Competitiveness of European fisheries and aquaculture: a dynamic CGE approach

Heleen Bartelings and Zuzana Smeets-Kristkova

International Policy Division, Wageningen Economic Research, Alexanderveld 5, 2585 DB The Hague, The Netherlands

Introduction

The global demand for seafood products is increasing. In a globalised economy, this should generate high opportunities for any seafood production activity. However, both fisheries and aquaculture companies in Europe are facing key challenges, which currently hinder them from reaping the full benefits of seafood markets expansion, and even question their sustainability. As a whole, the EU fisheries sector remains at low levels of profitability and sustainability. This paper will analyse how competitive European fisheries and aquaculture are compared to fisheries and aquaculture in other regions and simulate how this position may change in the next 20 years.

To simulate the trade competitiveness of the European fisheries and aquaculture sectors over the next 20 years we will use a CGE model. Our approach is first to develop a CGE modelling framework, based on the CGE model MAGNET. Three innovation will be implemented: extend MAGNET database with fisheries, aquaculture and fish processing sectors; split natural resources into fish stocks and other natural resources and make the fish stocks dynamic; make fish stocks endogenous and mobile.

Data update

The database used by MAGNET has been extended to include both wild catch fisheries, aquaculture and fish processing sectors. Interactions between aquaculture and fisheries, for example fisheries providing fishmeal and fish seed to aquaculture has been taken into account. Feed is explicitly modelled and attention is given to the competition between aquaculture and cattle sectors for available feed. Figure 1 shows a schematic representation of how the three new sectors have been implemented and how they interact with each other.

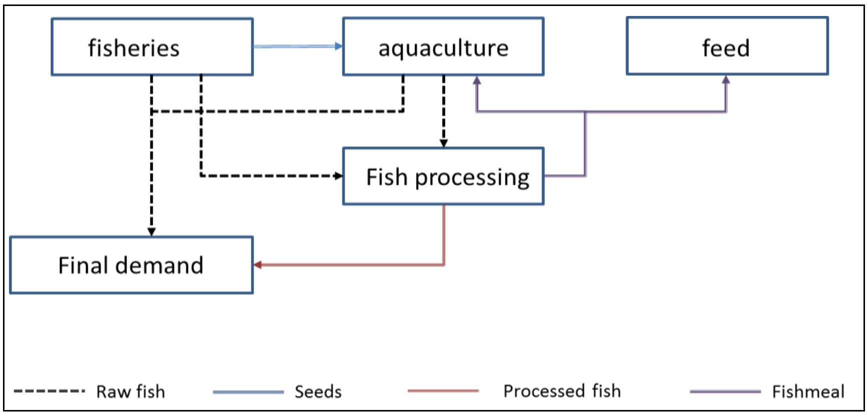

Figure 1 Schematic representation of fish and aquaculture sectors in MAGNET

Because the cost and feeding structure of different types of aquaculture differ a lot, we have decided to split out four main aquaculture groups: diadromous fish, fresh fish, crustaceans and marine fish (Table 3.4). These groups are also distinguished in the FAO statistics. For each of these aquaculture types cost structures are defined based on the literature, formulated as percentage of total cost and for feed also in content of the feed (from fish and from crops, distinguished by crop).

The Fish processing sector has so far been included in the other food category (OFD) in the GTAP database. For this report we have split fish processing from the OFD sector. The amount of data available about fish processing is very limited, therefore most of the data for this sector is constructed. STECF publishes an overview of fish processing annually. Based on this report we have constructed a cost structure for each European country. As there is a lack of data for countries outside the European Union, we have decided to take an average cost structure based on European data for the rest of the world.

We assumed that all fish used in the OFD sector according to GTAP was actually fish used by the fish processing sector. Based on the total intermediate use of fish and the cost structure of the fish processing sectors, we could determine the size of the sector in the base year. We assume that the fish processing sector produces both filleted fish and fishmeal. Based on a literature study we found the average share of fishmeal and filleted fish and thus we could determine the value of filleted fish and fishmeal in the base year. It has been decided that for international trade we assume that the fish processing sector follow the trade patterns from the GTAP database.

Dynamic modelling of fishstocks

To understand the workings of the wild catch fisheries sector, it is integral to include a linkage between economy and biology. The fisheries sector is a sector that is highly dependent on available fish stocks. Since the size of the fish stock is one of the primary drivers for the fisheries sector, attention will be given to dynamic modelling of the fish stocks. The size of the fish stock is determined by a yearly growth rate, natural mortality and fishing mortality of the previous year. The size of the fish stock will also determine in part the cost of fishing. The smaller the fish stock, the higher the fishing effort and thus the higher the cost of fish.

There are three particular features that distinguish MAGNET's fish stock module from the standard modelling approach of fisheries, commonly used in most CGE models, including GTAP:

- fish stocks are treated independently of other natural resources, removing thus the unwanted competition of mining sector and fisheries over the same natural resource
- the stocks of fish follow a biological surplus production function with the possibility for biomass regeneration;
- excessive harvest of fish (and hence declining biomass stock) increases the costs of production, which is addressed in a relationship between returns to fish stock and harvest rate.

The size of the fish stock is determined by a yearly growth rate, natural mortality and fishing mortality of the previous year. We assume that ideally fish stocks should be harvested at maximum sustainable yield (MSY). This means that the stock size is kept at the point of maximum growth rate by harvesting the fish that would normally be added to the population, allowing the stock to continue to be productive indefinitely. Shifter variables will be introduced to simulate countries harvesting fish stocks in a unsustainable manner.

market we feel that these extensions are essential and overcomes a deficiency in current CGE models.

Keywords: fisheries; aquaculture; dynamic CGE; bio-economic modelling