

PRICE AND QUANTITY INDICES FOR AQUACULTURE PRODUCTION IN EUROPE

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ABSTRACT

This paper considers the modelling of aggregate price and quantity of aquaculture production in the European countries since mid-80s. In general, the evolution of aquaculture production only considers the evolution of total value and total weight. The heterogeneity of aquaculture production is neglected. As a consequence, the unit value ('price') of cultured fish seems to be increasing due to the increasing trend towards more valued fish species. The right way to aggregate heterogeneous goods in economics is by using index numbers. In general, it is observed that the quantity indices increase much more than the weight of cultured fish. The trend for price indices is very different between countries, but in the EU-15 as an aggregate is decreasing, contrary to the trend with unit values.

Keywords: European Aquaculture, Quantity Index, Price Index.

INTRODUCTION

This paper considers the modeling of aggregate price and quantity of aquaculture production in France, Greece, Italy and Spain since 1985. In general, the evolution of aquaculture production only considers the evolution of total value and total weight. The heterogeneity of aquaculture production is neglected. As a consequence, the unit value ('price') of cultured fish seems to be increasing sometimes due to the increasing trend towards more valued fish species. The right way to aggregate heterogeneous goods in economics is by using index numbers. Aggregation without consideration of the changing structure of aquaculture production causes biases in the economic valuation of quantity and price evolution.

In this paper, translog price indices and implicit quantity indices are calculated and compared with unit value and weight indices for the different European countries in the period 1985 to 2001. The next section introduces the data used and some technical issues. The analysis for the 6 main aquaculture producers in Europe and the results for other countries are presented are presented in the following sections. The paper ends with some concluding comments summarizing the main results.

DATA AND TECHNICAL ISSUES

Aquaculture production data for the European countries are obtained from EUROSTAT in the NEWCRONOS database Theme 5: 'aqua'. The analysis is performed for the period 1985 to 2001 due to the availability of value data, because in some cases weight data begin in 1950. Quantity of aquaculture production is in tons and value is in euro. There is a potential problem with changing exchange rates of national currencies to euro, but value in national currencies is not available in general. On the other hand, weights and quantities are taken as they appear in the database. There is no attempt to correct errors in the database.

For the 6 main European producers (France, Greece, Italy, Norway, Spain and United Kingdom) the analysis is performed at the species level. If a zero value appear, as an example for a new species, the lowest price found for this species is used as a shadow price in the calculation of the price indices.

The analysis for the remaining countries is based on aggregates: F11 Carps, barbels and other cyprinids; F12 Tilapias and other cichlids; F13 Miscellaneous freshwater fishes; F21 Sturgeons, paddlefishes; F22 River eels; F23 Salmons, trouts, smelts; F31 Flounders, halibuts, soles tons); F32 Cods, hakes, haddocks; F33 Miscellaneous coastal fishes; F36 Tunas, bonitos, billfishes; F39 Marine fishes not identified; F41 Freshwater crustaceans; F45 Shrimps, prawns; F52 Abalones, winkles, conchs; F53 Oysters; F54 Mussels; F55 Scallops, pectens; F56 Clams, cockles, arkshells; F57 Squids, cuttlefishes, octopuses; F58 Miscellaneous marine molluscs and F90 Seaweeds. Obviously, only a few groups are used for each country.

Unit value is defined as total aquaculture production divided by total weight of aquaculture production. A Tonqvist-Divisia or translog price index (Diewert, 1976) is given by the equation:

$$\ln\left(\frac{P_t}{P_{t-1}}\right) = \sum_{i=1}^N \frac{1}{2}(w_{i,t-1} + w_{i,t}) \ln\left(\frac{p_{it}}{p_{i,t-1}}\right) \quad (\text{Eq. 1})$$

where w_{it} is the share of good i in the total value in year t , and p_{it} is the price (or unit-value) for good i in year t . We can observe that if the good is not homogeneous, the use of unit value for this item carries out the same kind of aggregation bias than the aggregation of quantities. This means, in particular, that some kind of aggregation bias remains for the countries not belonging to the 6 main producers.

The quantity index for year t is calculated implicitly as the total value of aquaculture production in year t divided by the price index number in year t , and arbitrarily based in a given year. The choice of base year is irrelevant for the calculation of rates of growth with the translog index because it is chained by definition. we have chosen 1995 as the base year for graphical representation of translog price and implicit translog quantity indices, and unit value and weight indices.

RESULTS FOR 6 MAIN COUNTRIES

In decreasing order of value (millions of euro) in 2001: Norway (1142), United Kingdom (572), Italy (476), France (475), Spain (444) and Greece (345). The following country (Denmark, 167) is less than half of Greece. We use only the reported species in the computation of the price index.

Norway produces 9 species, although more than 99% of production is concentrated in two species: Atlantic salmon (87% in 2001) and rainbow trout (13%). With this extreme specialization, and given that the evolution of prices for trout and salmon is very close, the index problem in this paper is not very important.

The United Kingdom is less specialized than Norway, with 20 species, but the only important difference is the production of mussels. Production is highly concentrated in 3 species, with 98% of share in total value: Atlantic salmon (81% in 2001), rainbow trout (12%) and blue mussels (6%). Again the index number problem is not very important.

We analyze France before Italy, because the evolution of indices is closer, in spite of very different production structure, to the first two countries. Aquaculture production is very diversified in France, with 25 species, the top 11 account for 95% of production: Pacific cupped oyster (47.9%), Rainbow trout (16.0%), Blue mussel (14.8%), European seabass (4.2%), Mediterranean mussel (3.5%), Turbot (1.6%), European flat oyster (1.6%), Sea trout (1.4%), Gilthead seabream (1.2%), Japanese carpet shell (1.2%), Grooved carpet shell (1.2%) and Common carp (1.1%). However, the evolution of the price index is very similar to the behavior of the unit value index. It is worth noting that some typically low price species (mussels) have in France a price considerably higher than in other countries (Italy, Spain), and with a different price evolution.

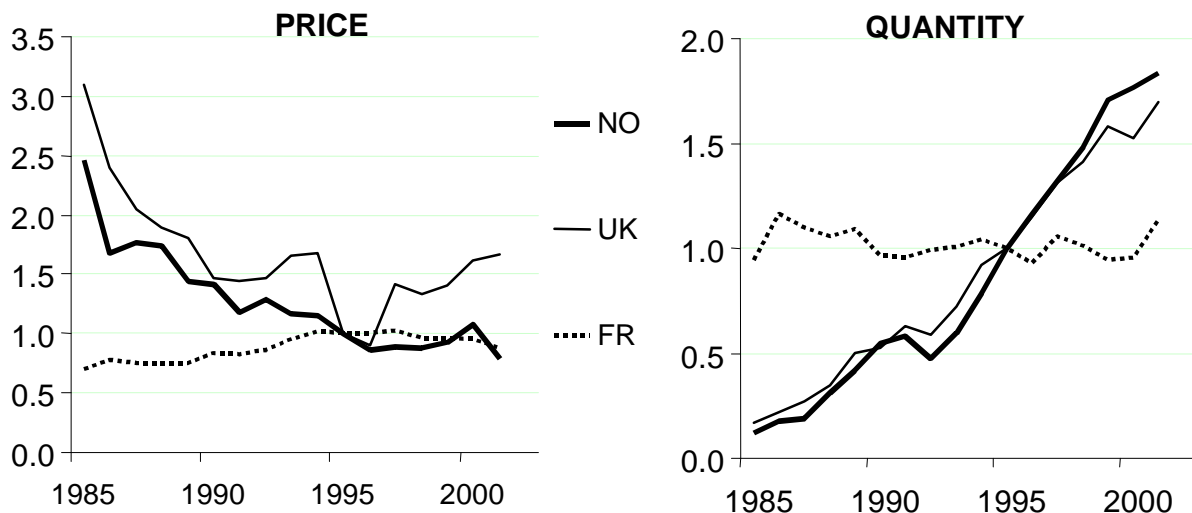


Figure 1. Translog Price index and Implicit Quantity Index for Aquaculture production in Norway, United Kingdom and France

Figure 1 illustrates the evolution of price and quantity for Norway, United Kingdom and France. Unit values and weights are not represented because they are close to price and quantity indices, but not equal. This occurs even for France, in spite of large diversification. France follows very peculiar quantity and price patterns. It is remarkable the quantity growth for Norway and the United Kingdom.

The situation is very different with the three main Mediterranean countries, although we can observe quite different production structures. Aquaculture in Italy is relatively concentrated with 11 species, and the main 6 accounting 95,6% of total value: Japanese carpet shell (26.2%), Rainbow trout (25.9%), Mediterranean mussel (14.8%), European seabass (14.9%), Gilthead seabream (11.9%), and European eel (2.6%).

Spanish aquaculture production is more diversified with 23 species, and the main 8 with a share of 93,7%: Blue mussel (24.1%), Rainbow trout (20.2%), Gilthead seabream (17.7%), Tuna (15.3%), European seabass (8.1%), Turbot (7.4%), Japanese carpet shell (2.1%), European flat oyster (1.9%) In principle, we can think of a situation close to, say, France. However, the introduction of new Mediterranean species has a huge impact in the evolution of quantities and prices.

Greece is a very important case favoring the index number approach due to the impressive growth of a few species, including the most important two. There are 15 cultured `species`, with the first 5 with ashare of 93.8% in 2001: Gilthead seabream (49.8%), European seabass (37.7%), Mediterranean mussel (3.9%), Rainbow trout (1.5%), European eel (0.9%). It is worth noting that a generic `other marine fishes` is 5% of total value in 2001.

Figure 2 shows the evolution of the unit value index and the translog price index for the main Mediterranean countries. Observe that the vertical axis is on the same scale in both pictures.

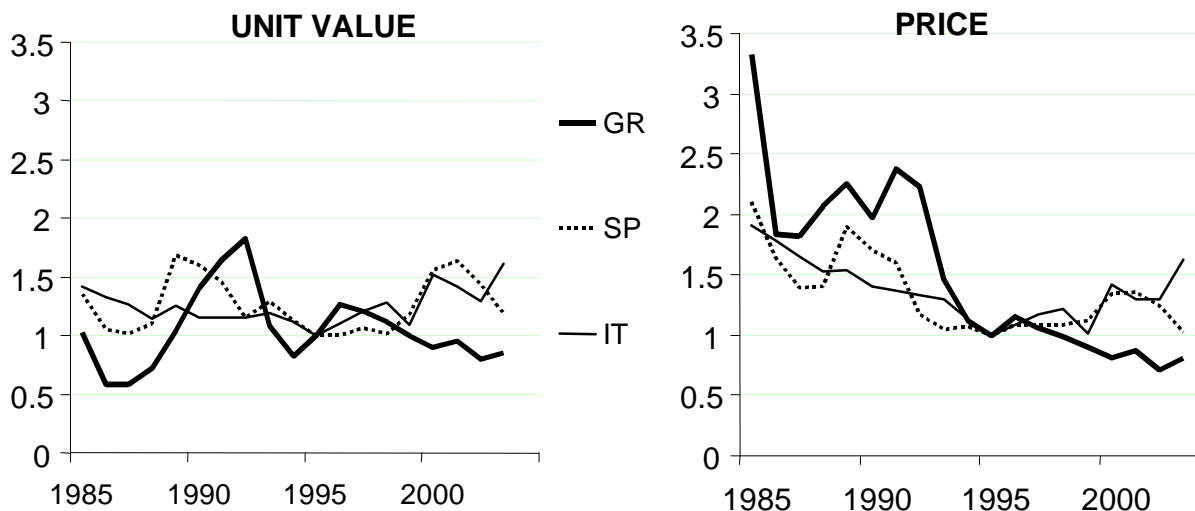


Figure 2. Unit Value Index and Translog Price Index for Aquaculture Production in Greece, Italy and Spain

There are several points to be noted here. The first one is that the price indices decrease a lot, in particular in Greece and in Spain, while unit values do not show a clear trend. A second observation is that price evolution patterns differ between countries, reflecting both the differences in production structures and the dissimilar evolution of prices for the same species in these countries (Millán and Aldaz, 2006).

As a consequence of the price indices evolution with respect to unit values indices, quantity indices increase much more than weight indices. Figure 3 compares the evolution of weights and the quantity indices for cultured seafood in the three main Mediterranean countries.

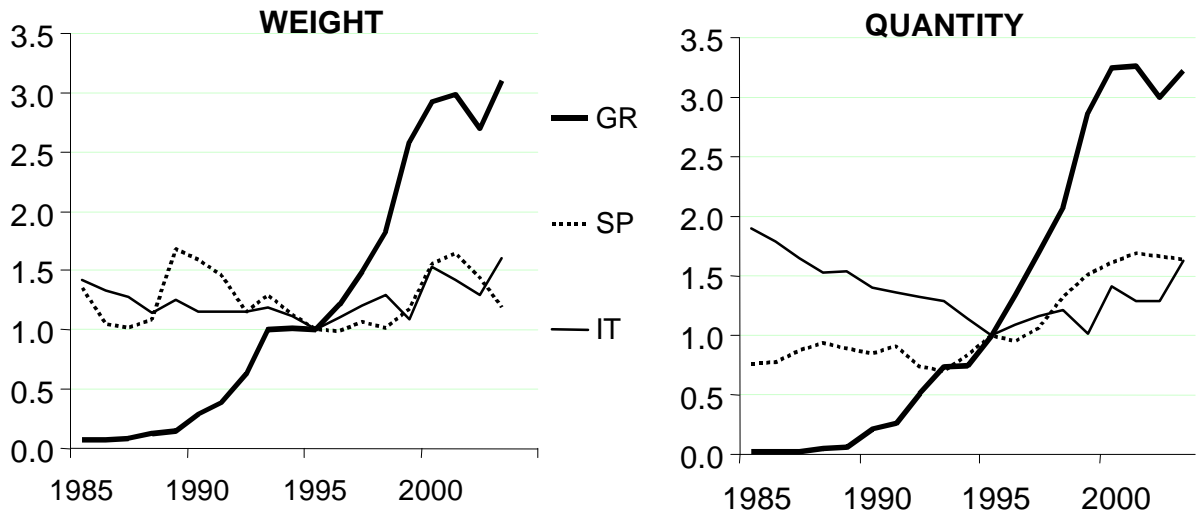


Figure 3. Weight Index and Implicit Quantity Index for Aquaculture Production in Greece, Italy and Spain

GENERAL RESULTS

In this section the results for 33 European countries and for the European Union-15 as an aggregate are presented. Figure 4 shows how European Union-15 follows the general pattern of evolution of price and quantity indices, and unit value and weight indices.

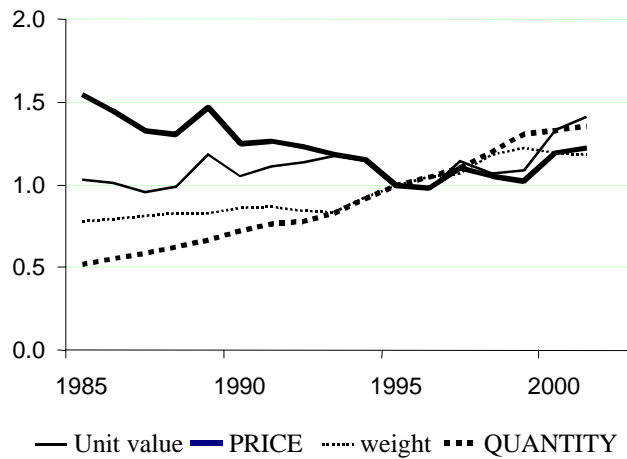


Figure 4. Unit Value and Price indices and Weight and Implicit Quantity Index for Aquaculture Production in European Union-15

The evolution of aquaculture production and prices for the different countries are presented in Table I and Table II. Only the rates of growth concerning the evolution of price and quantity indices, and not of unit values and weights, are presented. The rates of growth for the 6 main countries are included here.

Table I. Aquaculture Production in Europe. Translog Price Indices. Growth Rates.

<i>Country</i>	<i>Total</i>	<i>1985 to 1990</i>	<i>1990 to 1995</i>	<i>1995 to 2001</i>
European Union 15	-1.5	-4.3	-4.4	3.4
Belgium	2.0	3.4	1.3	1.3
Denmark	1.1	-2.1	-3.2	7.2
Germany (total)	0.0	-7.8	2.5	4.5
Greece	-8.2	-10.0	-13.8	-2.2
Spain	-3.9	-3.5	-14.3	4.4
France	0.7	0.5	1.1	0.6
Ireland	-3.8	-7.7	-2.5	-1.6
Italy	-1.5	-5.3	-5.8	5.2
Netherlands	2.1	-11.9	0.9	14.7
Austria	3.3	3.1	-3.6	9.3
Portugal	2.1	0.3	-2.2	7.1
Finland	-4.7	-8.3	-5.0	-1.4
Sweden	-1.3	-4.0	-0.2	0.2
United Kingdom	-2.7	-10.9	-7.1	7.6
Iceland	-3.7	-13.1	-3.9	4.2
Norway	-6.9	-10.1	-7.2	-4.0
Switzerland	2.2	-1.3	7.8	0.5
Bulgaria	-0.6	-6.0	0.6	2.9
Cyprus	-1.4	9.9	-8.2	-5.2
Czech Republic				5.2
Estonia	4.2	-11.7	8.0	6.3
Hungary	4.1	0.4	6.5	5.1
Lithuania	-3.4	-16.4	-9.8	6.2
Latvia	0.6	-3.7	6.2	-2.6
Malta				-15.1
Poland	-2.3	-12.5	6.1	-0.8
Romania	-4.1	-10.2	-1.3	-1.4
Slovenia				0.5
Slovak Republic				3.9
Albania	-2.9	-18.6	4.5	3.9
Croatia				4.0
Macedonia				10.8
Serbia Montenegro				16.4

Table II. Aquaculture Production in Europe. Quantity Indices. Growth Rates.

<i>Country</i>	<i>Total</i>	<i>1985 to 1990</i>	<i>1990 to 1995</i>	<i>1995 to 2001</i>
European Union 15	6.0	6.6	6.5	5.1
Belgium	8.1	9.5	6.7	8.0
Denmark	3.9	11.4	1.4	-0.3
Germany (total)	-0.3	1.8	0.1	-2.5
Greece	31.0	44.1	31.5	19.8
Spain	6.2	1.4	6.8	9.7
France	1.4	3.7	3.0	-1.7
Ireland	16.7	30.0	10.0	11.1
Italy	6.3	8.9	9.7	1.4
Netherlands	-1.2	-1.5	-0.6	-1.3
Austria	-3.2	-5.9	-1.0	-2.8
Portugal	1.3	-8.4	0.7	9.9
Finland	2.7	12.0	-1.4	-1.6
Sweden	4.8	22.6	-5.2	-1.7
United Kingdom	13.2	18.6	12.2	9.6
Iceland	23.7	66.3	4.1	4.6
Norway	16.8	29.4	12.3	10.2
Switzerland	8.9	27.4	1.6	-0.4
Bulgaria	-10.2	-5.6	-11.2	-13.3
Cyprus	23.5	19.1	27.1	24.2
Czech Republic				1.2
Estonia	1.7	34.3	-17.1	6.5
Hungary	-2.1	-0.6	-13.3	6.1
Lithuania	-4.9	10.6	-20.4	2.8
Latvia	-13.9	-14.0	-29.1	-1.2
Malta				5.2
Poland	4.0	6.0	-1.1	6.5
Romania	-8.2	-3.9	-11.3	-9.1
Slovenia				7.4
Slovak Republic				-7.1
Albania	-4.0	24.2	-54.7	14.8
Croatia				18.3
Macedonia				-3.8
Serbia Montenegro				0.5

CONCLUDING COMMENTS

The main idea in this paper is that the usual analysis of the evolution of aquaculture production using value and physical weight (and its ratio: unit value as prices) of culture seafood is not the

best way of describing the evolution of aquaculture in economic terms. The economic solution to the intertemporal comparison of the evolution of aggregate economic activity and aggregate price is by means of quantity and price indices.

In this paper, translog price and implicit quantity indices have been calculated for the aquaculture sector of the European countries. A comparison of the evolution of price versus unit value and quantity versus weight indices can be summarized as follow: In general, price growth is less than unit value growth. Price indices can decrease while aggregate unit values increase due to shifting to more valued species. As a consequence, the growth of economic activity in aquaculture (quantity indices) is larger than the growth in physical weight of cultured seafood. In some cases, the changes are quantitatively very important, as for Greece and Spain.

REFERENCES

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ENDNOTES

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