Review article DOI: /10.5513/JCEA01/19.3.2086
Journal of Central European Agriculture, 2018, 19(3), p.615-628

Production and trade of trout in the EU28
Pisztrángtermelés és kereskedelem az EU28-ban

Laura KARNAI

University of Debrecen, Faculty of Economics and Business, Institute of Applied Economics Sciences, Böszörményi str. 138., 4032 Debrecen, Hungary, correspondence: karnai.laura@econ.unideb.hu

Abstract

Within global meat production, the position of fish and fishery products are becoming more and more important because quarter of world's animal origin protein supply is produced by fisheries and aquaculture. Therefore, the importance of freshwater fish production is also growing at both European and domestic levels. Most determinative quantities of EU-28 production at intensive technological levels are salmon (21.3%), trout (14%) and seabass (13.5%), in the aspect of the value of production trout is almost 15.1%. The goal of this study is to present the status of the trout production at international and EU, paying special attention to the main exporting and importing countries. During the research secondary data collection was carried out, which was based on international and national literatures and statistical databases. Following the evaluation of the sectoral production trends over and above the trade data of the sector, advantages/disadvantages of the trout trade was compared based on the comparative advantages (RCA) method. To calculate the RCA index for the different processed products data was provided by COMTRADE and EUROSTAT International Foreign Trade Databases over the 2012-2015 period. The study examines the production trends and the causative relationships behind the RCA index results in detail.

Keywords: international trade, revealed comparative advantage (RCA), trout production

Összefoglaló

A globális hústermelésen belül a hal- és halászati termékek szerepe egyre inkább felértékelődik, hiszen a világ állati eredetű fehérjeellátásának mintegy negyedét a halászat és az akvakultúra állítja elő. Napjainkban az édesvízi haltermelés egyre nagyobb szerepet kap, mind európai Uniós, mind hazai szinten egyaránt. Az EU-28 intenzív technológiai színvonal melletti termelésében meghatározó a lazacfélék (21,3%), a pisztrángfélék (14%) és az aranydurbincs (13,5%) mennyisége, értékben a pisztráng közel 15,1%-ot tesz ki. A tanulmány célja a pisztráng termelés és kereskedelem nemzetközi, valamint EU-s helyzetének bemutatása, különös figyelmet fordítva a főbb exportáló és importáló országokra. A kutatás során szekunder

DOI: /10.5513/JCEA01/19.3.2086

adatgyűjtést végeztem, melynek alapját nemzetközi és hazai szakirodalmak, valamint statisztikai adatbázisok szolgáltatták. Az ágazati termelési tendenciák, valamint az ágazat kereskedelmi adatainak értékelését követően vizsgáltam a pisztráng külkereskedelme alapján megjelenő komparatív előnyöket/hátrányokat a megnyilvánuló komparatív előnyök (RCA) módszer alkalmazásával. Az RCA-index számításához felhasznált adatokat a COMTRADE és az EUROSTAT nemzetközi külkereskedelmi adatbázisok szolgáltatták a különböző feldolgozottságú termékekre vonatkoztatva 2010-2015-ös időszakra visszamenőleg. A tanulmány részletesen vizsgálja a termelési tendenciákat, valamint az RCA index eredmények mögött álló ok-okozati összefüggéseket.

Kulcsszavak: megnyilvánuló komparatív előny (RCA), nemzetközi kereskedelem, pisztrángtermelés

Introduction

The possession of natural resources and the provision of foods are becoming increasingly important due to globalisation and the increasing population which is expected to reach 9 billion people by 2050, according to forecasts (Pimentel and Pimentel, 2006). Currently, the most significant challenge is to provide the necessary quantity of proper quality food to the world's population. For this reason, foods produced using sustainable methods, including meat production, are becoming increasingly important (Pimentel and Pimentel, 2006; Food and Agriculture Organization, FAO, 2016). According to the forecast of Organisation for Economic Co-operation and Development, OECD – FAO (2015), meat production in the world may reach 520 million tons per year by 2023, consisting of 360 million tons of non-fish meat and 160 million tons of fish meat. This forecast represents around 12.5% increase compared to the 2015 value. This overall increase will be provided mainly by the growth of the poultry sector, as well as fishery and aquaculture. According to the research of Horn (2009), it can be concluded that around one quarter of the world's protein supply of animal origin is provided by the various species of fish, crustaceans and molluscs originating from fish farming which have been an important part of human nourishment for decades. As regards fishery and aquaculture, sustainability is mainly due to the expansion of the aquaculture sector, since the constantly growing demand calls for a relatively stable supply which cannot be achieved with fishery. Aquaculture is one of the most rapidly growing animal origin food supply branches of the world's food economy, as this sector provides the highest amount of production within the fishery sector (FAO, 2016).

Based on the most recent FAO (2017) data, the global fish and fisheries production was more than 199 million tons in 2015, involving fish, crustaceans, molluscs and the aquaculture production of aquatic plants. This value, which involves both the production of fisheries (marine and inland waterway) and aquaculture, has increased by around 3.3% since last year. The reason for this increase is mainly due to the increase of the aquaculture sector's production in addition to the stagnation of the fishery sector. During the past years, this tendency became even more pronounced than expected. Examining the production/fishing of fish with the highest output value within the total output and excluding all other products, it can be concluded that the

DOI: /10.5513/JCEA01/19.3.2086

amount of global fish production/fishery was 129.9 million tons in 2015, which involves the production of aquaculture and fishery together (Table 1).

Table 1. Development of fisheries and aquaculture fish production

	2010	2011	2012	2013	2014	2015	2010-2015 Growth rates (%)
Fisheries/Capture (million tons)							
World	74.7	78.7	75.7	76.6	76	78	4.4
China	11.1	11.4	11.6	11.6	12.1	12.4	2.5
European Union-28	4.9	4.6	4.1	4.4	4.9	4.8	-1.6
Aquaculture (million tons)							
World	38.5	40.7	44.5	47.3	49.7	51.9	34.8
China	21.5	22.9	24.4	25.9	27.2	28.8	5.9
European Union-28	0.7	0.6	0.6	0.7	0.7	0.7	1.5
Total (million tons)							
World	113.2	119.4	120.2	123.9	125.7	129.9	14.8
China	32.6	34.3	36	37.5	39.3	41.2	4.8
European Union-28	5.5	5.2	4.7	5.07	5.5	5.5	-1.3

Source: FAO (2017).

Of this value, 51.9 million tons result from production under intensive technological circumstances, while the remaining 78 million tons result from fisheries. Compared to the base year of 2010, fish production increased by 14.8% by 2015, of which the share of fisheries is 4.4%, while that of aquaculture is 34.8% on a world scale, mainly due to China's increase in production. On the contrary, in the European Union (EU-28), the production of fisheries decreased by 1.6%, while intensive technology increased by 1.5% (FAO, 2017).

China can be considered the leading country of fishery and aquaculture (31.7% of total production), followed by the fish production of Indonesia, Peru, the USA and the European Union in 2015. Despite the fact that only 3.2% of the global production originates from the 28 Member States of the European Union, the EU-28 is still the 5th biggest producer of fish and fishery products. The production of the EU Member States, involving the production of aquatic animals and plants (aquaculture and captures) was 6.7 million tons in 2015, showing a 1.3% decrease compared to the previous year. In the EU, the overwhelming majority of fisheries and aquaculture production consists of fish species, followed by molluscs (shellfish) and crustaceans. The fish production of the EU-28 is 5.5 million tons, which is 80.6% of the total fish and fishery production (which includes the production of fish, crustaceans, molluscs and the aquaculture production of aquatic plants). The EU production is 1.27% of the global aquaculture production in terms of quantity and 3.4% in terms of value, but this share is constantly growing (Failler, 2007). Spain, the UK, France, Italy and Greece are the five biggest aquaculture production countries (TOP-5). Their common production represents 70.2% of the total output. 43.6% of the aquaculture production of the EU-28 is represented by molluscs and crustaceans, 34.6% by saltwater fish

DOI: /10.5513/JCEA01/19.3.2086

(including salmon and trout raised in seawater) and 21.8% by freshwater fish (including salmon and trout raised in freshwater) (FAO, 2017).

In 2015, the TOP-5 countries producing the highest amount of fishery products (saltwater and seawater) in the EU were Spain, the UK, Denmark, France and the Netherlands. These countries (TOP-5) provide more than 62.6% of the total fishery captures of the EU. Herring, mackerel, sardine, horse mackerel and cod are among the most preferred species. Due to the capturing restrictions (fishing quotas), the EU supply can only be maintained with increasing aquaculture production in the near future if the volume of fishery decreases or stagnates. It is the goal of the Common Fisheries Policy (CFP) of the EU to make fisheries and aquaculture sustainable from the environmental protection, economic and social aspects, as well as to provide fishery food products to EU citizens. Furthermore, it is the aim of CFP to provide the dynamic development of the fishing industry and proper subsistence to those making a living from fisheries, while supporting sustainable development in the fisheries sector. According to the current policy, it is necessary to introduce catch limitations between 2014-2020 which guarantee the sustainability of fisheries and the subsistence of fish populations, while providing subsidisation to support the development of aquaculture (European Commission, 2016).

Due to the favourable hydrographic endowments of Hungary, it has been a key player in the extensive aquaculture production (carp-based) of Europe for decades. The national economic weight of the fish production sector (share within the gross production value) is not significant within the whole agricultural sector, since its proportion was 1.5% in the animal husbandry sector in 2015. The amount of fish production for human consumption is around 25.7 million EUR per year, while the amount of fish production for other purposes is 42.7 million EUR per year. As a result, fish production for human consumption within the fisheries sector contributed to the national GDP only to a slight extent (by 0.003%) in 2015. There are no other fish and fisheries products involved in the Hungarian fish meat production, other than finfish itself. All other products appearing on the consumption side (such as shellfish, squids and crustaceans) are imported. Hungarian fish production is focused on pond production and only 15.8% is produced under intensive large-scale circumstances. However, fish management in intensive systems is becoming increasingly preferred in addition to pond production, which is also shown by the fact that the amount of intensive large-scale fish production for human consumption purposes increased by 30.8% in 2015, compared to the previous year. In 2015, the total Hungarian fish production was 23.5 thousand tons, 72.4% (17.3 thousand tons) was produced for human consumption purposes which is a 12.8% increase compared to 2014. Similarly to the past years, carp was the dominant fish species of Hungarian fish production, originating from pond production. On the contrary, fish produced in aquaculture are primarily African catfish and trout (Agrárgazdasági Kutató Intézet, AKI, 2016; FAO, 2017).

Brown trout, brook trout, arctic charr, rainbow trout, marble trout and other trout types belong to the family Salmonidae. In the EU-28, trout is the most commonly produced fish species in intensive conditions, reaching a yearly amount of 187.8 thousand tons. Rainbow trout is the most widespread species, having a 27.9% share of the aquaculture fish production of the whole EU-28 (Hoitsy, 2002). On the contrary the

trout production has only 1.5% share of the world's total aquaculture production, reaching 784 thousand tons in 2015 (European Commission, 2017; FAO, 2017).

Within 28 EU Member States, 26 countries (except for Luxembourg and Malta) perform trout production/fishing, with the leading countries being France (36.5 thousand tons), Denmark (32.5 thousand tons) and Italy (32 thousand tons). These TOP3 countries provided 53.8% of the total EU trout production in 2015. The yearly trout production/fishery of Hungary is 61 tons, 42 tons of which are produced for human consumption purposes. With this yearly amount of production, Hungary is only ahead of Cyprus in the cumulated rank of trout production (AKI, 2017; European Commission, 2017; FAO, 2017). In 2014, trout production for human consumption was 61 tons per year, but it significantly decreased by 2015 by 31.1% (Gábor et al., 2016). Despite the fact that there are indigenous trout species in Hungary, it still cannot be considered a trout superpower in international comparison, even though it is a species looked after also on the international market and acknowledged by restaurants, as opposed to carp, the most commonly consumed fish in Hungary. The primary reason why the number of fish produced in Hungary is well below the amounts produced in other Member States of the European Union is that trout needs clean water rich in oxygen and colder than 20 oC both during the winter and summer, as they easily perish in waters which are permanently warmer. Mountain streams with significant water flow can provide these circumstances. For this reason, it is by no surprise that Denmark, Italy, Germany, France and Austria are among the main trout producer countries. In Hungary, trout farming is carried out on five farms in cold water flow-through systems and recirculation systems based on surface water flow. The biggest Hungarian trout farm is in Lillafüred. Recently the production in Lillafüred is over 60 tons in 2016, which volume increase by 50% from 2015 to 2016, due to a novel technology using water purification and recycling (Hancz et al., 2000; Hoitsy and Hoitsy, 2016).

The aim of this study is to present the international conditions of trout production, with special focus on that of the European Union. Accordingly, it was a key objective to examine the comparative advantages or disadvantages of trout farming in the largest trout exporting countries of the Member States of the European Union.

Material and methods

Secondary data collection was performed to achieve the objectives of this study. The reviewed international and Hungarian technical literature sources and the statistical databases describing the situation of the sector provided a proper basis for evaluation. The collected and processed data primarily referred to the production of fish and fishery products, the trade of fish products, as well as the export and import of trout, mainly within the European Union. The sector's position in the international dimension was identified with the help of the databases of the International Trade Statistics Database (COMTRADE), the Food and Agriculture Organization of the United Nations (FAO) and the Statistical Office of the European Communities (EUROSTAT). Following the collection of relevant data from these databases, evaluations were prepared for 2015. Hungarian market conditions were presented using previously published papers of Hungarian experts, as well as the analysis of databases of the Hungarian Central Statistical Office (HCSO) and the Research

Institute of Agricultural Economics. The performed evaluation compares the trout trade of Denmark, Romania and Hungary to the EU-28 related to the period between 2012 and 2015, in which EU values were retrospectively determined by adjusting them to all 28 Member States. As regards the EU, this method is appropriate because trout farming is present in all Member States with the exception of two countries. The trade (export and import) data of the main products in the sector (in the case of different levels of processing) were accessed in the currently used Combined Nomenclature. Within the main group of fish (3), detailed product-level data of trout can be accessed under “030191” (live trout), “030211” (fresh or chilled trout), “030314” (frozen trout), “030442” (trout fillet), “030452” (fresh or chilled trout - other), “030482” (frozen trout fillet from other fish), and “030543” (trout salted, dried or preserved in brine, smoked).

In order to reach the objective of this study, the revealed comparative advantage (RCA) model was used to measure revealed comparative advantages or disadvantages, which identifies the international specialisation of the examined countries. This index is primarily used to compare regions or countries based on trade data and it is generally used for certain products or groups of products. As a result, it is possible to analyse both international demand and supply at the same time (Ballance et al., 1987; Fertő, 2003).

Table 2. Revealed comparative advantage method indicators

Description	Algorithm
B – index (the original index)	$B_{ij} = \left(\frac{X_{ij}}{Xit}\right) / \left(\frac{X_{nj}}{X_{nt}}\right)$ where, x = export, i = a given country, j = a specific product, t = a group of products and, n = a given groups of countries
Relative trade advantage (RTA)	$RTA_{ij} = RXA_{ij} - RMA_{ij}$ where, $RXA_{ij} = B_{ij}$, $RMA_{ij} = \left(\frac{m_{ij}}{m_{it}}\right) / \left(\frac{m_{nj}}{m_{nt}}\right)$ and m = import
Logarithm of relative export advantage	$lnRXA$
Revealed competitiveness (RC)	$RC_{ij} = lnRXA_{ij} - lnRMA_{ij}$

Source: own construction based on the data of De Benedictis and Tamberi (2001), Fertő and Hubbard, (2001), Fertő and Hubbard (2003).

This method consists of four indexes, as shown in Table 2. The original index was developed by Balassa (1965), which became one of the significant members of the system. This method is based on observed trade, i.e., it compares the proportion of a given product to its share in the trade of a given country or group of countries in relation to the whole range of product export. Comparative advantage is realised if index B>1, otherwise there is a disadvantage (Fertő, 2006). The Balassa index is

criticised for several reasons, i.e., the index does not include various state interventions and trade restrictions, which distort the trade structure. Further problems arise from the fact that the obtained results range from 1 to infinite in the case of comparative advantages, while they are between 0 and 1 in the case of disadvantages, which leads to the overestimation of the given sector's relative weight. In order to overcome this latter problem, Hinloopen and Van Marrewijk (2001) grouped revealed comparative advantages/disadvantages into four categories (category "A" $0<B\leq1$ comparative disadvantage, category "B" $1<B\leq2$ weak, category "C" $2<B\leq4$ average, and category "D" $4<B$ strong comparative advantage). Hillman (1980), Bowen (1983) and Vollrath (1991) criticised this method, stating that the B index is not suitable for measuring the comparative advantages/disadvantages of groups of products altogether, but the introduction of various specifications would make it appropriate for the analysis of international competitiveness. Vollrath (1991) suggested the introduction of three other indexes (relative trade advantage, the logarithm of relative export advantage and relative competitiveness) in addition to the primary index, thereby making the RCA method complete as it is accepted in science.

The RTA index also involves the effects of demand in addition to supply; therefore, it is the import side counterpart of the primary index, since it is defined as the difference between the relative export advantage (RXA) and the relative import advantage (RMA). If the obtained value is positive, i.e., RTA>0, then the given country has comparative advantage in relation to the group of countries concerning the examined product and comparative disadvantage in the case of a negative value (Fertő, 2006). Further indexes include lnRXA and RC (which is the difference of the logarithm of relative export advantage and the logarithm of relative import advantage), which show competitive advantage in the case of positive results and competitive disadvantage in the case of negative results. The advantage of the latter index is that it includes the (export and import side) distortions to be observed in trade, while it is able to manage intersectoral trade. This feature can also be considered a negative aspect, as if there is no imported quantity, the index itself cannot be interpreted both (Fertő and Hubbard, 2003).

This study compares the main group of trout (involving live fish and trout products processed for other nourishment purposes) to each subgroup in Hungary, Romania and Denmark compared to the whole EU-28 trade, using the whole system of indexes. The selection aspect of the examined countries was to perform quantitative examination and substantiation of the competitive advantages or disadvantages of the main competitors. The calculations related to the aim of the study were determined in the case of all meat products in the trout sector for the period between 2012-2015.

Results and discussion

Based on FAO (2017) data, the increase of production also resulted in the increase of trade in the sector. In recent years, the global fisheries and aquaculture sector became the segment of the food industry with the largest turnover with a share of 50.4% for fish and fisheries products, 19.9% for beef, 15.2% for pork and 14.5% for poultry meat of all products of animal origin. In 2015, more than 200 countries

exported and imported fish and fisheries products and other products prepared from them. Around 36% of the so-called “food” and “non-food” fish and fisheries products are included in international trade at a value of nearly 133.9 billion EUR. Of this amount, around 16.4 billion EUR worth of fish and fisheries products of “food” category was marketed, of which 67.7% result from the trade of fish, 21.7% from crustaceans, 9.8% from molluscs and 0.8% from other aquatic animals (FAO, 2016). Globally, the main exporting countries are China, Norway and Vietnam, while the main importers are the USA, Japan and China (FAO, 2016; 2017).

As regards quantity, the European Union has a slight share from the global trade, but it is still considered to be a leading trade actor of fisheries and aquaculture products globally from the value aspect, since the specific selling prices are higher. In the past few years, EU trade increased dynamically (both import and export) and reached 54 billion EUR in 2015. The European Union is the net importer of – mainly frozen and prepared – fisheries and aquaculture products. If the aquaculture products produced in the EU are sold on the European market, the EU export consists almost exclusively of fisheries products from captures; therefore, the level of self-sufficiency is below 100% and the produced amount covers around two thirds of consumption (PCP, 2016). Trade towards third countries outside the EU and trade within the EU can be distinguished. In 2015, the value of EU export towards third countries increased to 4.4 billion EUR. Of the Member States, Spain, the UK, Denmark and the Netherlands export the largest amounts to third countries. The main buyers include the USA, Norway (non-saltwater fish), Switzerland, China, Nigeria, Japan and Russia. 12% of all exported products are sold to the USA and nearly 11% to Norway (European Commission, 2017). The value of import from outside the EU is 21.7 billion EUR, which is coming primarily from Norway, China and Ecuador, although Morocco, Vietnam and the USA also carry out significant export activities to the EU. Norway is the largest supplier to the EU as 23% of the total import originates from this country (in terms of quantity), mainly as saltwater fish. In addition, 20% of the whole import quantity comes from Asia. A significant part of imported products is delivered in frozen, fresh and chilled form, but the proportions of canned products and convenience foods are also worth mentioning (PCP, 2016). Of the different Member States, Spain imported the largest quantity, reaching more than 1.5 million tons per year, which is 14% of the whole imported quantity of all Member States. The value of trade within the EU was 28 billion EUR, of which 15.1 billion EUR was exported and 12.9 billion EUR was imported. Of the different EU Member States, Sweden, Denmark, the Netherlands and Spain export the largest amount of products to other Member States, while the biggest importers are France, Germany, Italy and Spain (European Commission, 2017). As a conclusion, the EU is the most important market of fisheries products around the world and this market is in constant growth. Currently, the EU is a net importer and its annual deficit (3.5 million tons per year) is slightly, but constantly increasing and it has one of the highest general price levels on the market of fisheries products. Import-focused trade is the result of the low quantity of production in comparison with demand. One of the possible reasons is that the fish production of the world is different in each continent; therefore, Asian countries capture/produce different species in larger quantities in comparison with the EU production and the EU needs to import these products due to the demand for them. It can also be observed within the EU that the trade of fish and fisheries products

DOI: /10.5513/JCEA01/19.3.2086

differs in each Member State. Significant differences can be seen in also in the case of other fish products in addition to trout.

According to the tendency of the recent years, the fish export and import of Hungary increased in 2015, both in terms of quantity and value. The foreign trade of Hungary was 111 million EUR in the given year due to the 12% export increase and 15% import increase compared to 2014. The target countries of Hungary's fish export are mostly the Member States of the European Union (Austria, Germany, Romania, Poland, the Czech Republic) (Gábor et al., 2016). A significant part of the Hungarian export revenue consists of live fish (common carp, silver carp, catfish), as well as sales in fresh, chilled or frozen form. As regards import, canned fish products, caviar and fish fillet represent the largest share (Magyar Akvakultúra és Halászati Szakmaközi Szervezet, MAHAL, 2016) (Table 3).

Table 3. Trout's product trade (2015)

		Hungary (euro)	Romania (euro)	Denmark (euro)	European Union-28 (euro)
Export	Live trout	-	-	20 977 631	70 212 654
	Fresh or chilled trout	11 080	712 326	21 164 481	98 284 045
	Frozen trout	59 360	63 453	14 190 757	38 544 206
	Fresh or chilled fillets of trout	1 340	402	1 247 629	17 735 497
	Fresh or chilled meat	-	71 288	128 520	4 502 172
	Frozen fillets of pacific trout	21 496	378	1 831 381	12 812 781
	Fish smoked, whether or not cooked before or during smoking trout / Smoked trout of salted, dried or preserved in brine	535	4 958	36 796 766	120 320 074
	Trout total	93 811	852 806	96 337 166	362 411 429
Import	Live trout	418 949	52 743	392 373	51 795 125
	Fresh or chilled trout	829 340	6 766 107	452 037	105 749 669
	Frozen trout	330 269	893 490	555 720	34 134 487
	Fresh or chilled fillets of trout	5 835	99 405	1 605 980	28 922 130
	Fresh or chilled meat	-	6 914	154	3 587 361
	Frozen fillets of pacific trout	182 010	120 722	290 372	22 119 273
	Fish smoked, whether or not cooked before or during smoking trout / Smoked trout of salted, dried or preserved in brine	419 168	309 270	810 282	108 761 597
	Trout total	2 185 572	8 248 652	4 106 917	355 069 642

Source: COMTRADE (2017), European Commission (2017).

In 2015, the amount exported fish products in the EU was 15.1 billion EUR and the amount imported products was 12.9 billion EUR. Of this value, the trade of trout products had a nearly identical ratio of around 717 million EUR of foreign trade at the end of the examined year. As for the EU trade, it can be observed that the export activity is mainly (33.1%) significant in the case of processed smoked products, as well as fresh or frozen products. As regards import, the largest turnover is realised with the same groups of products. The previously mentioned two groups of products represent 60.4% of the whole imported quantity.

In accordance with the objectives of this study, of the different EU Member States, Denmark was selected in addition to Hungary as one of the biggest traders of trout products within the European Union. Also, Romania was selected as one of the main competitors of Hungary due to their geographical location and production processes. It is important to note that the data of the three analysed countries include the re-export and re-import values in addition to import and export, since processed products also have a significant share of trout products. The quantity of processed products is well above production/breeding limits. As regards the trout trade of the three analysed countries, it can be concluded that Romania and Hungary are import-focused in relation to trout products. In the case of Hungary, despite the small amount of trout breeding, 93.8 thousand EUR worth of export is realised, 63.3% of which originated from the sales of frozen trout in 2015. On the contrary, the value of Hungarian import is 2.2 million EUR, the overwhelming majority of which comes from the trade of fresh or chilled products. Romania has a much larger trade share of trout products between Member States, since its export amounted to 0.9 million EUR and its import amounted to 8.2 million EUR in 2015; therefore, its foreign trade can be considered significant. It can be observed that the biggest value in Romania is realised in relation to fresh or chilled trout both in relation to export and import. However, the value of import is nearly 9.5 times as high as that of export in this product category. Denmark is the second main exporter within the EU and it produced 96.3 million EUR export revenue in 2015, which came from the sales of trout salted, dried or preserved in brine and smoked trout (38.2%), fresh or chilled trout (21.9%) and live fish (21.7%). In addition, the value of import is 4.1 million EUR in Denmark, 39% of which comes from trout fillet (COMTRADE, 2017).

Table 4 summarises the comparative advantages or disadvantages explored at the different levels of trout processing, showing the statistics of the four RCA indexes (based on mean and standard deviation) between Hungary, Romania and Denmark and the EU-28 between 2012-2015. B values above 1 represent comparative export advantage, while those below 1 show export disadvantage. The positive value of the other indexes (RTA, lnRXA and RC) show competitive advantage, while their negative values show competitive disadvantage.

Based on the obtained results, it can be concluded that Hungary has comparative export advantage in relation to frozen trout, frozen trout fillet and frozen fillet from other types of fish. Based on the B index, Hungary has strong comparative advantage (B>4) concerning frozen products and frozen fillet from other types of fish, while there is an average export advantage in relation to trout fillet. As regards trout fillet, the standard deviation is high in the examined period, which is caused by the big difference between years in terms of value. The reason for this finding is that the share of these products within the whole trout export is relatively high. The situation

DOI: /10.5513/JCEA01/19.3.2086

of Hungary is also weakened by the fact that there was a decline in the export of trout products from 2014 to 2015, in addition to the increase of import activity.

Table 4. Revealed comparative advantage or disadvantage of Hungarian trade of each country regarding their trade of trout products in the EU-28 (based on means between 2012-2015)

	Revealed comparative advantage, in case on	Mean 2012-2015				Standard deviation 2012-2015			
		B	RTA	lnRXA	RC	B	RTA	lnRXA	RC
		>1	>0	>0	>0				
Hungary	Live trout	0	-1.9	-	-	0	0.5	-	-
	Fresh or chilled trout	0.7	-0.3	-0.3	-0.2	0.6	1.2	0.3	0.7
	Frozen trout	4.8	2.6	0.7	0.4	1.3	2.9	0.1	0.4
	Fresh or chilled fillets of trout	2.2	1.9	0.1	0.9	2.2	2.1	0.5	0.2
	Fresh or chilled meat	0	-0.1	-	-	0	0.1	-	-
	Frozen fillets of pacific trout	4	3	0.6	0.6	1.9	1.9	0.2	0.3
	Fish smoked, whether or not cooked before or during smoking trout / Smoked trout of salted, dried or preserved in brine	0	-0.4	-1.7	-1.2	0	0.2	0.2	0.3
Romania	Live trout	0	-0.1	-	-	0	0.1	-	-
	Fresh or chilled trout	0.8	-0.1	0.4	-0.1	0.8	0.7	0.2	0.2
	Frozen trout	1.6	0.9	-0.1	0.2	2.3	2.3	0.6	0.6
	Fresh or chilled fillets of trout	0.6	0.5	-0.9	-0.2	0.9	0.9	1.2	1.3
	Fresh or chilled meat	3.6	3.3	-	-	4.1	4.4	-	-
	Frozen fillets of pacific trout	0	-0.3	-	-	0.1	0.1	-	-
	Fish smoked, whether or not cooked before or during smoking trout / Smoked trout of salted, dried or preserved in brine	0	-0.1	-	-	0	0.1	-	-
Denmark	Live trout	1.4	1.1	0.1	-	0.2	0.5	0.1	-
	Fresh or chilled trout	0.8	-0.1	-0.1	-0	0	0.4	0	0.2
	Frozen trout	1.3	0	0.1	0.1	0.1	0.7	0	0.4
	Fresh or chilled fillets of trout	0.3	-2.4	-0.6	-0.9	0.1	1.5	0.1	0.3
	Fresh or chilled meat	0.1	0.6	-0.9	0.4	0.1	0.1	0.3	0.8
	Frozen fillets of pacific trout	0.5	-2.5	-0.3	-0.6	0.1	2.7	0.1	0.4
	Fish smoked, whether or not cooked before or during smoking trout / Smoked trout of salted, dried or preserved in brine	1.1	0.4	0	0.3	0.1	0.5	0	0.4

Note: The reason for the non-computable data in the table is that the logarithm of 0 cannot be interpreted so that mean and standard values cannot be realised if the above-mentioned problem is already present in a given year.

Source: own calculation based on COMTRADE (2017), European Commission (2017).

In the case of Romania, based on the obtained results, it can be concluded that they have no comparative advantage in comparison with the EU-28 in relation to either product. The obtained values do not show any significant competitive disadvantage and the reason why no advantage can be realised in the case of “other trout fresh or chilled” is only the adverse results of 2012, even though results are constantly improving from year to year. This tendency is also properly shown by the high value of mean absolute deviation (B=4.1; RTA=4.4).

Denmark is one of the biggest exporters of the EU-28. Based on the results from the RCA index, Denmark has comparative advantage based on all four indexes in relation to live trout, as well as frozen and smoked products, while it has significant competitive disadvantage concerning fillet (RTA=-2.4). Based on the low relative standard deviation values, it can be concluded that there were no significant fluctuations from one year to another in the trade of Denmark, which shows stable foreign trade.

Conclusions

As regards quantity, the European Union has a slight share from the global trade, but it is still considered to be the leading trade actor of fisheries and aquaculture products globally. Trout is the most commonly fished/bred species and dynamic growth can be observed in its foreign trade. Based on the trade within the EU-28, Denmark is considered to be the main exporter, followed by Romania and Hungary. On the basis of the four RCA indexes focusing on the period between 2012-2015, it can be observed that Hungary and Denmark has comparative advantage of frozen products in comparison with the EU-28, while there is a disadvantage concerning the other trout products of various levels of processing.

Based on market circumstances and consumer habits, it can be concluded that the market share of trout products is constantly increasing. Due to the natural endowments of Hungary, there is a lower possibility to increase live fish export; therefore, the opportunity of more significant competitive advantage lies in processed products, since Hungarian processed trout products generally have great results at international competitions.

References

AKI (2016) Agrárgazdasági Figyelő. Budapest: Agrárgazdasági Kutató Intézet, 8 (3), 1-32.

Balassa, B. (1965) Trade liberalization and „revealed” comparative advantage. The Manchester School, 33 (1), 99-123. DOI: https://doi.org/10.1111/j.1467-9957.1965.tb00050.x

Ballance, R. H., Forstner, H., Murray, T. (1987) Consistency tests of alternative measures of comparative advantage. Review of Economics and Statistics, 69 (2), 157–161.

Bowen, H. P. (1983) On the theoretical interpretation of indices of trade intensity and revealed comparative advantage. Weltwirtschaftliches Archiv, 119 (3), 464–472. DOI: https://doi.org/10.1007/BF02706520

COMTRADE (2017) UN Comtrade Database. Available at: http://comtrade.un.org [Accessed 3 March 2018].

De Benedictis, L., Tamberi, M. (2001) A note on the Balassa Index of Revealed Comparative Advantage. Paper provided by Universita' Politecnica delle Marche, Dipartimento di Scienze Economiche e Sociali in its series Working Papers with number 158 (37), 3-7. Available at: https://ideas.repec.org/p/anc/wpaper/158.html#author-abstract [Accessed 10 October 2017].

European Commission (2016) Facts and figures on the Common Fisheries Policy. Luxembourg: Publications Office of the European Union. ISSN: 1977 3609.

European Commission (2017) Eurostat database of national trade. [online] Brussels: European Commission. Available at: http://epp.eurostat.ec.europa.eu/newxtweb/loadpage.do [Accessed 4 March 2018].

Failler, P. (2007) Future prospects for fish and fishery products. 4. Fish consumption in the European Union in 2015 and 2030. Part 1. European overview. FAO Fisheries Circular. No. 972/4, Part 1. [online] Rome: Food and Agriculture Organization of the United Nations. Available at: http://www.fao.org/docrep/010/ah947e/ah947e00.HTM [Accessed 15 October 2017].

Food and Agriculture Organization of the United Nations (FAO) (2016) Climate change implications for Fisheries and Aquaculture. Summary of the findings of the Intergovernmental Panel on Climate Change Fifth Assessment Report. [online] Rome: Food and Agriculture Organization of the United Nations. Available at: www.fao.org/3/a-i5707e.pdf [Accessed 15 October 2017].

Food and Agriculture Organization of the United Nations (FAO) (2017) Fish and Aquaculture Department Statistics. [online] Food and Agriculture Organization of the United Nations. Available at: http://www.fao.org/fishery/statistics/en [Accessed 10 March 2018].

Fertő, I. (2003) A komparatív előnyök mérése. Statisztikai Szemle, 81 (4), 309-327.

Fertő, I. (2006) Az agrárkereskedelem átalakulása Magyarországon és a Kelet-Közép-Európai országokban. Budapest: MTA Közgazdaságtudományi Intézet.

Fertő, I., Hubbard, L. J. (2001) Versenyképesség és komparatív előnyök a magyar mezőgazdaságban. Közgazdasági Szemle, 48 (1), 31–43.

Fertő, I., Hubbard, L. J. (2003) Revealed comparative advantage and competitiveness in Hungarian agri–food sectors. The World Economy, 26 (2), 247-259. DOI: https://doi.org/10.1111/1467-9701.00520

Gábor, J., Udvari, Zs., Lengyel, P., Kiss, G., Bojtárné, L. M. (2016) Magyarország tógazdasági és intenzív üzemi haltermelése 2015-ben. Available at: www.halaszat.kormany.hu [Accessed 15 November 2017].

Hancz, Cs., Horváth, L., Kiss, I., Mézes, M., Orbán, L., Ördög, V., Szabó, T., Szűcs, I., Urbányi, B., Váradi, L. (2000) Halbiológia és haltenyésztés. Budapest: Mezőgazda Kiadó.

Hillman, A. L. (1980) Observation on the relation between 'revealed comparative advantage' and comparative advantage as indicated by pre-trade relative prices. Review of World Economics, 116 (2), 315-321. DOI: http://dx.doi.org/10.1007/BF02696859

Hinloopen, J., Van Marrewijk, C. (2001) On the Empirical Distribution of the Balassa Index. Weltwirtschaftliches Archiv 137 (1), 1-35. DOI:http://dx.doi.org/10.1007/BF02707598

Hoitsy, Gy. (2002) A pisztráng tenyésztése és horgászata. Miskolc: '96 Studio Kft.

Hoitsy, Gy., Hoitsy, M. (2016) A lillafüredi pisztrángtelepen, a HOP 2. tengelyen meghirdetett beruházási támogatás keretében megvalósuló projektek. [online] Budapest: Magyarország Kormánya. Available at: http://halaszat.kormany.hu/download/8/c3/b1000/Lillaf%C3%BCredi%20Pisztr%C3%A1ngtelep.pdf [Accessed 10 April 2018].

Horn, P. (2009) Az európai élelmiszertermelés jövője. Szarvas: XXXIII. Halászati Tudományos Tanácskozás.

MAHAL (2016) Jelentés a Szövetség működésének 2015. évi eredményeiről. Budapest: Magyar Haltermelők és Halászati Vízterület-hasznosítók Szövetsége

Organisation for Economic Co-operation and Development - Food and Agriculture Organization of the United Nations (OECD-FAO) (2015) Agricultural Outlook 2014-2023. Statistics [online] Organisation for Economic Co-operation and Development - Food and Agriculture Organization of the United Nations. Available at: http://stats.oecd.org/Index.aspx?DataSetCode=HIGH_AGLINK_2013, [Accessed 5 September 2017].

Pimentel, D., Pimentel, M. (2006) Global environmental resources versus world population growth. Ecological Economics, 59 (2), 195-198. DOI: https://doi.org/10.1016/j.ecolecon.2005.11.034

Vollrath, T. L. (1991) A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage. Weltwirtschaftliches Archiv, 127 (2) 265–279. DOI: https://doi.org/10.1007/BF02707986