Sensitivity of Future Regional and Global Economic Activity to Energy Market Disruptions:

What If Russia Couldn't Export Energy?

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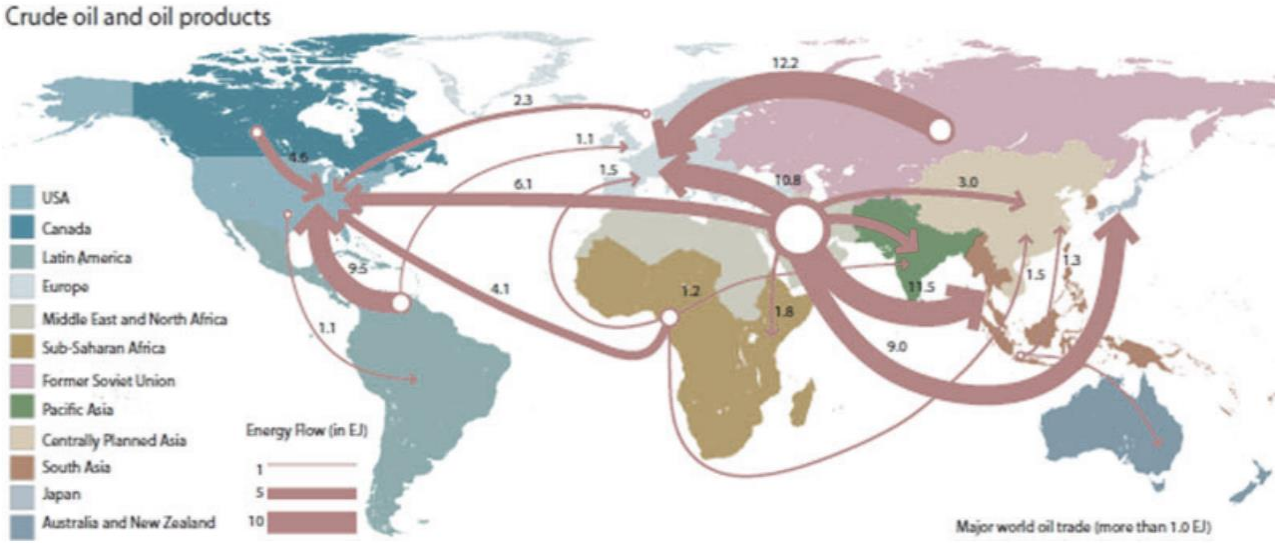
Motivation

The macroeconomy defines the scale of human activity and is one of the most important factors determining the scale of human-physical Earth system interactions.

Individual human activities can have substantial feedback effects on the macroeconomy.

We explore feedback effects from international energy trade on the economies of the world.



Source: Rasha M. Abou Samra, Rasha Eissa & Maie El-Gammal (2018): Applying the environmental sensitivity index for the assessment of the prospective oil spills along the Nile Delta Coast, Egypt, Geocarto International, DOI: 10.1080/10106049.2018.1533592

Research question: ***How would the world accommodate a major disruption in energy trade such as a cession of energy exports from the Russian economy?***

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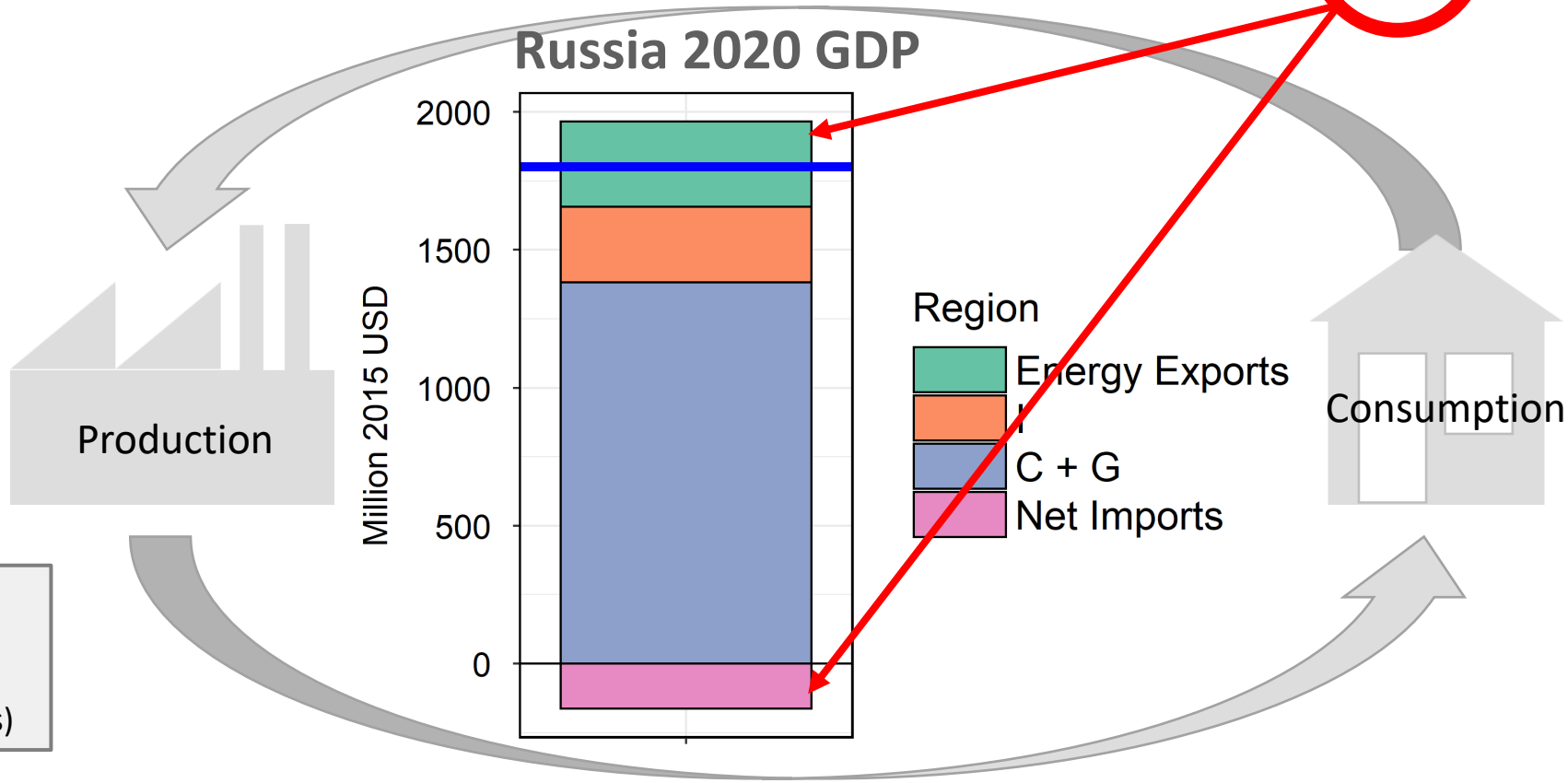
Background—What is GDP?

GDP is the monetary value of new final goods and services produced in a given year

GDP=C+G+Investment+Net Exports (NX)



C=Consumption
G=Government Spending
I=Investment Spending
NX=Net exports (Exports-Imports)

GDP=Wages+Interest+Rents+Profits

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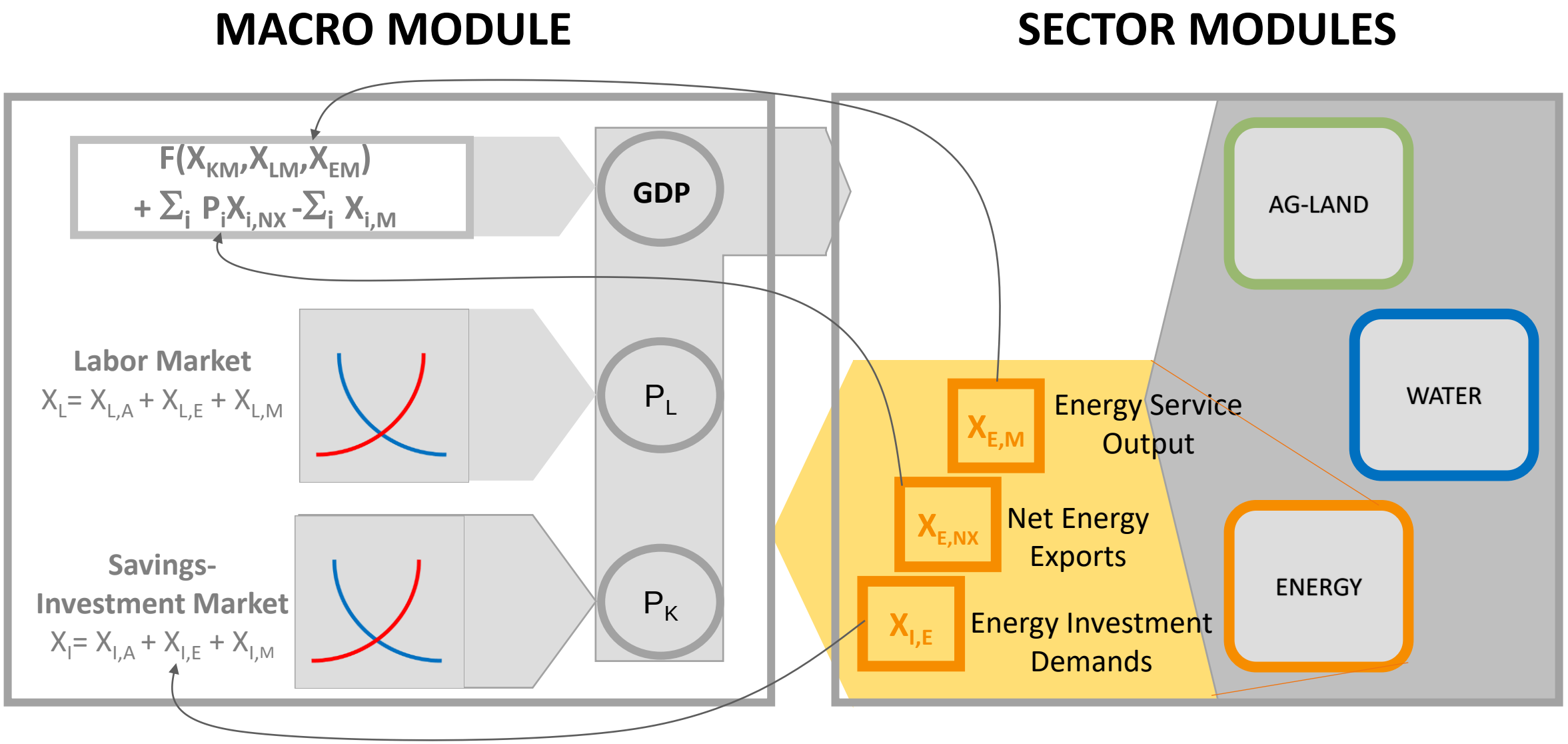
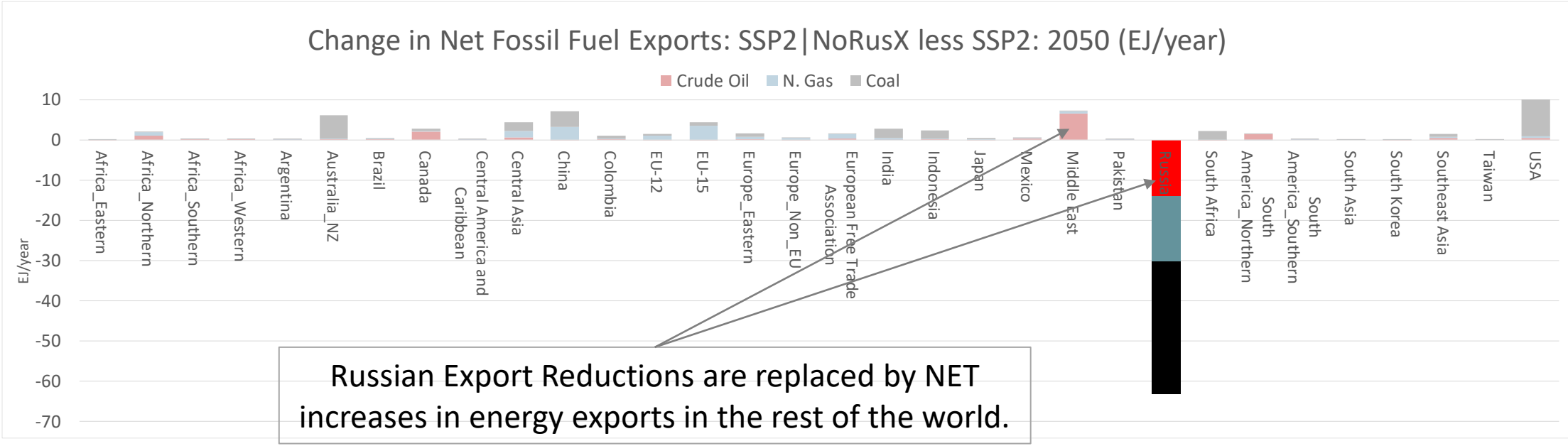
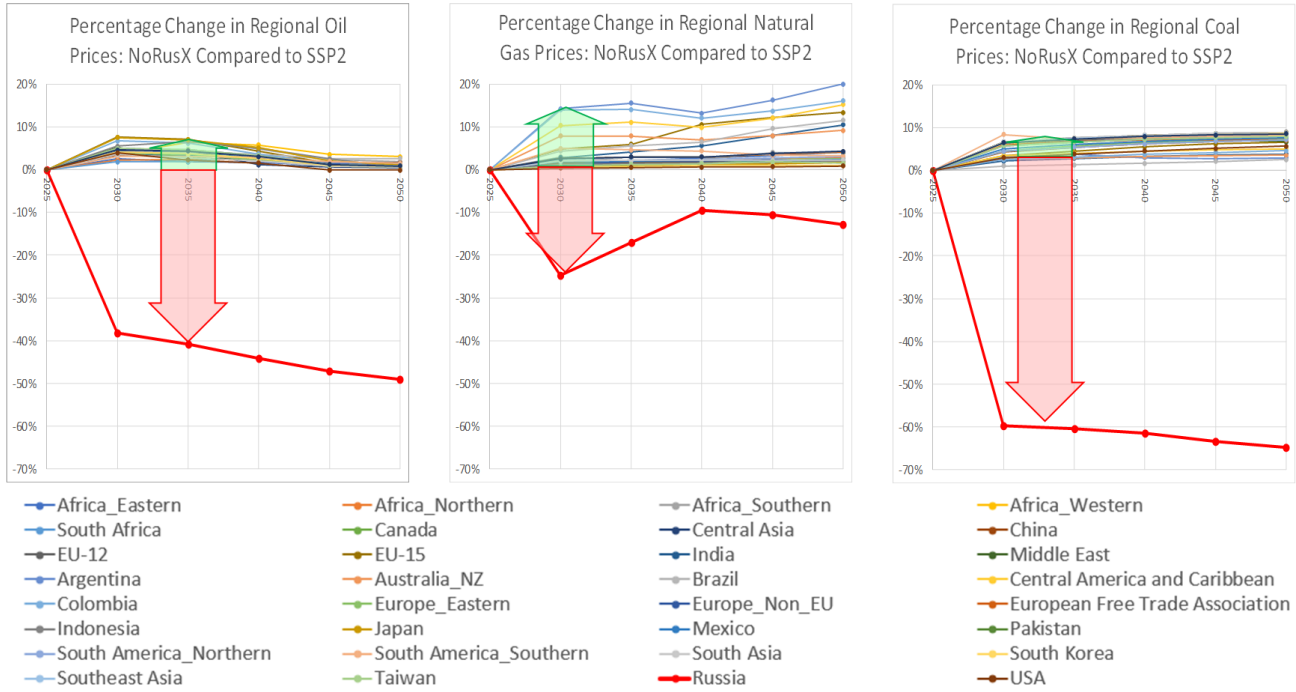
The Global Change Analysis Model (GCAM) v7.0 an MSD Model

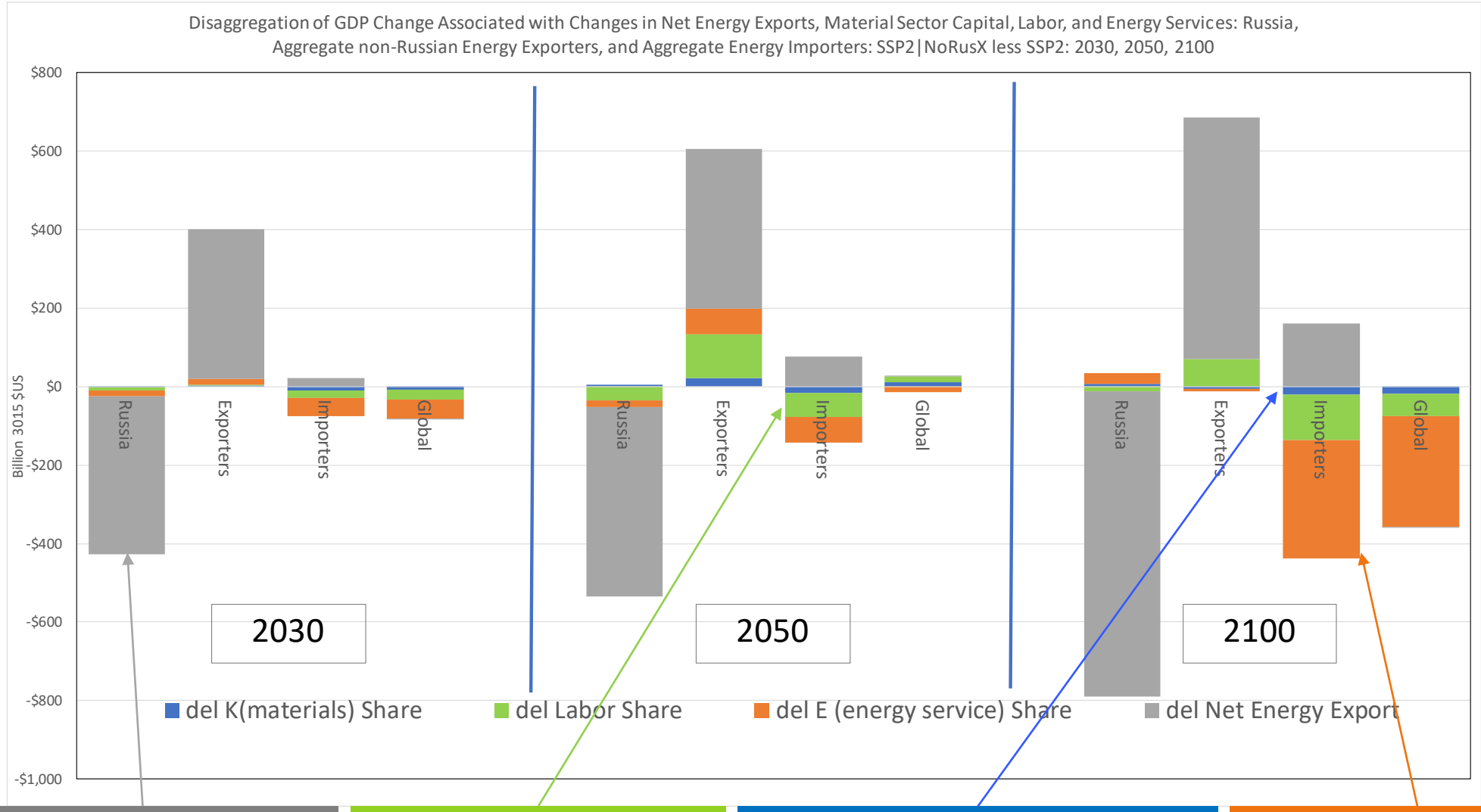




Experimental Design



GDP Change: Energy Exporters, Importers, and Global: SSP2|NoRusX less SSP2



Net Energy Export Term | Labor Term | Materials Sector Capital Term | Energy Services Term

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Insights

Research question: ***How would the world accommodate a major disruption in energy trade such as a cession of energy exports from the Russian economy?***

Energy trade feedback effects on GDP were substantial.

Russian GDP was reduced by $500 billion/year in 2050.

- Russian GDP reduction was transferred to the rest of the world as an increase in GDP.
- Non-Russian energy exporters received most of the GDP increase.
- Energy net importers' GDPs changed substantially less, and in some cases, suffered reductions.

Balance of Trade Effects were the dominant mechanism changing GDP for energy net exporters.
Energy availability was the dominant mechanism changing GDP for energy net importers.

Wages rose in non-Russian energy exporters and fell in energy importing regions and Russia through capital stock interactions.

Our approach can be used to assess a wide range of other feedback effects that operate through a wide range of pathways including energy, land, meteorology, and water.