is how different households would gain or lose | CBC News]

How SPSD/M helps in the process?

Analyze complex systems: Capture the interactions between various policy measures and their impact on different segments of the population.

Project outcomes: Predict the immediate or short-term effects of policy changes before they are implemented.

How SPSD/M helps in the process?

Inform decision-making: Help policymakers make informed decisions by understanding potential impacts on the economy and society.

Address specific questions: Can explore the consequences of specific policy proposals on targeted groups or issues.

Advantages in using SPSD/M

- Easy to use – Computer software runs simulation with a few clicks
- Data is non-confidential – Can Work in Office / Work from Home
- Statistically representative database – provide reliable estimates
- Detailed information - Enough information on each individual and family to compute taxes and transfer amount

Overview of the PASSAGES Initiative

- PASSAGES is a dynamic microsimulation model focused on the Canadian retirement income system. First phase of development focused on detailed modelling of the Canada Pension Plan

- PASSAGES has been developed in partnership between ESDC, Statistics Canada and HEC Montreal
- PASSAGES microsimulation model (statcan.gc.ca)
- statcan.passagesmodel-modelepassages.statcan@statcan.gc.ca

Example of PASSAGES applications

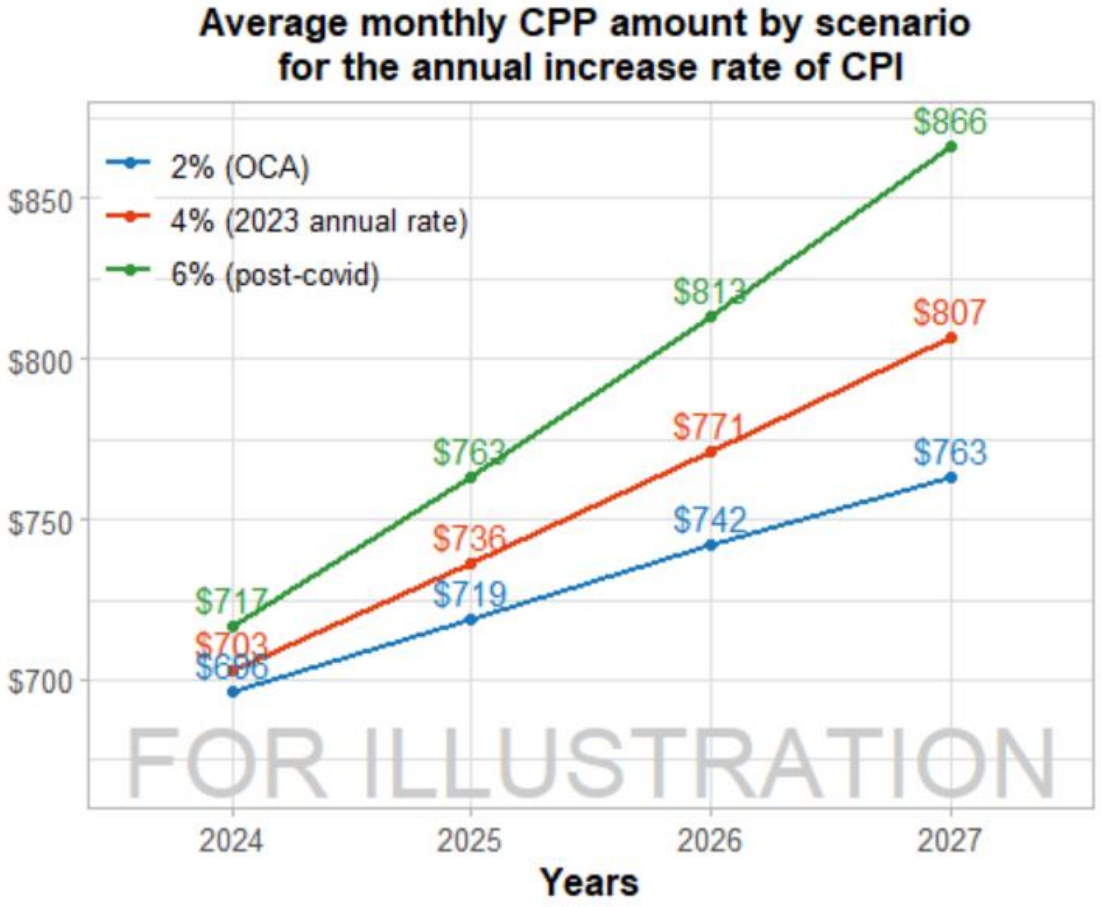
Question

How does the annual rate of increase in the Consumer Price Index (CPI) affect average monthly CPP amount?

Scenarios for CPI rate of increase

Based on the annual rate of increase in the CPI between 2023 to 2026

- 6% (~post-covid 2022)
- 4% (~annual rate 2023)
- 2% (~OCA assumptions)



Want to learn more? Contact us!

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Thank you!