

# The European Commission's science and knowledge service

## Joint Research Centre



# Aquaculture modelling in a general equilibrium framework. *An application for the EU*

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# Outline

- **Background**
- **Aquaculture modelling in MAGNET**
  - Interrelations aquaculture, wild fish and food processing sectors
  - Integrating income subsidies on fisheries and aquaculture
- **Baseline**
  - Horizon 2050
- **Simulation scenarios**
  - Aquaculture subsidy increase
  - Change in fish and seafood final demand
- **Concluding remarks and main caveats**

# Background

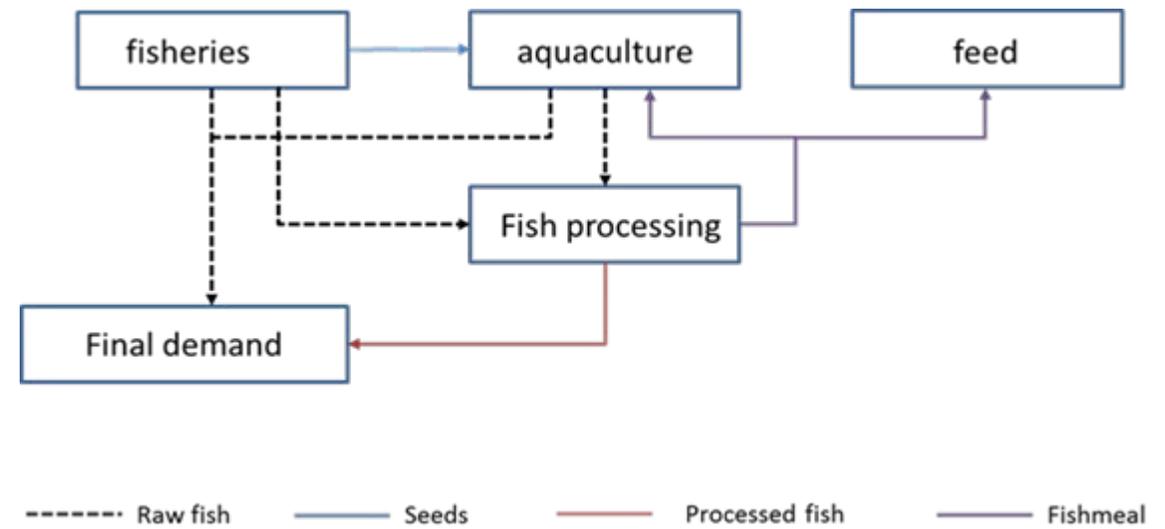
- Aquaculture is the **fastest growing food production** sector at global level. It can be instrumental in sustainable development, poverty reduction, and food and nutrition security.
- EU represents **1.2% of the world aquaculture production** in volume and highly relies on imports (more than 50% of the EU seafood consumption). China contributes to 58% of the global aquaculture production
- The EU aquaculture sector is **highly concentrated**: five countries contribute to 70% of total EU aquaculture production in volume (65% in value)
- Over the last two decades, EU support to boost the aquaculture amounted about **3 billion euros**
- The complexity and **interconnections** of wild-captured fish and aquaculture sectors to the food-processing industry, and the rest of the economy require systems-wide modelling

→ This paper is the first attempt of **disaggregating aquaculture sector and subsidies** within a global CGE modelling framework



# Modelling fish, aquaculture and processing sectors in MAGNET

- GTAP database v.10
- GTAP fish sector (*frs*) split into **six sectors**:
  - diadromous fish (salmon and trout)
  - fresh fish (carp, tilapia, pangasius, other freshwater fish)
  - farmed marine fish (sea bass and other marine fish)
  - molluscs (clam, mussel, oyster)
  - crustaceans (shrimp, other shellfish)
  - wild fish
- **Fish-processing sector** is extracted from other food sector (*ofd*)
- **Fishmeal** and fish oil are included
- Wild **fish stocks** are introduced

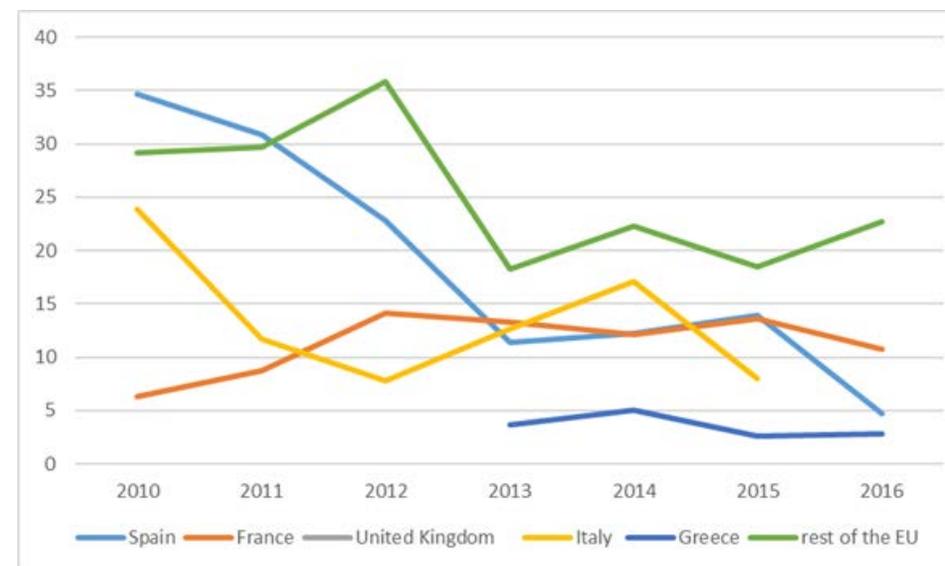


*Schematic representation of interactions between fisheries, aquaculture and fish processing sectors in MAGNET*

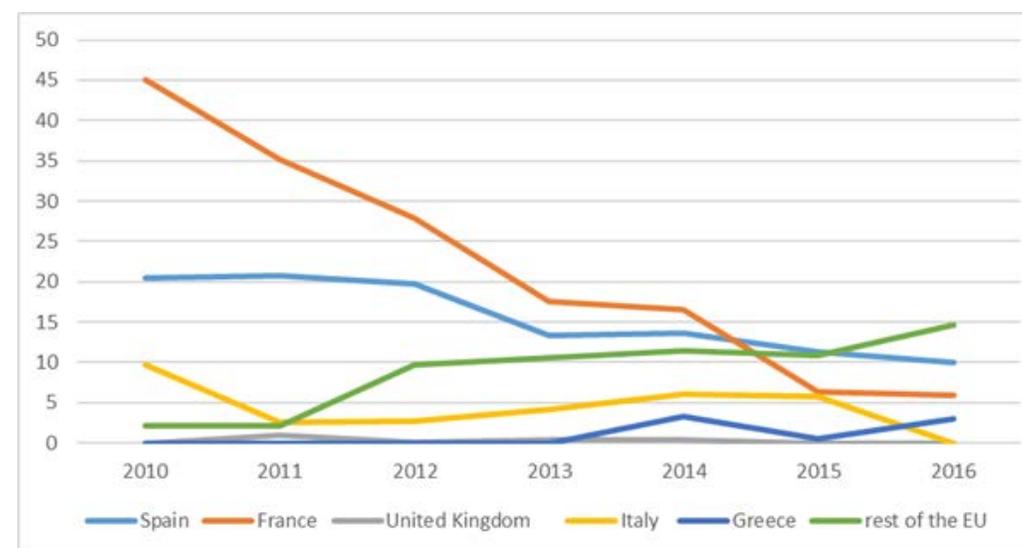
→ **Modeling and database adjustments** (including cost structures of aquaculture sectors, fish processing sector, etc.)

# Integrating subsidies on fisheries and aquaculture

- Common Fisheries Policy and relative financial instrument: **European Maritime and Fisheries Fund (EMFF)**
- Shock the variable output tax/subsidy for each aquaculture sectors and wild fish
- **Direct income subsidy rate** estimated by EU country and each aquaculture sectors and wild fish
- Data of spending from the JRC Scientific, Technical and Economic Committee for Fisheries (STECF)
- Same procedure for Japan, South Korea, China, Russia, Taiwan and the USA when data available



Direct income subsidies in fisheries, million euros



Direct income subsidies in aquaculture, million euros

# MAGNET data aggregation

## Regional Aggregation (36 countries/regions)

- **Southern Europe:** Greece, Italy, Spain, Rest Southern Europe
- **Northern Europe:** Ireland, Norway, United Kingdom, Rest Northern Europe, rest of EFTA,
- **Western Europe:** France, Netherlands, Rest Western Europe
- **Eastern Europe:** Poland, Rest East Europe, Rest Europe
- **Asia, Russia, and Oceania:** China, Hong Kong, Mongolia and Taiwan, India, Indonesia, Japan, Korea, Malaysia, Philippines, Rest of Asia, Thailand, Turkey, Viet Nam, Russia, Oceania
- **Africa:** Egypt, Morocco, rest of Africa
- **America:** USA and Canada, Brazil, Chile, Mexico, rest South and Central America

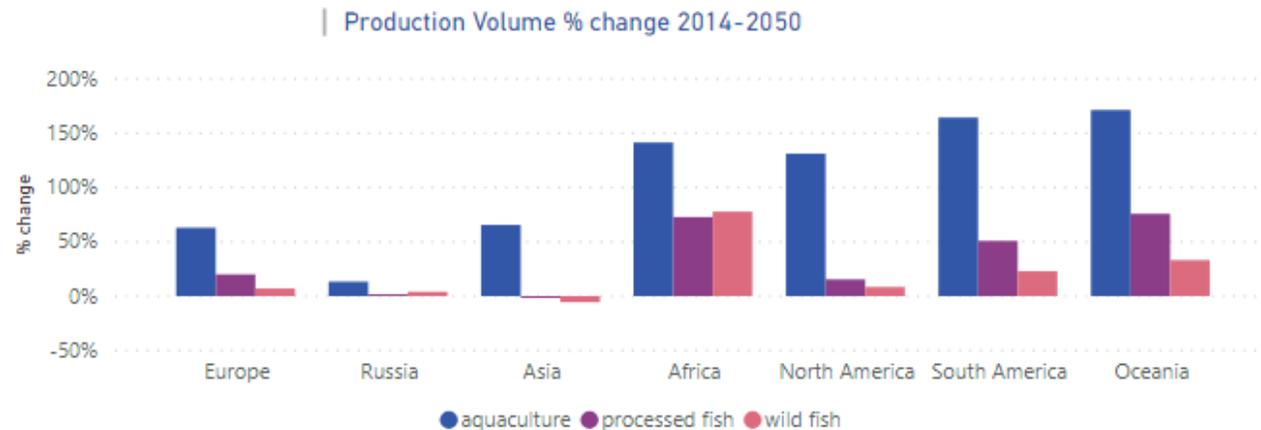
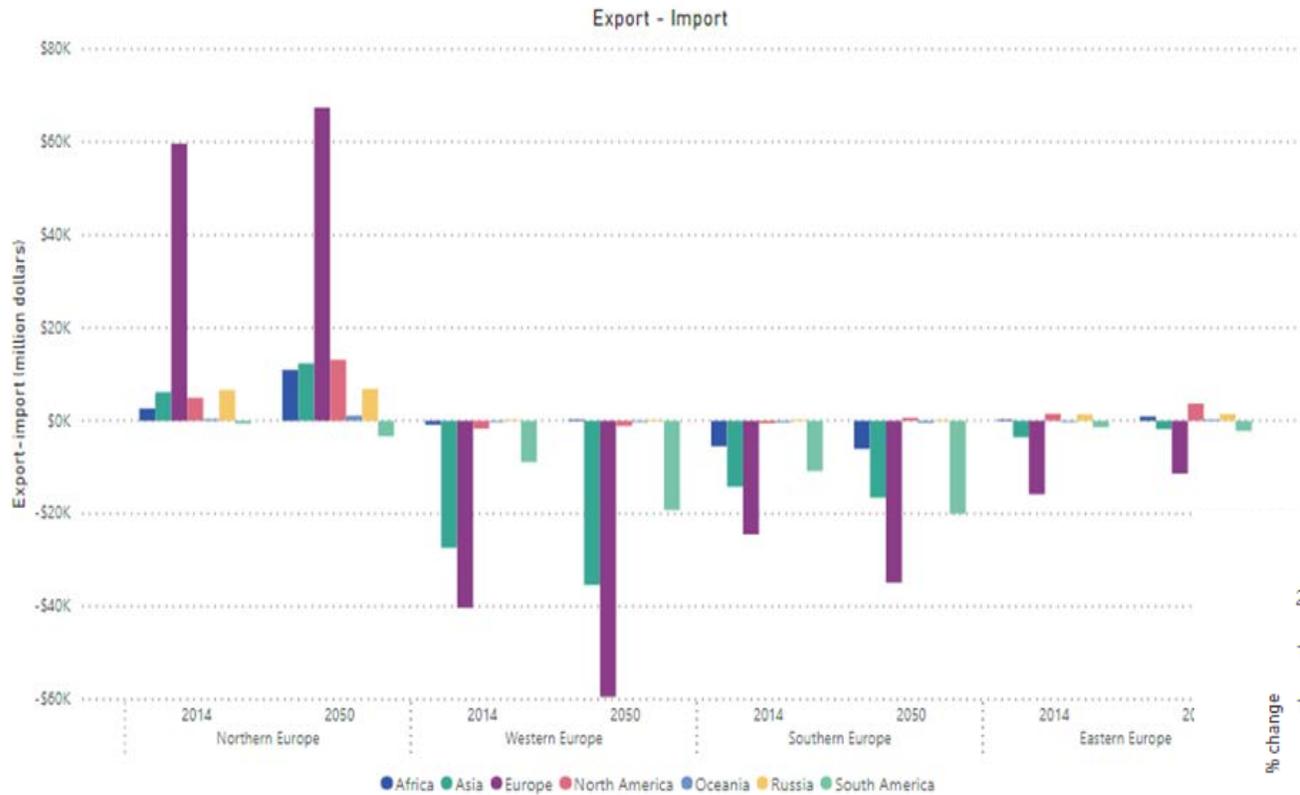
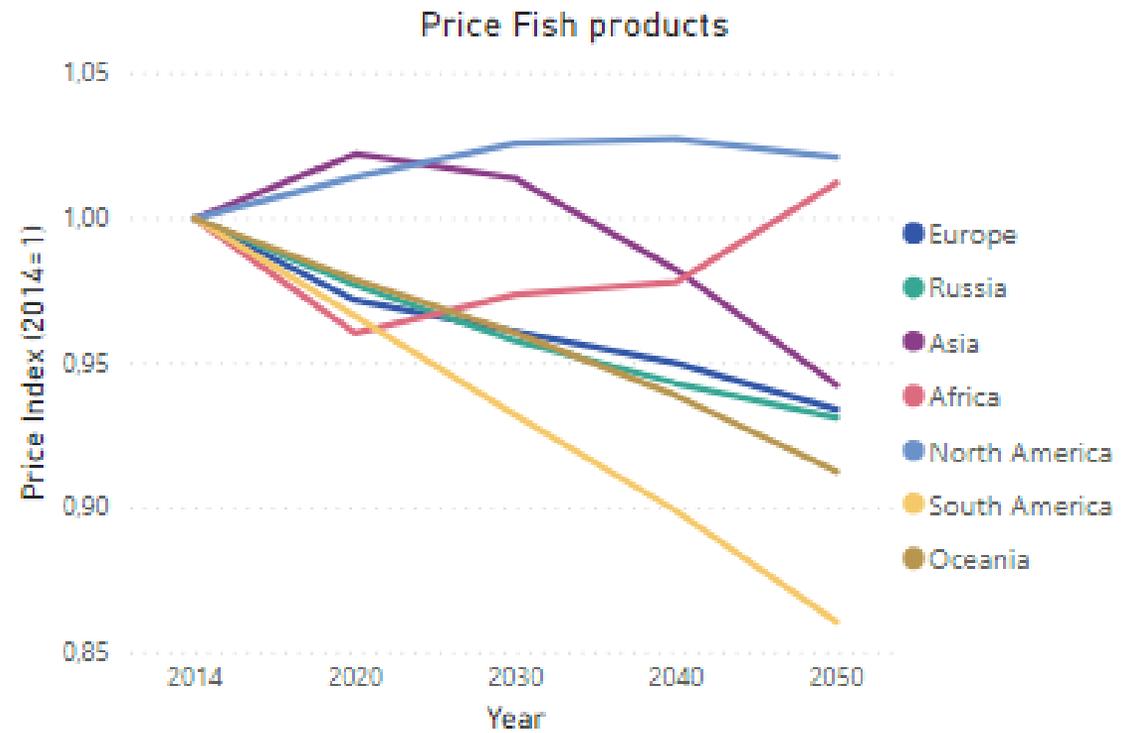
## Sectoral disaggregation (44 commodities)

- **Aquaculture and wild fish (6 commodities):** Crustaceans (Crust); Diadromous fish (Diad); Freshwater fish (Fresh); Marine fish (Marin); Molluscs (Molus); Wild fish (fsh)
- **Primary agriculture (5 commodities):** Paddy rice (pdr); Wheat (wht); Other grains (grain); Oilseeds (oils); Vegetables, fruits and nuts (hort); Other crops (crops)
- **Livestock (6 commodities):** Cattle and sheep (cattle); Pigs and poultry (pigpoul); Raw milk (milk); Meat (cmt); Meat product (omt); Dairy (dairy)
- **Processed food (4 commodities):** Sugar processing (sugar); Vegetable oils and fats (vol); Other food and beverages (ofd); Processed fish (fishp)
- **Feed (4 commodities):** Animal feed (feed); Crude vegetable oil (cvol); Fish meal (fishm ); Oil cake (oilcake)
- **Industry and services (18 commodities)**

# Baseline and scenarios

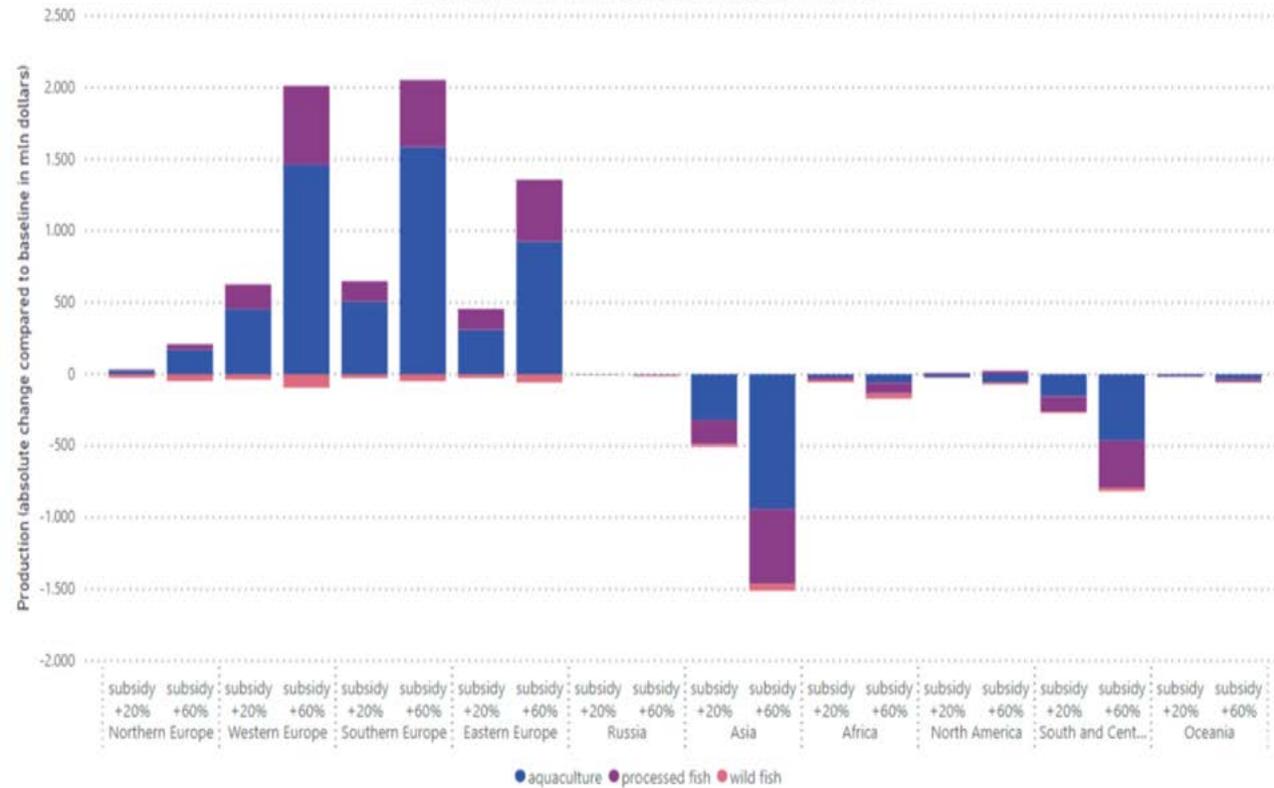
- **Baseline** to 2050
  - GDP and population growth based on the Shared Socioeconomic Pathway 2 (**SSP2**)
  - Availability of **fish stocks' biomass remains constant** over the period 2017-2050. Years 2014-2017 are shocked to values reported by FAO
  - Aquaculture growth projections from FAO and **moderate technological development** in worldwide aquaculture from World Bank
  - Direct income **subsidy rates** in wild fish and aquaculture sectors
- **Scenarios** scrutinize the nexus between (low/high) subsidies under (low/high) demand for fish products
  - Scenario 1 on **increase in EU aquaculture support**: low amounts of current spending provide room for increase (between 20% and 60%)
  - Scenario 2 on **increase in world demand for fish products**: World demand growth of 2% and 4% extra per year compared to the baseline
  - Scenario 3 on cumulated increase in support and demand

# Baseline results: production, price, international trade

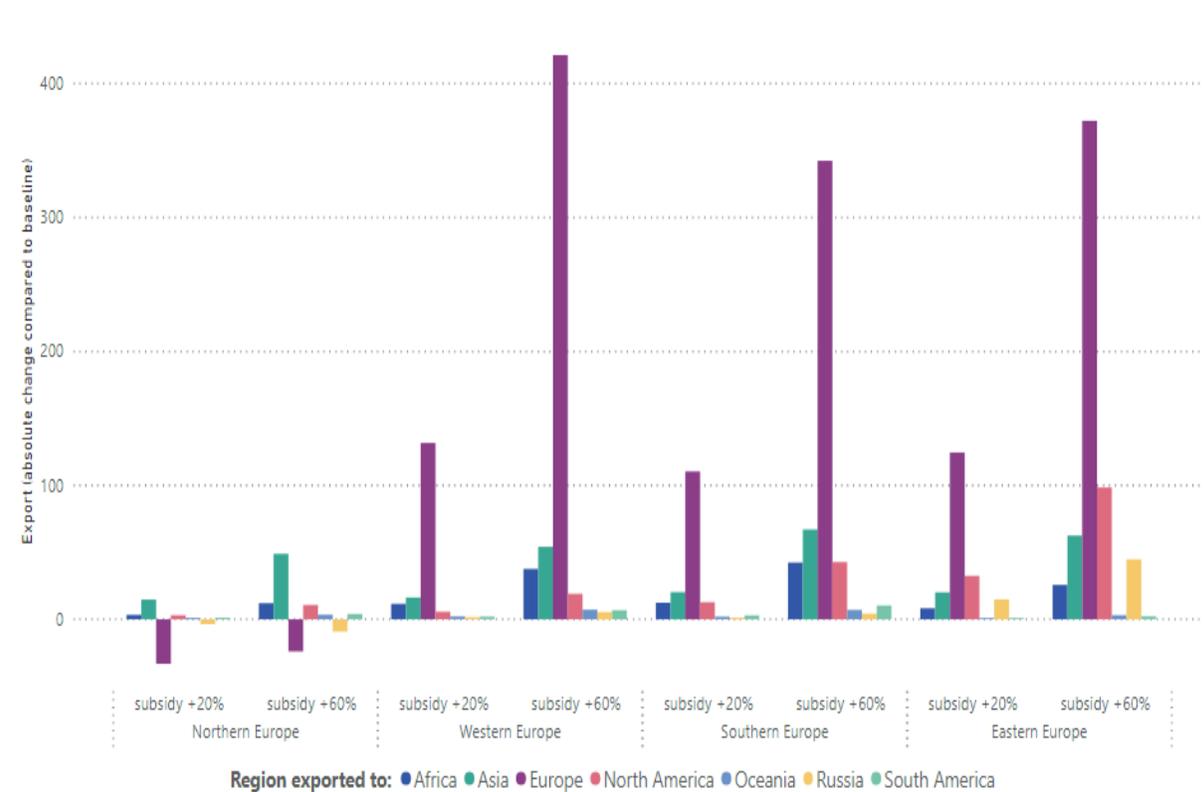


# Scenario results *increase in EU aquaculture support*

Production Volume (absolute change compared to baseline)

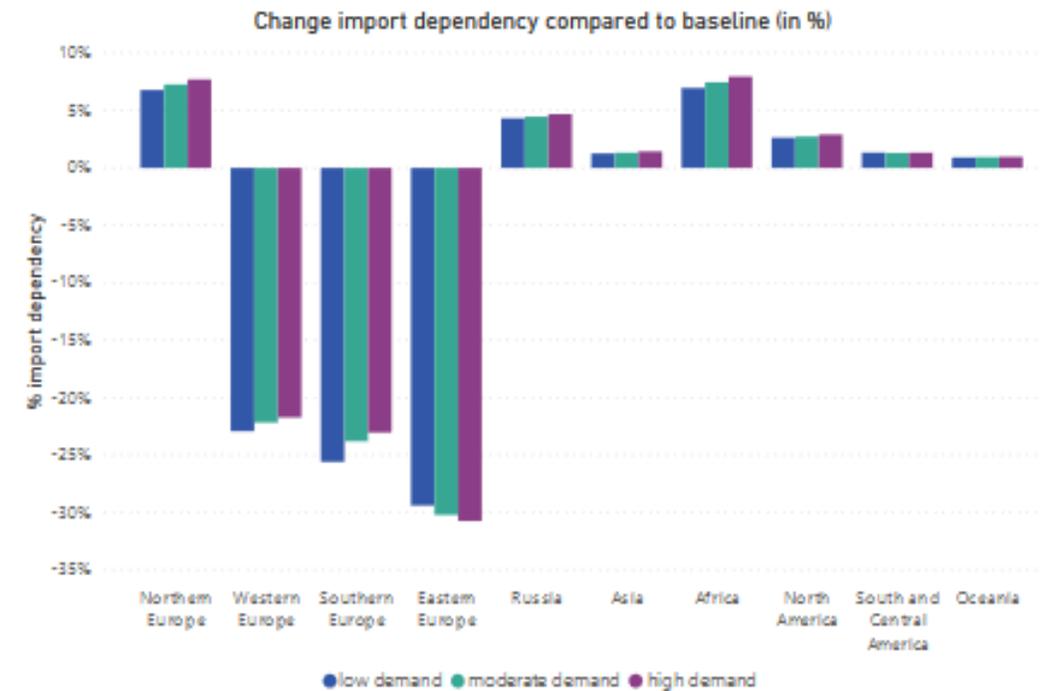
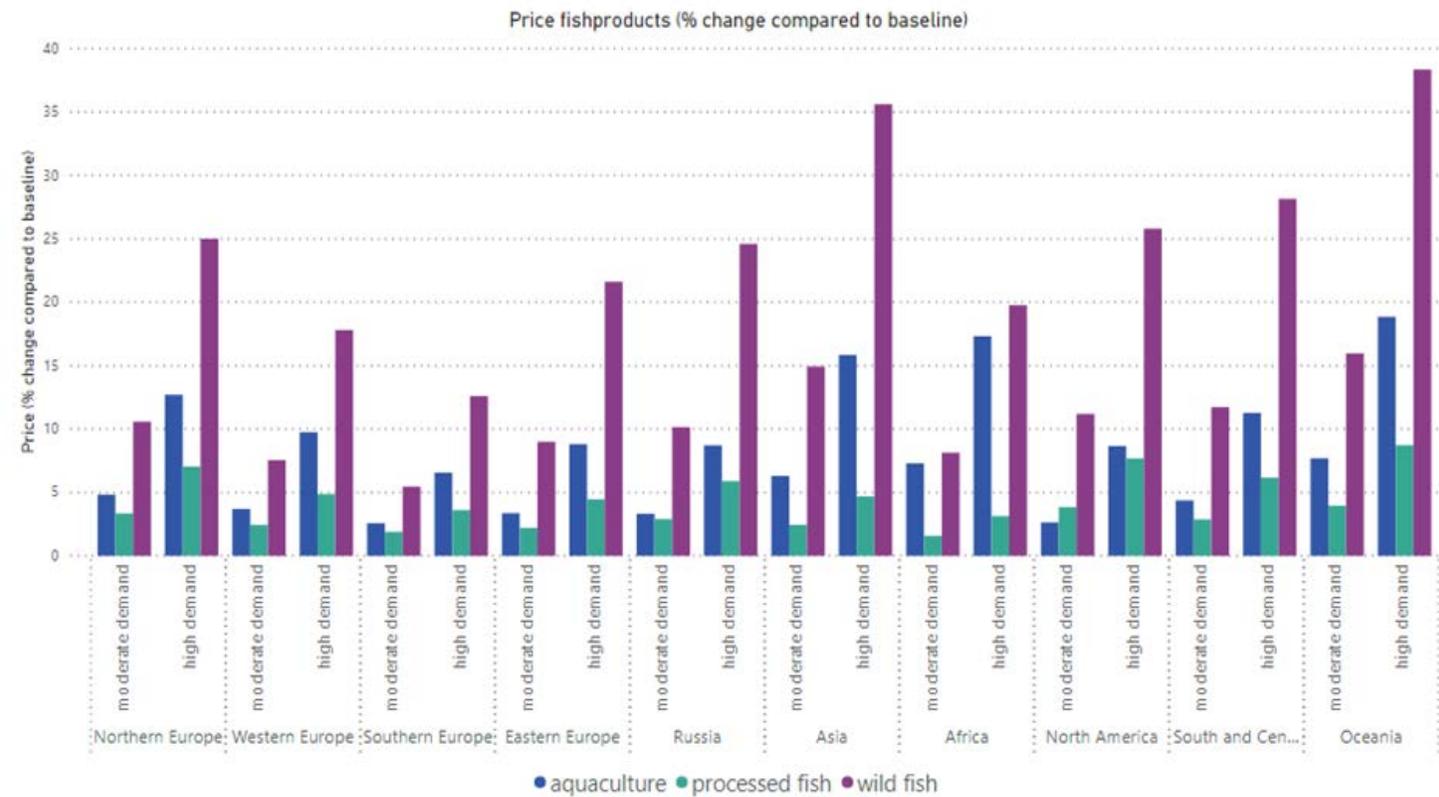


Export fishproducts (absolute change compared to baseline)



# Scenario results

## *increase in demand (left) plus subsidies (right)*



# Concluding remarks and main caveats

- Key sector part of several EU strategies: **Farm to Fork**, Bioeconomy, Blue growth
- At the horizon 2050 aquaculture becomes **more feed efficient**, prices generally decrease
- **China** remains the largest aquaculture producer but the rest of the world is slowly catching up, including the EU
- Strong modelling assumption
  - **Fish stocks** remain constant over time
  - Robust data on **technical change** in the sector are missing
- **Income vs. investment** subsidies
  - Availability and comparability of data
  - Modelling as output or transfer payment? Productivity effects?
- **Brexit**
  - Trade relation UK-EU (and with Norway, Iceland, Asia, etc.)
  - Access to fishing grounds
  - Gain/loss (e.g., 90% of EU Atlantic salmon come from the UK)

# Concluding remarks and main caveats

- Absence of trade policy
  - **FTAs** (e.g. EU-Vietnam, EU-MERCOSUR)
  - WTO (e.g. negotiations on **fisheries subsidies** with possible increase in operational costs)
  - **NTMs** (trade restrictiveness)
- **Climate change and environmental** externalities not considered
  - Resource limitation and deterioration in the EU and worldwide
  - Adequate policy response?
- Capturing the **change in diets** is crucial
  - Healthy eating - reduced meat and dairy - fish acts as a (partially) protein substitute
- Some **Covid-19** considerations
  - Short-term vs. long-term effects: Contraction of demand, global (and local) food supply chain disruption, transitory support to the sector, less fishing and faster recovery of fish stocks?
  - A specific factors approach of the model ?

# Thank you

