

# Climate Policy and Trade Restrictions in a Production Network Context: Evidence from a CGE Model for Russia

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This research examines how **climate policy and trade restrictions propagate through production networks** in the Russian economy. Using a **Computable General Equilibrium (CGE)** model with detailed inter-industry linkages, it analyses the introduction of a **domestic emissions trading system (ETS)** under conditions of **quantitative export constraints** and worsening terms of trade. The model extends *Burova et al. (2023)* by incorporating an **auction-based mechanism for export quota allocation**, capturing both price and quantity channels of trade adjustment within a networked production structure.

The simulation framework covers six scenarios aligned with **NGFS Phase III** global climate pathways (*NDC, Below 2 °C, Net Zero 2050*), each modelled with and without a domestic ETS. These scenarios jointly trace **global-to-domestic transmission of shocks** through export prices, quantitative restrictions, and carbon costs.

Results show that in adverse external environments—characterised by falling prices for carbon-intensive exports—the binding effect of quantitative quotas weakens, as equilibrium export volumes fall below imposed limits. The opposite holds when world prices for carbon-rich fuels remain stable or rise: in such cases, **the domestic cost of quantitative restrictions increases sharply**, amplifying welfare losses.

Network analysis within the CGE framework reveals **asymmetric propagation**: upstream sectors (oil extraction, refining, pipeline transport) contract sharply, while downstream and demand-driven industries (chemicals, machinery, food processing) gain relative weight through input substitution and domestic reallocation.

At the macro level, an ambitious 70 % cut in CO<sub>2</sub> emissions relative to 2016, combined with declining export prices, reduces GDP by about **11 % by 2040**, whereas a **moderate policy** (36 % reduction) results in only a **4.7 % decline**, of which **0.3 percentage points** stem from the ETS itself. Recognition of Russia's ETS in international markets slightly mitigates these effects through higher effective export prices.

The findings underscore that the **structure of production and trade networks** critically shapes the transmission and magnitude of climate-policy shocks. Integrating carbon pricing into export-oriented supply chains without access to global green technologies amplifies systemic effects along the network. A feasible transition path therefore requires **moderate, internationally coordinated climate policy**, combined with **investment in low-carbon, export-oriented industries**, to sustain both emission reduction and network resilience.

**Keywords:** Production networks, Russia, climate policy, CGE, NGFS scenarios, export restrictions, emissions trading

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