EUROPEAN ECONOMIC IMPACTS OF CUTTING ENERGY IMPORTS FROM RUSSIA: A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

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Overview

In this paper, we assess the impacts on the European economy of restricting fossil energy imports from Russia. We use the computable general equilibrium model GEMINI-E3 and simulate a scenario in which the European Union achieves a complete cut off of energy imports from Russia in 4 years. We consider capacity constraints on additional natural gas imports from non-Russian partners. We run the model on the period 2022 to 2030. The plan of the paper is the following: the first section deals with the European Union's current dependence on Russian fossil energy export. The section 2 presents the model used and the scenarios design. Section 3 provides the numerical analysis, and section 4 concludes. Simulation results show that (i) the macroeconomic costs are likely to be substantial but manageable. With a GDP decrease by 0.4% in the short term, and a cost per European citizen estimated at 400 US$ in 2030. (ii) The results are mainly driven by the increase in the price of natural gas which reaches 75% in 2030. (iii) Closure of coal-fired power plants is postponed and electricity from renewable increases. (iv) Support measures that are not considered in our analysis would be necessary to limit the cost for low-income households. (v) Russia would bear a higher cost estimated at 2.5% of household consumption in 2030.

Methods

This study uses the latest modification of GEMINI-E3 based on the study of Bernard and Vielle (2008). The model incorporates a multi-country, multi-sector, recursive dynamic computable general equilibrium model with backward-looking (adaptive) expectations. The current version is built on the GTAP 10 database (Aguiar et al., 2019) with the year 2014 as reference. For analytical purposes, the regional aggregation of this version covers the EU, the US, China and the rests of the world, which is represented by 8 countries and regions. Scenario design for reference case uses a more updated complementary climate-development of CD-Links policies database (McCollum et al. 2018, Roelfsema et al. 2020), with harmonized assumptions detailed in our previous work of Giarola et al. (2021) and Sognaes et al. (2021). The baseline or reference scenario is constructed based on the EU's current policies.

Results

The restriction on Russian import has a huge impact on European natural gas price. As imports from non-Russian partners are constrain, natural gas price increases to meet the new supply. In 2022, the natural price increases by 6.5% whereas the price increase reaches 74% in 2030. The demand for natural gas decreases by 4% in 2022 and by 28% in 2025 and afterward. In 2030, the fall in natural consumption is evaluated to 97 billion cubic meters (Bcm) coming from:

- Electricity generation (-56 Bcm),
- Energy intensive industries (-20 Bcm),
- Households (-16 Bcm),
- Other sectors (-5 Bcm).

Natural gas consumption is partly substituted by coal consumption which increases by 3.4% in 2022 and by 22% in 2025. Coal consumption increases mainly in electricity generation where closures of coal power plants are postponed. Electricity generation from coal increases by 105 TWh in 2025 and by 69 TWh in 2030. New capacity of renewable (mainly wind and solar) are gradually installed and the additional generation coming from these renewable reaches 196 TWh in 2030. In 2030, electricity consumption increases by 1.3%. This additional demand of coal rises the coal price before indirect taxation by 30% in 2030. Petroleum products consumption are slightly unchanged with respect to the reference scenario and its price only increase by 12% in 2030.

By construction the two scenarios reach the same level of emissions in the ETS and non-ETS sectors. The increase in fossil energy prices reduces the CO2 prices needed to achieve the fit for 55 targets and leads to different price increases according to energy carriers, as can be seen when looking to the final consumer prices. The user price of coal drops by 43% in 2030 for households, on the contrary price of natural gas price increases by 36%. In the ETS sectors, CO2 emissions in the electricity sectors increase because coal replace natural gas and also because the decrease of the ETS price from 2022 to 2025 limits the installation of CCS in coal power plants. In contrary other ETS-sectors like energy intensive industries increase their CO2 abatement following the gas price increase. In non-ETS sectors, the decrease of natural gas consumption by households reduces their CO2 emission, the CO2 tax applied in these sectors decrease and drop from 195 US$ to 54 US$ in 2030. Therefore, the contribution of non-GHG emissions (i.e. CH4, N2O and F-gases) increases.

At macroeconomic level, the European GDP decreases slightly by 0.37% in 2025, and by 0.24% in 2030. The welfare change computed from the utility function shows a much more significant cost evaluated to 1.5% of household's consumption in 2030, which is equal to around 400 US$ per European citizen in 2030. Regarding the other regions. Russia bears the higher cost with a welfare cost equal to 2.5% of household consumption, other energy exporting regions benefit from additional energy exports, respectively Africa, Rest of the World (which includes Norway and Canada), Middle East, and USA. The Chinese economy is not affected by the European import restrictions.

Conclusions

This paper analyses the European economic implications of banning fossil energy imports from Russia. Simulation results show that (i) the macroeconomic costs are likely to be substantial but manageable. With a GDP decrease by 0.4% in the short term, and a cost per European citizen estimated at 400 US$ in 2030. (ii) The results are mainly driven by the increase in the price of natural gas which reaches 75% in 2030. (iii) Closure of coal-fired power plants is postponed and electricity from renewable increases. (iv) Support measures that are not considered in our analysis would be necessary to limit the cost for low-income households. (v) Russia would bear a higher cost estimated at 2.5% of household consumption in 2030.

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