ITAXCGE-DF

Dynamic General Equilibrium Tax Policy Model for Italy

Dimensions

- 20 activities
- 20 commodities
- Agents: producers, households, NPO, firms, government, ROW
- 10 households
- 2 trade partners
- 4 types of labor
- Capital and mixed income
- 18 taxes

Taxes

- VAT (differentiated by agent and by purpose of expenditure, such as consumption or investment)
- Excise duties
- Other Net Tax on Products
- Social security contributions (employers')
- Social security contributions (employees')
- Social security contributions (on mixed income)
- Corporate income tax (IRES)
- Regional corporate tax (IRAP)
- Real estate tax on companies (IMU_TASI_A)

Taxes

- Real estate tax on households (IMU_TASI_H)
- Tariffs on imports from non-EU countries
- Personal income tax (IRPEF)
- Additional income taxes (IRPEF supplement)
- Lumpsum tax (forfait)
- Tax on rents
- Capital income tax
- Other taxes on production
- Subsidies (negative taxes) on production

Taxes

- Erosion of CIT IRAP base by activity
- Erosion of CIT IRES base by activity
- Erosion of FORFAIT base (mixed income) by decile
- Erosion of PIT IRPEF base (comprehensive income) by decile

- Evasion irregular labor by decile
- Evasion of mixed income by decile

Transfers

- Pensions
- Child care
- Unemployment benefits
- Labor subsidies
- Citizens' income
- Interest payments on public debt
- Other net subsidies

Activities and Commodities

1. Agriculture, forestry, fishing
2. Mining and quarrying
3. Manufactured products
4. Electricity, gas, steam and air conditioning
5. Water supply sewerage, waste management and remediation services
6. Construction
7. Wholesale and retail trade services repair services of motor vehicles and motorcycles
8. Transportation and storage services
9. Accommodation and food services
10. Information and communication services

Activities and Commodities

11. Financial and insurance services
12. Real estate services
13. Professional, scientific and technical services
14. Administrative and support services
15. Public administration and defense services compulsory social security services
16. Education services
17. Human health and social work services
18. Arts, entertainment and recreation services
19. Other services
20. Services of households as employers

Production Function
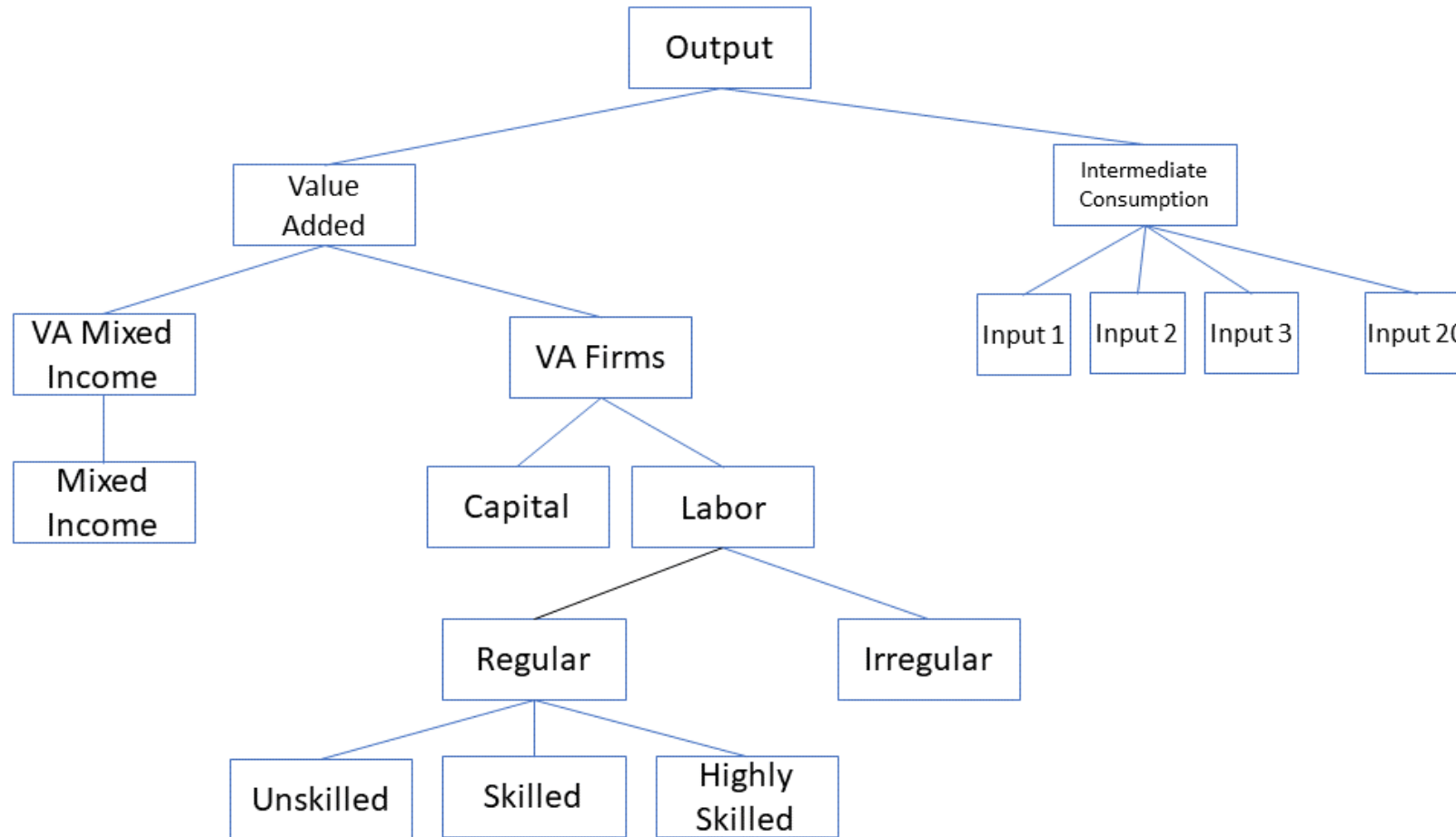
Taxes on Producers and Factors

- VAT on intermediate consumption
- Excise duties
- Other net taxes on products
- Social security contributions (employers')
- Social security contributions (employees')
- Social security contributions (on mixed income)

Taxes on Producers and Factors

- Corporate income tax (IRES)
- Regional corporate tax (IRAP)
- Real estate tax on companies (IMU_TASI_A)
- Other taxes on production
- Subsidies to production

- Erosion of CIT IRAP base by activity
- Erosion of CIT IRES base by activity

Production Function

$$VA\_FIRM_a = \left[\gamma_{LC,a}^{VA} LC_a^{-\rho_a^{VA}} + \gamma_{KS,a}^{VA} \left(u_a K_a \right)^{-\rho_a^{VA}} \right]^{\frac{-1}{\rho_a^{VA}}}$$

$$LC_a = \gamma_{LC,a}^{VA\_FIRM} \left(\frac{PVA\_FIRM_a}{PLC_a} \right)^{\sigma_a^{VA\_FIRM}} VA\_FIRM_a$$

$$u_a K_a = \gamma_{K,a}^{VA\_FIRM} \left(\frac{PVA\_FIRM_a}{PKTAX_a} \right)^{\sigma_a^{VA\_FIRM}} VA\_FIRM_a$$

Labor Demand

- Irregular labor
- Regular unskilled labor
- Regular skilled labor
- Regular highly skilled labor

Labor Demand

$$LC_a = \left[\gamma_{LC,a}^{LC} LREG_a^{-\rho^{LC}_a} + \gamma_{LIRREG,a}^{LC} LIRREG_a^{-\rho^{LC}_a} \right]^{\frac{-1}{\rho^{LC}_a}}$$

$$LREG_a = \gamma_{LREG,a}^{LC} \left(\frac{PLC_a}{PLREG_a} \right)^{\sigma^{LC}_a} LC_a$$

$$LIRREG_a = \gamma_{LIRREG,a}^{LC} \left(\frac{PLC_a}{PLIRREG} \right)^{\sigma^{LC}_a} LC_a$$

$$LREG_a = \left[\sum_{sk} \gamma_{LSKILL_{sk,a}}^{LREG} LSKILL_{sk,a}^{-\rho^{LREG}_a} \right]^{\frac{-1}{\rho^{LREG}_a}}$$

$$LSKILL_{sk,a} = \gamma_{LSKILL_{sk,a}}^{LREG} \left(\frac{PLREG_a}{PLSKILLTAX_{sk,a}} \right)^{\sigma^{LREG}_a} LREG_a$$

Supply of Commodities

$$XD_a = \left[\sum_c \gamma_{a,c}^{XS} XS_{a,c}^{\rho_a^{XD}} \right]^{\frac{1}{\rho_a^{XD}}}$$

$$XS_{a,c} = \gamma_{a,c}^{XS} \left[\frac{PXS_{a,c}}{PXDTAX_a} \right]^{\sigma_a^{XD}} XD_a$$

$$DS_{a,c} = \gamma_{a,c}^{DS} \left[\frac{PDD_c}{PXS_{a,c}} \right]^{\sigma_a^{XS}} XS_{a,c}$$

$$ES_{a,c,r} = \gamma_{a,c,r}^{ES} \left[\frac{PE_{a,c,r}}{PXS_{a,c}} \right]^{\sigma_a^{XS}} XS_{a,c}$$

Household Deciles

Comprehensive income =

    Labor income (net of employers' SSC)

    + Capital income

    + Mixed income

    + Transfers from the government

        Pensions

        Child care

        Labor benefits

        Unemployment benefits

        Citizens' income

    + Transfers from the firms

    + Interest on government debt

Household Deciles

Disposable income =
    Comprehensive income
       - PIT IRPEF
       - PIT SUPPLEMENT
       - Taxes on capital income
       - IMU TASI
       - Tax Forfait on mixed income
       - Social security contributions on mixed income

Household Deciles

$$SH_h = rateSH_h YDH_h$$

$$CHBUDGET_h = YDH_h - SH_h$$

$$UH_h = \prod_c \left[CH_{c,h} - CH_{c,h}^{MIN} \right]^{\alpha_{c,h}^{LES}}$$

$$PXCHTAX_{c,h} CH_{c,h} = PXCHTAX_{c,h} \cdot CH_{c,h}^{MIN} + \alpha_{c,h}^{LES} \left(CHBUDGET_h - \sum_c PXCHTAX_{c,h} CH_{c,h}^{MIN} \right)$$

Businesses as an Institutional Sector

Income of corporation sector =

    Capital income

      + Interest on government debt

      + Transfers from the government to the firms

Firms' savings =

    Income of corporation sector

    - Transfers to the households

Government

- Government revenue is the sum of all the taxes and social security contributions minus the subsidies

- Government outlays are the sum of current government consumption on goods and services, transfers to the households, to the firms, and to the rest of the world.

- Real government savings or expenditures are fixed depending on the closure.

Government Purchases

- CGBUDGET = YG - TRANSFERS_TOTAL - INTEREST – SG
- PXCGTAX(c)*CG(c) = alpha_CG(c)*CGBUDGET

VAT Theoretical Rate and VAT Gap

VAT_REVENUE =

sum(h, sum(c, rate_VAT_CH(c,h)*PX(c)*CH(c,h)))

+ sum(c, rate_VAT_CNPO(c)*PX(c)*CNPO(c))

+ sum(c, rate_VAT_CA(c)*(1+rate_EXCISE(c))*PX(c)*DIT(c))

+ sum(c, rate_VAT_CG(c)*PX(c)*CG(c))

+ sum(h, sum(c, rate_VAT_IH(c,h)*PX(c)*IH(c,h)))

+ sum(c, rate_VAT_INPO(c)*PX(c)*INPO(c))

+ sum(c, rate_VAT_IFIRM(c)*PX(c)*IFIRM(c))

+ sum(c, rate_VAT_IG(c)*PX(c)*IG(c))

+ sum(c, rate_VAT_INVENTORY(c)*PX(c)*INVENTORY(c))

VAT Theoretical Rate and VAT Gap

- rate_VAT_CH(c,h) = rate_VAT_THEORY_CH(c,h) * (1 - VAT_GAP_CH(c,h))
- rate_VAT_CNPO(c) = rate_VAT_THEORY_CNPO(c) * (1 - VAT_GAP_CNPO(c))
- rate_VAT_CA(c) = rate_VAT_THEORY_CA(c) * (1 - VAT_GAP_CA(c))
- rate_VAT_CG(c) = rate_VAT_THEORY_CG(c) * (1 - VAT_GAP_CG(c))
- rate_VAT_IH(c,h) = rate_VAT_THEORY_IH(c,h) * (1 - VAT_GAP_IH(c,h))
- rate_VAT_INPO(c) = rate_VAT_THEORY_INPO(c) * (1 - VAT_GAP_INPO(c))
- rate_VAT_IFIRM(c) = rate_VAT_THEORY_IFIRM(c) * (1 - VAT_GAP_IFIRM(c))
- rate_VAT_IG(c) = rate_VAT_THEORY_IG(c) * (1 - VAT_GAP_IG(c))
- rate_VAT_INVENTORY(c) = rate_VAT_THEORY_INVENTORY(c) * (1 - VAT_GAP_INVENTORY(c))

Excise Theoretical Rate and Excise Gap

- EXCISE_REVENUE = sum(c, rate_EXCISE(c)*PX(c)*DIT(c))
- rate_EXCISE(c) = rate_EXCISE_THEORY(c) * (1 - EXCISE_GAP(c))

Investment

- STOTAL = SUM(h,SH(h))+ SNPO + SFIRM + SG + SEU + SNONEU
- INVENTORY(c) = rate_INVENTORY(c)*X(c)
- GFCF = STOTAL - SUM(c,PXINVENTORYTAX(c)*INVENTORY(c))

Allocation of total savings among agents:
  - GFCF_H(h) = share_GFCF_H(h) * GFCF
  - GFCF_NPO = share_GFCF_NPO * GFCF
  - GFCF_FIRM = share_GFCF_FIRM * GFCF
  - GFCF_G = share_GFCF_G * GFCF

Commodity Demand for Investment

- $(1 + \text{rate\_VAT\_IH}(c,h)) * \text{PX}(c)*\text{IH}(c,h) = \text{alpha\_IH}(c,h)*\text{GFCF\_H}(h)$

- $(1 + \text{rate\_VAT\_INPO}(c)) * \text{PX}(c)*\text{INPO}(c) = \text{alpha\_INPO}(c)*\text{GFCF\_NPO}$

- $(1 + \text{rate\_VAT\_IFIRM}(c)) * \text{PX}(c)*\text{IFIRM}(c) = \text{alpha\_IFIRM}(c)*\text{GFCF\_FIRM}$

- $(1 + \text{rate\_VAT\_IG}(c)) * \text{PX}(c)*\text{IG}(c) = \text{alpha\_IG}(c)*\text{GFCF\_G}$

Capital Accumulation

$$K_{h,t+1} = (1-d_h)K_{h,t} + INV_{h,t}$$

$$K_{a,t+1} = (1-d_a)K_{a,t} + INV_{a,t}$$

$$K_{g,t+1} = (1-d_g)K_{g,t} + INV_{g,t}$$

$$K_{NPO,t+1} = (1-d_{NPO})K_{NPO,t} + INV_{NPO,t}$$

Segmented Labor Markets

Irregular labor market:

Labor supply of irregular labor = Labor demand of irregular labor by the activities

Regular labor markets, by skill:

Unemployment by skill =

 Labor supply of regular labor in each skill segment

 - Labor demand of activities for each skill

Exports

$$XS_{a,c} = \left[\sum_c \left(\gamma_{a,c}^{DS} DS_{a,c}^{\rho_a^{XD}} + \sum_r \gamma_{a,c,r}^{ES} ES_{a,c,r}^{\rho_a^{XD}} \right) \right]^{\frac{1}{\rho_a^{XD}}}$$

$$ES_{a,c,r} = \gamma_{a,c,r}^{ES} \left[\frac{PE_{a,c,r}}{PXS_{a,c}} \right]^{\sigma_a^{XS}} XS_{a,c}$$

$$ED_{c,r} = EDZ_{c,r} \left[\frac{ER_r \cdot PWE_{c,r}}{PE_{c,r}^{FOB}} \right]^{\sigma_{c,r}^{ED}}$$

Imports

$$X_c = \left[\sum_r \gamma_{c,r}^M M_{c,r}^{-\rho_c^Q} + \gamma_c^{DD} DD_i^{-\rho_c^Q} \right]^{\frac{-1}{\rho_c^Q}}$$

$$M_{c,r} = \gamma_{c,r}^M \left[\frac{PX_c}{PM_{c,r}} \right]^{\sigma_c^Q} X_c$$

Markets and Price Determination

- Markets for commodities in equilibrium. Prices determined by market equilibrium. However, they are sticky because of rigidities in the regular labor market segments and in the use capital.

- Irregular labor market segment in equilibrium. Wage rate determined by market equilibrium.

- Regular labor market segments for each skill are in disequilibrium.
- Wages by skill determined by wage curve mechanism

- Installed capital is not necessarily fully used. The utilization rate depends on the changes in the real rental rate of capital.

Dynamics

- Steady state assumption for the baseline path
- All prices remain constant in then benchmark path
- All quantities increase in the same proportion

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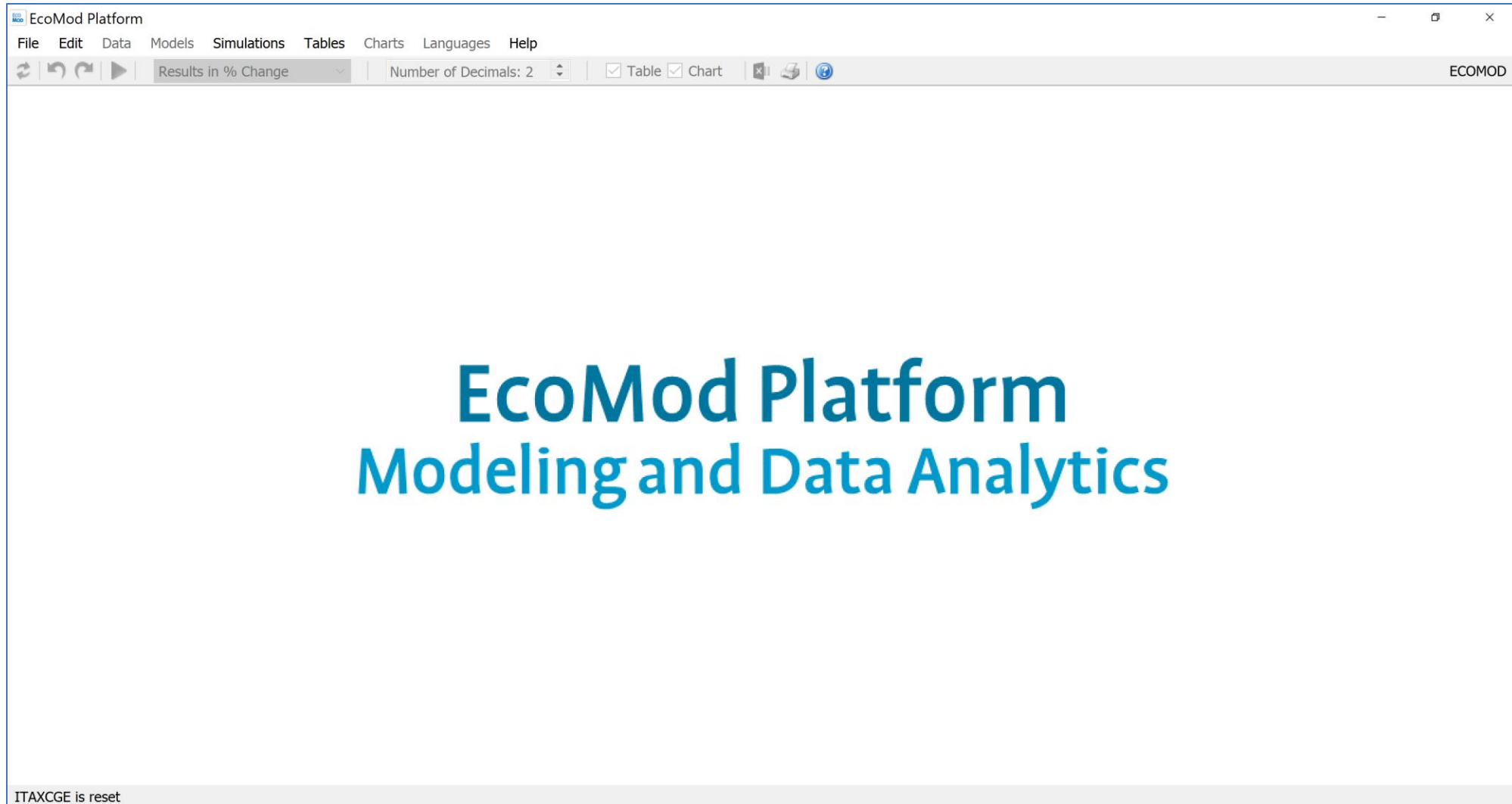
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    - Erosion PIT IRPEF
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    - Rate PIT Supplement
    - Rate SSC Employees
    - Rate SSC Employers
    - Rate SSC Mixed Income
    - Rate Production Subsidies
    - Rate Tariffs

Please select the simulation horizon for your simulation

Start   End

2020   2030

ITAXCGE is reset

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Please select the simulation horizon for your simulation

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2020	2030

2021
2022
2023
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Closure	**Description**
☑ Government savings fixed.	Government savings are fixed in real terms. Government current consumption is endogenous.
☐ Ratio of government savings to GDP fixed.	The ratio of the government savings to GDP is fixed. Government current consumption and savings are endogenous.
☐ Government consumption fixed.	Government current consumption is fixed in real terms. Government budget balance is endogenous.
☐ Ratio of government consumption to GDP fixed.	Government current consumption and savings are endogenous. Ratio of the government consumption to GDP is fixed.

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- Base IMU TASI, Households
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- Rate Tax on Rents
- Rate Theory VAT on Intermediate Consumption
- Rate Theory VAT on Government Purchases

Rate Excise Theory

	2020	2021	2022	2023	2024	2025	2026
Agriculture fishing	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacturing	6.79	6.79	6.79	6.79	6.79	6.79	6.79
Electricity gas	50.45	50.45	50.45	50.45	50.45	50.45	50.45
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trade						0.00	0.00
Transportation						0.00	0.00
Hotels restaurants						0.00	0.00
Information communica						0.00	0.00
Finance						0.00	0.00
Real estate						0.00	0.00
Professional services						0.00	0.00
Support services						0.00	0.00
Public Administration						0.00	0.00
Education						0.00	0.00
Health						0.00	0.00
Entertainment						0.00	0.00
Other services	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Household services	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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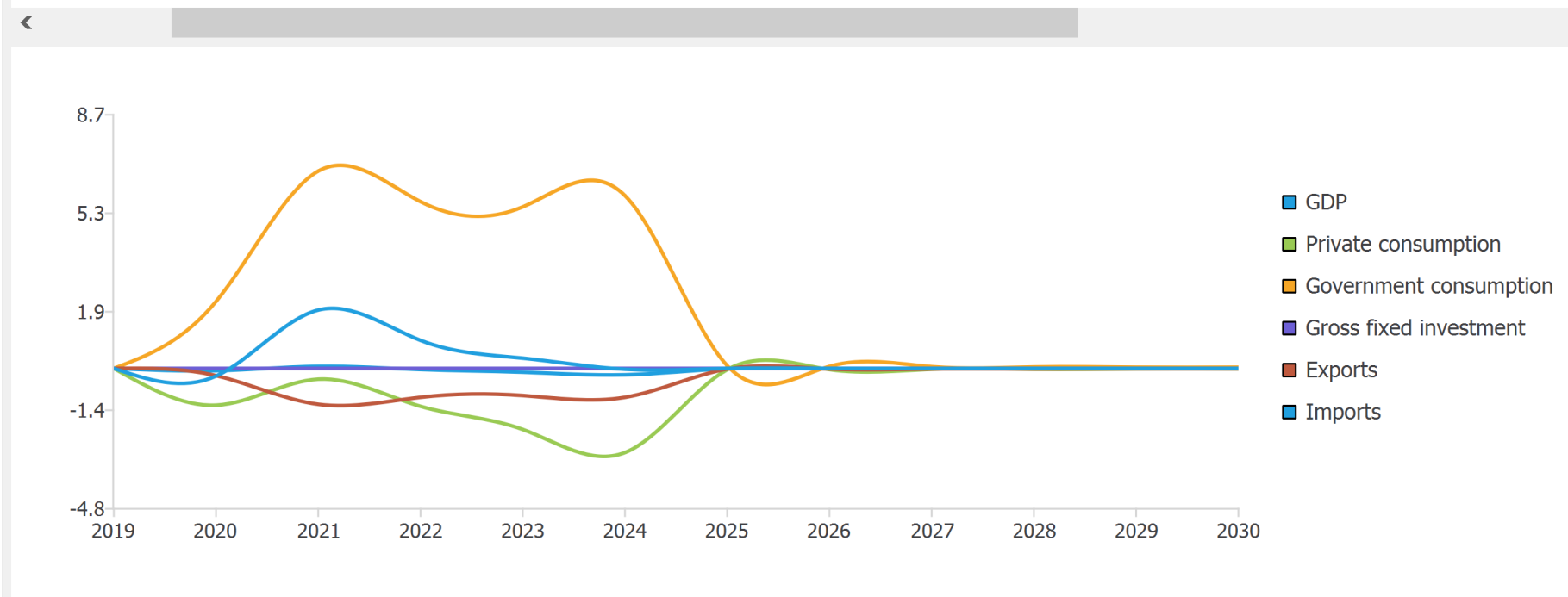Number of Decimals: 2

☑ Table   ☑ Chart

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  - **Macroeconomic effects in real terms**
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  - Imports
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  - Balance of payments
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  - Public investment goods
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  - Average wage - by skill and nationality
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Macroeconomic effects in real terms

	2020	2021	2022	2023	2024	2025	2026
GDP	-0.08	0.07	-0.04	-0.13	-0.22	-0.01	-0.01
Private consumption	-1.26	-0.37	-1.30	-2.09	-2.88	-0.04	-0.04
Government consumption	2.30	6.76	5.71	5.53	5.91	0.09	0.07
Gross fixed investment	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exports	-0.25	-1.23	-0.99	-0.93	-0.99	-0.02	-0.02
Imports	-0.26	2.00	0.96	0.35	-0.03	0.00	0.00

- GDP
- Private consumption
- Government consumption
- Gross fixed investment
- Exports
- Imports

Platform

Results in % Change

☑ Table ☑ Chart

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Data

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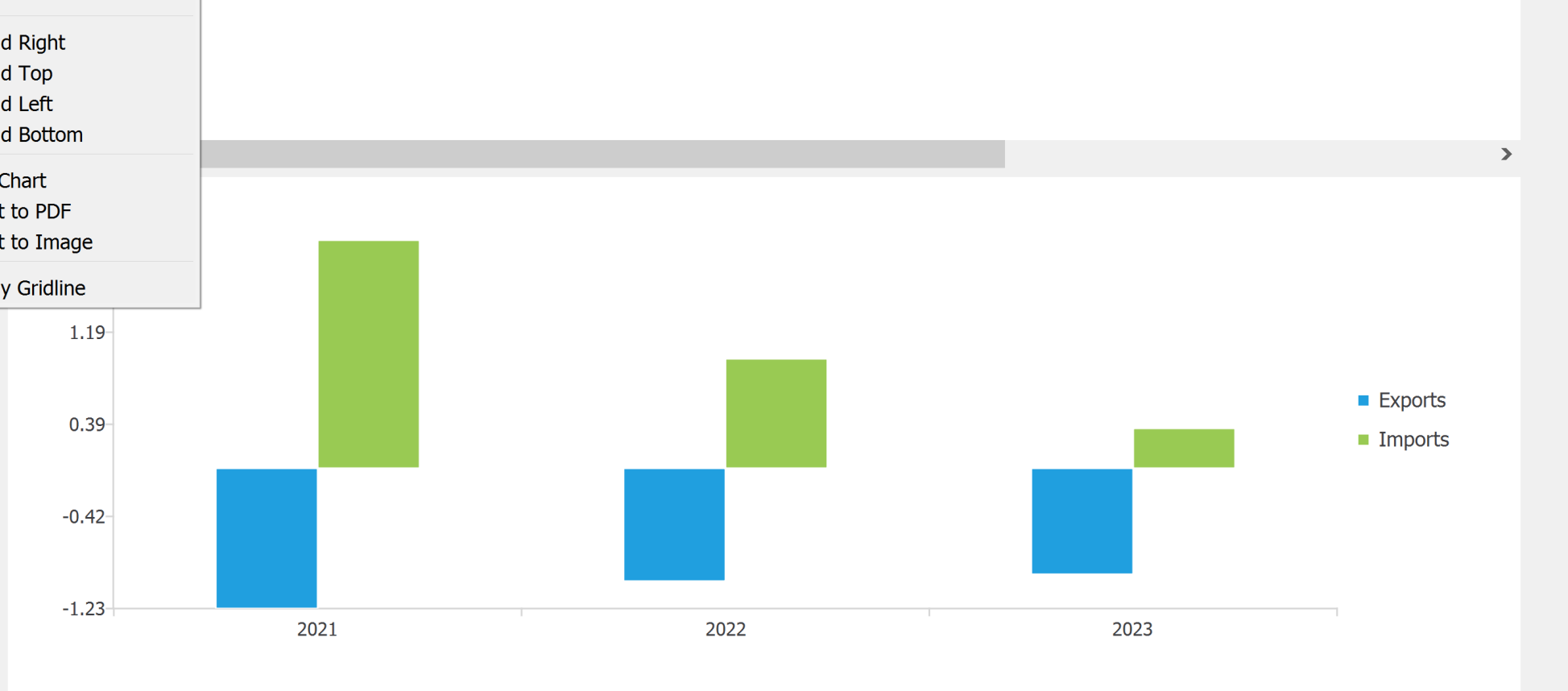|	2020	2021	2022	2023	2024	2025	2026	20
	-0.08	0.07	-0.04	-0.13	-0.22	-0.01	-0.01	-0.
	-1.26	-0.37	-1.30	-2.09	-2.88	-0.04	-0.04	-0.
...ption	2.30	6.76	5.71	5.53	5.91	0.09	0.07	0.
...nt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.
	-0.25	-1.23	-0.99	-0.93	-0.99	-0.02	-0.02	-0.
	-0.26	2.00	0.96	0.35	-0.03	0.00	0.00	0.

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Chart showing Exports and Imports bars for 2021, 2022, 2023. Y-axis values: 1.19, 0.39, -0.42, -1.23. Legend: Exports (blue), Imports (green).

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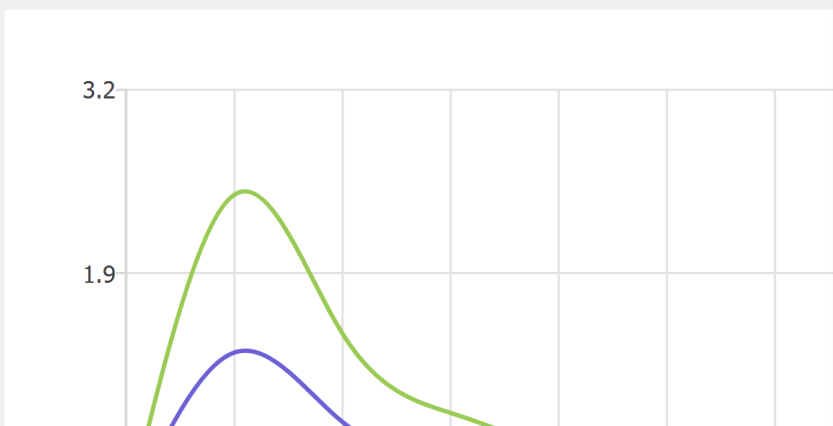
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Value added

	2020			2023	2024	202
Agriculture, livestock and fishing	0.04			0.01	0.00	0.0
Crude oil	0.01			0.00	0.00	0.0
Natural gas	-0.01			0.00	0.00	0.0
Quarrying	-0.02			-0.02	-0.02	-0.0
Petrochemicals	-0.44			-0.08	0.00	0.0
Other manufacturing industries	-1.11			-0.22	-0.02	-0.0
Electricity, gas and water	-0.12			-0.03	-0.01	0.0
Construction	0.58			0.11	0.00	0.0
Wholesale, retail trade and repairing services	-0.19			-0.04	0.00	0.0
Hotels	-0.21			-0.04	0.00	0.0
Restaurants	-0.15			-0.03	0.00	0.0
Transport and storage	-0.23			-0.04	0.00	0.0
Communication services	-0.48			-0.08	0.00	0.0
Real estate	-0.12			-0.03	-0.01	-0.0
Business services	-1.53			-0.30	0.00	0.0

Filters

▼ Years

- ☑ All
- ☑ 2019
- ☑ 2020
- ☑ 2021
- ☑ 2022
- ☑ 2023
- ☑ 2024
- ☑ 2025
- ☑ 2026
- ☑ 2027
- ☑ 2028
- ☑ 2029
- ☑ 2030

▼ Activities

- ☑ All
- ☑ Agriculture, livestock and fishing
- ☑ Crude oil
- ☑ Natural gas
- ☑ Quarrying
- ☑ Petrochemicals
- ☑ Other manufacturing industries
- ☑ Electricity, gas and water
- ☑ Construction
- ☑ Wholesale, retail trade and repair
- ☑ Hotels
- ☑ Restaurants
- ☑ Transport and storage
- ☑ Communication services
- ☑ Real estate
- ☑ Business services

Legend:
- ■ Agriculture, livestock and fishing
- ■ Crude oil
- ■ Natural gas
- ■ Quarrying
- ■ Petrochemicals
- ■ Other manufacturing industries
- ■ Electricity, gas and water

EcoMod Platform

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Results in % Change | Number of Decimals: 2 | ☑ Table ☑ Chart

Model	Data

Tax rate on private consumption, by commodity
Value added tax rate, by commodity
Subsidy rate on private consumption, by
Tariff rate, by commodity (level, in %)
Tax rate on exports, by commodity (level, in %)
Social contributions rate, by branch (level, in %)
Corporate tax rate, by branch (level, in %)
Tax rate on production, by branch (level, in %)
Subsidy rate on production, by branch (level, in
Personal income tax rate (level, in %)
World price of exports, by commodity (% change
World price of imports, by commodity (% change
Exports (in %)
Bilateral tariff rates (level, in %)
Bilateral transport cost (level, in %)
Bilateral deliveries by industries (level, in %)
Solve
⌄ Results
   Macroeconomic effects in real terms
   Exports
   Imports
   Government budget
   Balance of payments
   Private consumption - total
   Private investment goods
   Public investment goods
   Private investments by branch
   Public investments by branch
   Domestic sales
   Domestic production
   Value added
   Intermediate consumption by type of commodity
   Intermediate consumption by branch

Domestic production

	2019	2020	2021	2022
Petrochemicals - Simulation 01	0.00	-0.44	-0.24	-0.14
Other manufacturing industries - Simulation 01	0.00	-1.11	-0.65	-0.38
Electricity, gas and water - Simulation 01	0.00	-0.12	-0.07	-0.04
Petrochemicals - Simulation 02	0.00	0.47	0.37	0.27
Other manufacturing industries - Simulation 02	0.00	-0.73	-0.58	-0.43
Electricity, gas and water - Simulation 02	0.00	-0.08	-0.07	-0.05

Chart legend:
- ■ Petrochemicals - Simulation 01
- ■ Other manufacturing industries - Simul...
- ■ Electricity, gas and water - Simulation 01
- ■ Petrochemicals - Simulation 02
- ■ Other manufacturing industries - Simul...
- ■ Electricity, gas and water - Simulation 02
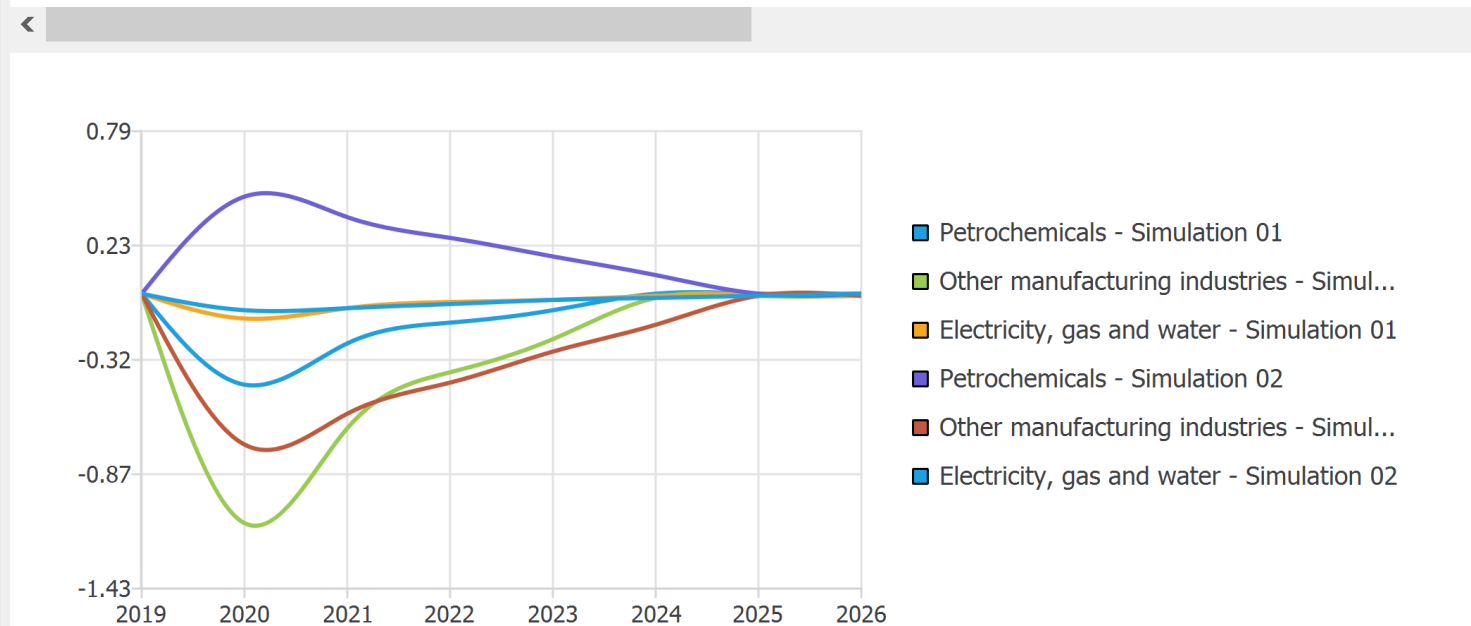
Filters

Simulations
☑ All
☑ Simulation 01
☑ Simulation 02

⌄ Years
☐ All
☑ 2019
☑ 2020
☑ 2021
☑ 2022
☑ 2023
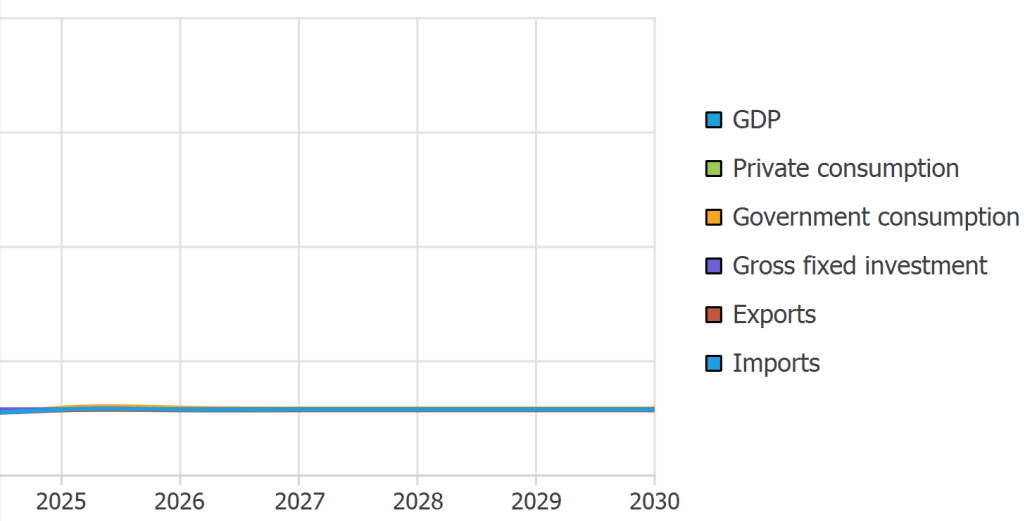☑ 2024
☑ 2025
☑ 2026
☐ 2027
☐ 2028
☐ 2029
☐ 2030

⌄ Activities
☐ All
☐ Agriculture, livesto
☐ Crude oil
☐ Natural gas
☐ Quarrying
☑ Petrochemicals
☑ Other manufacturi
☑ Electricity, gas and
☐ Construction

EcoMod Platform

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Results in % Change

Number of Decim

	Arabic	Swedish
	Armenian	Thai
	Azerbaijani	Turkish
	Bulgarian	Ukrainian
	Chinese	Urdu
	Croatian	Vietnamese
	Czech	
	Danish	
	Dutch	
	English	
	Filipino	
	Finnish	
	French	
	German	
	Greek	
	Hebrew	
	Hindi	
	Hungarian	
	Icelandic	
	Indonesian	
	Irish	
	Italian	
	Japanese	
	Kazakh	
	Korean	
	Latvian	
	Lithuanian	
	Macedonian	
	Malay	
	Norwegian Bokmal	
	Persian	
	Polish	
	Portuguese	
	Romanian	
	Russian	
	Serbian	
	Slovak	
	Slovenian	

Model / Data

Reset
Simulation Horizon
Closure
> Shocks
Solve
∨ Results
  Macroeconomic effects in real terms
  Exports
  Imports
  Government budget
  Balance of payments
  Private consumption - total
  Private investment goods
  Public investment goods
  Private investments by branch
  Public investments by branch
  Domestic sales
  Domestic production
  Value added
  Intermediate consumption by type of commodity
  Intermediate consumption by branch
  Employment - total
  Capital stock
  Consumer prices - excluding taxes
  Consumer prices - including taxes
  Producer prices
  Real wage cost by branch
  Real capital cost by branch
  Return to capital by branch
  Relative price of export demand
  Relative price of export supply
  Relative price of imports
  Private consumption - by household type

Macroeco

	2021	2022	2023	2024	2025
GDP	0.88	0.49	0.27	0.00	0.00
Private cor	0.70	0.40	0.22	-0.01	-0.01
Governme	2.20	1.24	0.70	0.02	0.02
Gross fixed	0.00	0.00	0.00	0.00	0.00
Exports	1.05	0.57	0.31	-0.01	-0.01
Imports	1.30	0.74	0.42	0.00	0.00

- GDP
- Private consumption
- Government consumption
- Gross fixed investment
- Exports
- Imports

4.7

3.3

1.9

0.6

-0.8
201

2025   2026   2027   2028   2029   2030

Thank You.