MIDAS includes the descriptions of models in use by the Commission in support to the policy cycle. MIDAS is developed and managed by the **Competence Centre on Modelling** of the European Commission.

Find out more at https://ec.europa.eu/knowledge4policy/modelling_en
Contact: EU-MIDAS@ec.europa.eu

Factsheet

SWD/2021/25 final

IMPACT ASSESSMENT REPORT Accompanying the document COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Forging a climate-resilient Europe - The new EU Strategy on Adaptation to Climate Change

Supporting model(s)

GINFORS-E

Impact assessment
SWD/2021/25 final

Fact sheet on model contributions

Source: Commission modelling inventory and knowledge management system (MIDAS)

Date of Report Generation: 16/04/2021

Dissemination: Public

Overview

Title

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Document ID

SWD/2021/25 final

Year of publication

2021

Led by

 CLIMA

Model(s) used

GINFORS-E

Additional information

-

GINFORS-E

Full title
Global Interindustry FORecasting System - Energy

Run for this impact assessment by
Gesellschaft für Wirtschaftliche Strukturforschung (GWS) mbH

Contributed to
Baseline and assessment of policy options

Helped to assess the following impacts

Impact area	Impact category	Impact subcategory
Economic impacts	Trade and investment flows	EU Exports & imports
Economic impacts	Trade and investment flows	Investment flows & trade in services
Economic impacts	Functioning of the internal market and competition	Competition
Economic impacts	Macroeconomic environment	Economic growth and employment
Social	Employment	Impact on jobs
Social	Employment	Impact on jobs in specific sectors, professions, regions or countries

GINFORS-E

Global Interindustry FORecasting System - Energy

Fact sheet

Source: Commission modelling inventory and knowledge management system (MIDAS)

Date of Report Generation: 16/04/2021

Dissemination: Public

Overview

Acronym GINFORS-E

Full title Global Interindustry FORecasting System - Energy

Main purpose

GINFORS-E is a global model with country and sector detail for 64 countries and one rest of world region mainly based on OECD and IEA data. It is designed for assessments of economic, energy, climate and environmental policies up to the year 2050.

Summary

GINFORS-E can be used to analyse the macroeconomic effects of a variety of price changes and policies in individual countries in the global context. It is designed for assessments of economic, energy, climate and environmental policies up to the year 2050.

Bilateral trade data are consistently linked to OECD input-output tables. For every country, important macroeconomic variables are determined in a macro model. In addition, energy, and emissions data as well as energy prices are linked to the economic driver variables. It flexibly models trade structures, labour markets, energy intensities and energy source structures, considering price dependencies and the situation in specific countries. Explicitly included are all EU countries, all OECD countries and their major trading partners. GINFORS_E is a macroeconometric model, which builds on Post-Keynesian theory. The parameters used in the model equations are econometrically estimated based on time-series data. Agents have myopic expectations and follow behavioural routines of the past. Markets are not assumed to be cleared. The model solves annually.

The model can be applied for formulation, implementation, and evaluation. It is mainly used for ex ante simulations. This can include the effect of changed framework data (international oil prices), policy measures (carbon prices), technological changes (renewable energy deployment) or structural change (e-mobility). It is enlarged towards energy technology goods and bioeconomy. However, the database can also be used to determine past and current parameters (consumption-based emissions).

Keywords

Energy , Environment , climate change , bioeconomy , economy , global coverage

Model category (thematic)

Agriculture, Climate, Economy, Environment, Energy

Model home page

https://www.gws-os.com/de/index.php/energy-and-climate/models/model-details/ginfors-e.html

Ownership & license

Ownership

Sole ownership [3rd party]

Ownership details

Gesellschaft für Wirtschaftliche Strukturforschung (GWS) mbH

Licence type

Non-Free Software licence. The license has one or more of the following restrictions: it prohibits creation of derivative works; it prohibits commercial use; it obliges to share the licensed or derivative works on the same conditions.

Details

GINFORS-E structure and approach
The GINFORS-E (global inter-industry forecasting system – energy) model is a bilateral world trade model based on OECD data, which consistently and coherently models exports and imports of 25 goods groups for 64 countries and one 'rest of the world' region. It incorporates a macro-model, consisting of exports and imports, other core components of final demand (private and public sector consumption and investment), markets for goods and the labour market, for each country. The models are also divided into 36 goods categories in accordance with the latest OECD internationally harmonised input-output (IO) tables. For every country OECD bilateral trade data on industry level is linked to the IO tables. For EU countries, UK and Norway transport is further distinguished in land, water, air plus warehousing and support activities based on the WIOD World Input-Output Database. These variables are reported for 40 industries.

GINFORS-E can be used to analyse the macroeconomic effects of a variety of price changes and policies in individual countries. It flexibly models trade structures, labour markets, energy intensities and energy source structures, taking into account price dependencies and the situation in specific countries. The use of intermediate inputs, domestic and imported, labour demand and foreign trade are modelled price dependent. Changes in prices due to tax adjustments will be accounted for. The parameters used in the model equations are econometrically estimated (OLS) on the basis of time-series data.

Production prices of industries are driven by unit costs. If prices of electricity in the steel industry increase, producer prices will increase according to their electricity price share. Higher producer prices will influence global competitiveness of the respective industry and other downstream production (e.g. in the automotive industry).

Important behavioural parameters of the model are estimated econometrically, and different specifications of the functions are tested against each other, which gives the model an empirical validation. An additional confirmation of the model structure as a whole is given by the convergence property of the solution which has to be fulfilled on a yearly basis. The econometric estimations build on times series from OECD, UN, IMF and IEA from 1990 to 2000 onwards.

Each national model is linked to an energy model, which determines energy conversion, energy generation and final demand for energy for 19 energy sources disaggregated by economic sector. The model considers technological trends and price dependencies.

Input and parametrization
The model is solved simultaneously year after year. Almost all model variables are endogenously determined via identity or behavioural equations. Behavioural variables are econometrically estimated as far as possible. Only a few variables, such as population development and international energy prices, are exogenously specified based on international projections or kept constant such as tax rates.

Data for 64 countries plus one region for rest of world include:

- Macroeconomic data as GDP and components (consumption, investment, exports, imports), in constant and current prices plus deflators

- Bilateral trade by 33 product groups

- Population, employment, unemployment, wages

- Input-Output tables (https://www.oecd.org/sti/ind/input-outputtables.htm)

- Sector data for 36 industries: output in constant and current prices, value added, employment, and final demand

- Energy balances

- CO_2 emissions by sector and fuel, other GHG emissions

- Energy prices by user and fuel, including tax rates (VAT, energy)

- Carbon prices

Main output

Due to the modelling approach, all input variables determined ex-ante by the model can also be output variables. The most important of these are macroeconomic indicators on national level, as well as corresponding sector variables, which are calculated for all countries considered for all years up to 2050. The most important among them are:

- GDP and its components (household consumption, government consumption, investment, exports, imports)

- Employment, production, value added and prices on sector level

- International trade flows by product group, origin and destination

- Energy demand by sector and fuel, energy prices

- CO_2 emissions by sector and fuel

The model is flexible to reflect, for example, different uses of CO_2 price revenues to reduce labour costs, increase (specific) government spending, or reduce government debt. Various other policy measures can also be mapped quite easily.

Spatial - temporal extent

The output has the following spatial-temporal resolution and extent:

Parameter	Description
Spatial Extent / Country Coverage	World trade model representing 64 countries, and one 'rest of the world' region. Explicitly included are all EU countries, all OECD countries and their major trading partners.
(Spatial) resolution	National Sub-national (NUTS2)
Temporal extent	Short-term (period of 5 years or less), Medium-term (5 to 15 years), Long-term (more than 15 years)
Temporal resolution	Years

Quality & transparency

Quality

Question	Answer	Details
Models are by definition affected by uncertainties (in input data, input parameters, scenario definitions, etc.). Have the model uncertainties been quantified? Are uncertainties accounted for in your simulations?	yes	The model can be run multiple times to test sensitivity of model properties including key assumptions.
Sensitivity analysis helps identifying the uncertain inputs mostly responsible for the uncertainty in the model responses. Has the model undergone sensitivity analysis?	yes	Due to the large number of variables per country and sector and the size of the result data set, this is not systematically possible. However, short model runtimes of about one minute allow extensive testing of individual important specifications and new model parts.
Has the model undergone external peer review by a panel of experts, or have results been published in peer-reviewed journals?	yes	Several peer-reviewed publications have been made by the developers of the model. References on www.gws-os.com and in the reference section at the end of this document. A comprehensive model description can be found most recently in Lutz et al. (2010). An updated model description publication is planned by 2022. Applications are published in Lutz et al. (2012), Lutz, Meyer 2009a and b), Wiebe, Lutz (2016), and Wiebe et al. (2016).
Has model validation been done? Have model predictions been confronted with observed data (ex-post)?	yes	Simulation properties of the model are compared with results of other similar models such as E3ME, GTAP-E and GEM-E3.

References related to external peer-review and publication in scientific journals:

- No references provided in MIDAS

Transparency

Question	Answer	Details
Is the model underlying database (i.e. the database the model runs are based on) publicly available?	yes	Data are publicly available sources such as OECD (input-output tables, bilateral trade data), IEA (energy balances, energy prices, CO2 emissions), and other sources such as IMF, UN, World Bank, Eurostat.
Can model outputs be made publicly available?	yes	Depending on contract.
Is the model transparently documented (including underlying data, assumptions and equations, architecture, results) and are these documents available to the general public?	no	Not yet. It will be made available to the general public by 2022.
Is the model source code publicly accessible or open for inspection?	no	

References related to documentation:

- No references provided in MIDAS

The model's policy relevance and intended role in the policy cycle

The model is designed to contribute to the following policy areas
- Agriculture and rural development
- Climate action
- Economy, finance and the euro
- Employment and social affairs
- Energy
- EU enlargement
- Environment
- Transport
- Competition
- International cooperation and development
- Business and industry
- Trade

The model is designed to contribute to the following phases of the policy cycle
- Formulation
- Implementation
- Evaluation

The model's potential
Although GINFORS-E can be used for forecasting, the model is mainly used for evaluating the impacts of policy scenarios, changes in assumptions such as international energy prices or another change to model variables. The model can be enlarged to include more detail on interesting datasets, currently e.g. on the bioeconomy and energy technology goods.

The analysis is mainly forward looking (ex-ante), but can also inform implementation or evaluate previous developments ex-post.

Previous use of the model in ex-ante impact assessments of the European Commission

Use of the model in ex-ante impact assessments since July 2017.

In the Year	GINFORS-E contributed to the Impact assessment called	Led by	By providing input to the	The model was run by	Details of the contribution
2021	IMPACT ASSESSMENT REPORT Accompanying the document COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Forging a climate-resilient Europe - The new EU Strategy on Adaptation to Climate Change	DG CLIMA	Baseline and assessment of policy options	GWS	The model helped to assess the following impacts: - EU Exports & imports - Investment flows & trade in services - Competition - Economic growth and employment - Impact on jobs - Impact on jobs in specific sectors, professions, regions or countries

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