

GTAPSIM: A USER-FRIENDLY MODELLING INTERFACE FOR GTAP IN GAMS

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AIM

Introduce the user-friendly modelling interface:

- Why use a modelling interface?
- What can it do?
- Who is it for?

Demonstration of GTAPSim

Example of an expanded user interface for policy makers

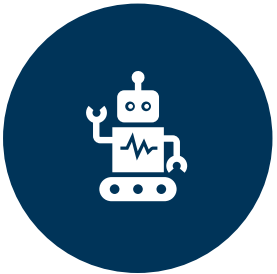
WHY USE A MODELLING INTERFACE?



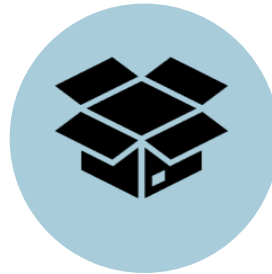
CGE models are widely used by international organisations for policy impact analysis



Models are powerful tools to inform policy making but are complex and require significant training to use



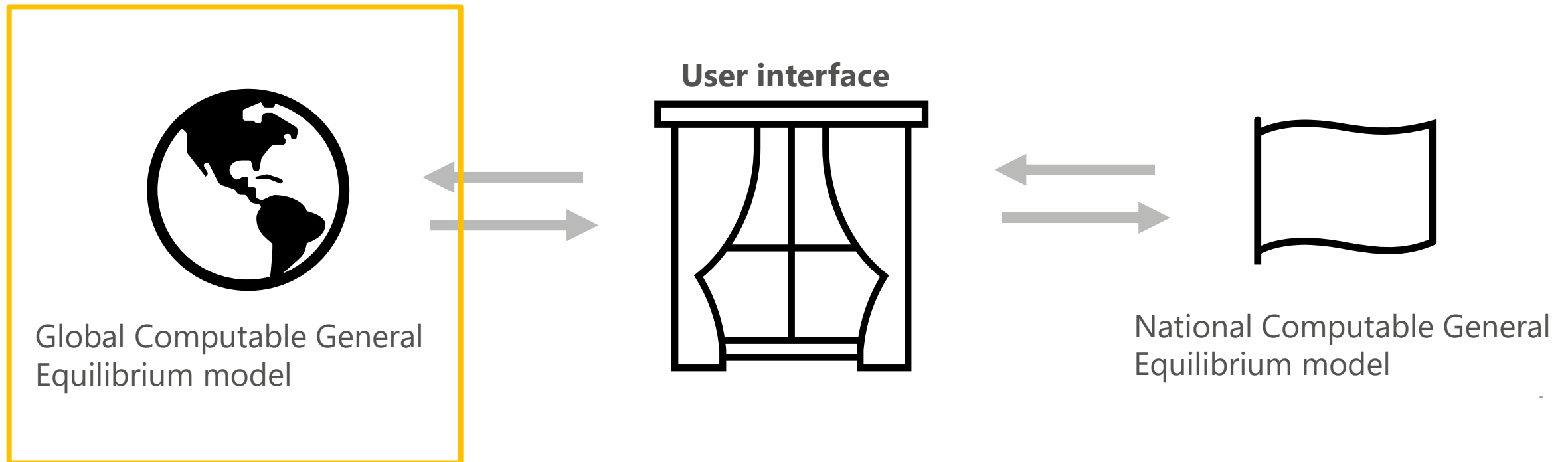
GAMS-MIRO – recent software



Accessible format for demystifying the modelling 'black box'

WHAT IS THE MODELLING INTERFACE?

- An interface to GTAP in GAMS v7.1 (van der Mensbrugghe, 2022) powered by GAMS MIRO
- Model run in comparative static mode currently



IMPLEMENTING SCENARIOS IN THE INTERFACE



- Models are like systems with levers
- Move the levers, change the model outcomes → impacts
- Interface: subset of the levers in the model

RESULTS DASHBOARD

Global indicators (real)

	GDP +0.12%		ABSORPTION +0.16%
	OUTPUT +0.04%		FACTOR PRICES (GLOBAL NUMERAIRE)
	EXPORTS +3.88%		IMPORTS +4.2%
	SAVINGS +0.58%		HOUSEHOLD DEMAND +0.17%
	GOVERNMENT TAX REVENUE -1.86%		WELFARE
	SCENARIO SHOCKS		

DEMONSTRATION OF GTAPSIM

WHO IS THE MODELLING INTERFACE FOR?

Students: run simulations via the **interface** to

- Introduce CGE modelling
- Interact with models to explore policy impacts
- Learn the process of defining scenarios and analysing results

Modellers: run simulations via the **interface** to

- Become familiar with a new model e.g. GTAP in GAMS!
- Understand the set-up options for the model, e.g. CDE vs CD utility function
- Run repeated scenarios including sensitivity analysis

Policy advisors: run simulations via the **interface** to

- Interact with global and country models to explore policy impacts
- Define and commission studies
- Increase confidence in information supplied by policy analysts

Policy analysts (modellers): runs simulations via the **model code** to

- Explain causal factors
- Adapt models

ASSUMPTIONS & CAVEATS

Assumptions

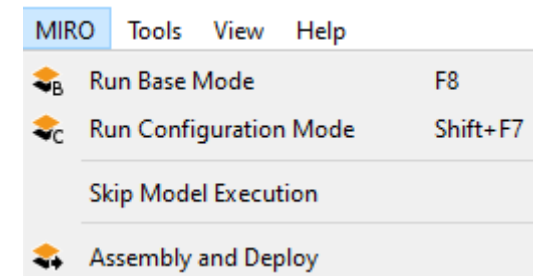
- The underlying data and model are of good quality.
- The behavioural relationships and parameter values that govern the responses in the model are suitable. (Options in MIRO)
- The policy instruments and results indicators in the interface cover relevant policies and outcomes. (Customisable in MIRO.)

Caveats

- A basic understanding of the underlying models is required to interpret the results and to construct logically consistent scenarios.
- Limitations of the interface: not a substitute for in-depth analysis using the model in its native mode.

BUILDING A MODEL INTERFACE

- Possible for any model coded (or recoded) in GAMS
- GAMS MIRO connector licence (free with GAMS academic licence)
- Fully customisable interface
 - \$OnExternalInput, \$OffExternalInput
 - \$OnExternalOutput, \$OffExternalOutput
 - MIRO Configuration Mode
 - Dashboard option in next MIRO version (via json configuration file)
- Options for local, server and remote GAMS hosting
- Hypercube option available via GAMS Engine



EXAMPLE: CLIMATE POLICY INTERFACE

CLIMATE POLICY MODELLING INTERFACES

- User interface for UNFCCC for use by policy makers & stakeholders
- Question: impact of international and domestic climate policies
- Two interfaces: global and national (Maldives)
- Linked interfaces: changes in world prices passed from global interface to local interface
- Used for 5-day training of staff at Ministry of Climate Change, Environment and Energy, Maldives

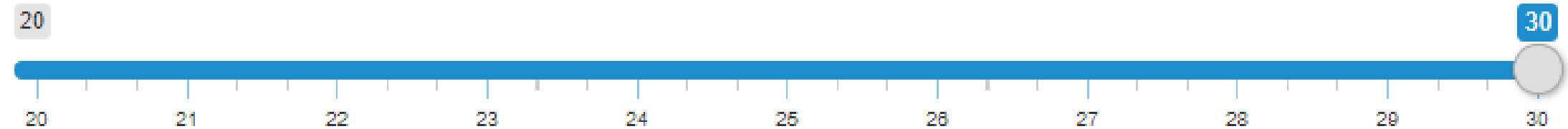
GLOBAL EMISSIONS REDUCTION SCENARIOS I

Select scenario

- ☒ Scenario 1: Reducing global CO2 emissions
 - ☒ Quantity reduction
 - ☐ Percentage reduction
- ☐ Scenario 2: Introducing a price on carbon

Scenario 1: Reducing global CO2 emissions

Global CO2 emissions (Gt/year) 



Regions participating in global emissions reduction

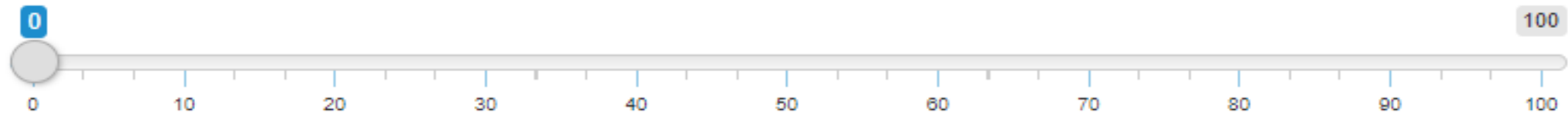
- ☒ Australia & New Zealand

GLOBAL EMISSIONS REDUCTION SCENARIOS II

- ☒ Scenario 2: Introducing a price on carbon

Scenario 2: Introducing a price on carbon

Carbon tax in USD per ton CO₂



Share of carbon revenue to distribute to low income regions (%)



Select the way transfers are distributed

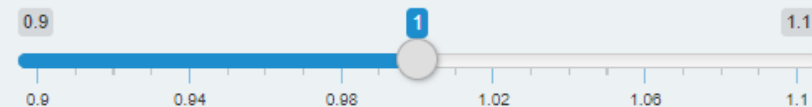
- ☒ Based on historical emissions
- ☐ Based on emissions per capita
- ☐ Based on GDP
- ☐ Based on population

DOMESTIC EMISSIONS REDUCTION SCENARIOS I

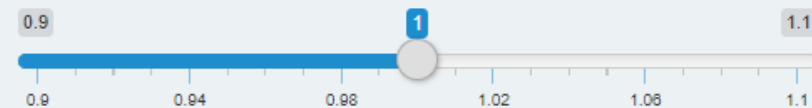
Scenario: World import prices

Change in world import prices (1 = no change)

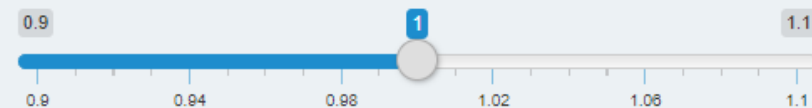
Agricultural import prices ⁱ



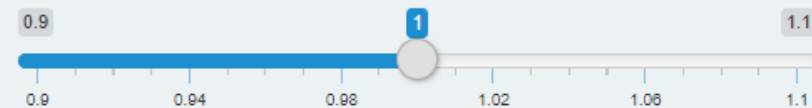
Food import prices ⁱ



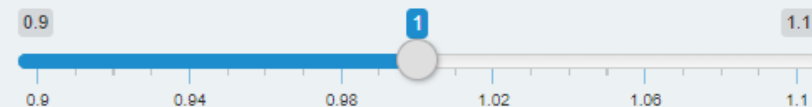
Industrial import prices ⁱ



Other service import prices ⁱ



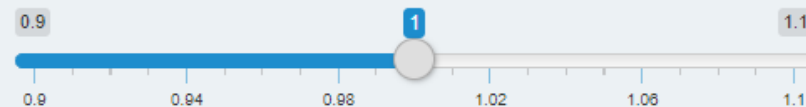
Minerals import prices ⁱ



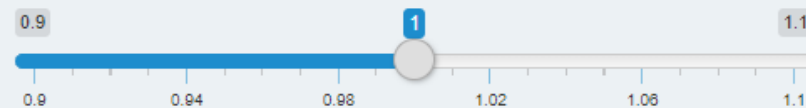
Scenario: World export prices

Change in world export prices (1 = no change)

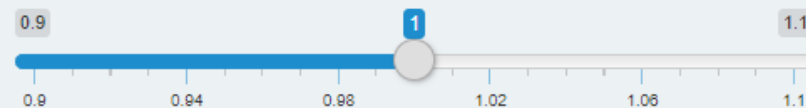
Agricultural export prices ⁱ



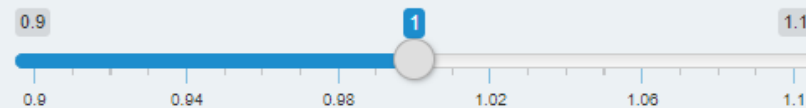
Food export prices ⁱ



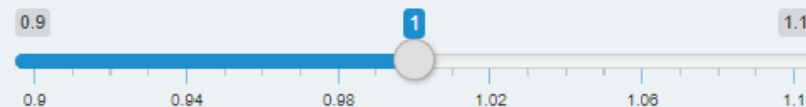
Industrial export prices ⁱ



Other services export prices ⁱ



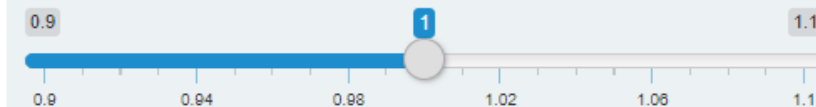
Transport service export prices ⁱ



Exchange rate

(1 = no change)

Change in the exchange rate ⁱ



Reset settings to default

MALDIVES EMISSIONS REDUCTION SCENARIOS II

Welcome

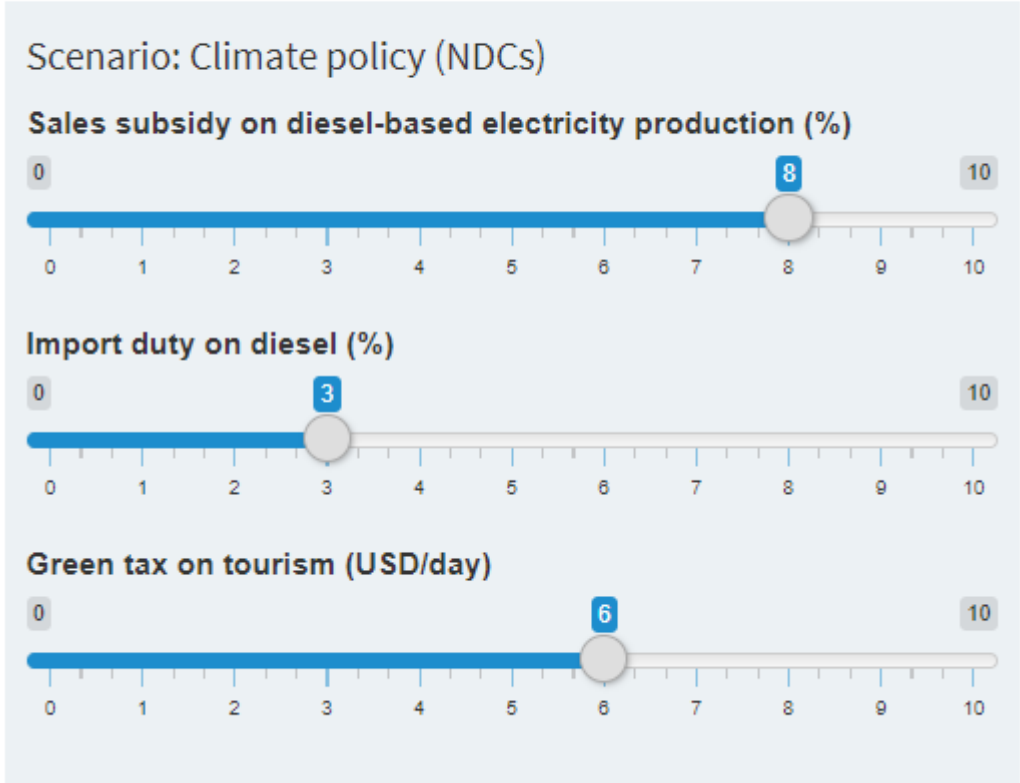
World prices

Climate policy (NDCs)

Assumptions

Maldives Social Accounting Matrix (SAM)

More >>



Reset settings to default

SDG labels	Plus_20	Minus_20
SDG7 Renewable Energy Share	22.973	-23.317
SDG7 Fossil Energy Share	-0.067	0.068
SDG7 LNG Energy Share	0.76	-0.699
SDG7 Pv Energy Share - Non Resorts	19.768	-20.968
SDG7 Fossil Energy Share - Non Resorts	-0.076	0.081
SDG7 LNG Energy Share - Non Resorts	-1.882	2.364
SDG7 Pv Energy Share - Resorts	26.751	-24.99
SDG7 Fossil Energy Share - Resorts	-0.001	0.001
SDG8 GDP Growth Per Worker (Real)	-0.073	-0.801
SDG8 Domestic Material Consumption (DMC)	-6.958	12.007
SDG8 DMC Per Capita	-6.958	12.007
SDG8 DMC Per Unit GDP	-6.89	12.911
SDG8 Tourism Share Of GDP	-3.531	5.007
SDG9 Manufacturing Value Added Share Of GDP	-5.526	11.46
SDG9 Manufacturing Value Added Per Capita	-5.595	10.567
SDG9 Manufacturing Share Of Employment	-2.037	5.198
SDG9 CO2 Emissions From Fuel	-16.98	26.897
SDG9 CO2 Emissions Per Unit GDP	-16.919	27.921
SDG10 Low Income Household Consumption Per Capita	-2.263	2.133

SUMMARY

- Why: make CGE models more accessible and harness the power of CGE model for policy analysis with a lower training requirement
- What: an interface providing a window into
 - Global and national CGE models programmed in GAMS
 - with multiple policy instruments and
 - a comprehensive set of modelling results including scenario comparison
- Who: students, policy advisors and stakeholders, modellers



THANK YOU

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