Štefan BOJNEC* and FERTŐ Imre**

Agri-food exports from European Union Member States using constant market share analysis

The 27 European Union (EU) Member States increased their total agri-food exports during the period 2000-2011. However, despite agri-food exports having grown, the shares of the world agri-food markets of 13 EU Member States and the EU-27 as a whole have declined. Those with increasing market share are mainly among the Eastern EU Member States. Constant market share analysis by 27 EU Member States suggests that the structural effects in agri-food and dairy exports are more important than the residual and second order effects. The declining market share is largely associated with negative residual and second order effects. Large positive structural effects cannot compensate for the impact of negative residual and second order effects and this results in declining agri-food market shares.

* Univerza na Primorskem, Cankarjeva 5, SI-6104, Slovenia. Corresponding author: stefan.bojnec@fm-kp.si
** Budapesti Corvinus Egyetem, Budapest, Hungary and MTA Közgazdaságtudományi Intézet, Budapest, Hungary

Introduction

Previous research has investigated different aspects of agri-food trade in Central and Eastern European (CEE) countries and in the European Union (EU) Member States. For example, Bojnec (2001) investigated trade and revealed comparative advantage measures in the agricultural trade of CEE countries, while Fertő and Hubbard (2003) studied revealed comparative advantage and competitiveness in Hungarian agri-food sectors with the EU. In addition, in a series of articles these authors investigated EU enlargement and agri-food trade (Bojnec and Fertő, 2008, 2009a, 2012a) and price and quality competitiveness (Bojnec and Fertő, 2009b, 2012b).

This paper focuses on agri-food trade shares and constant market share (CMS) in the 27 EU Member States. The CMS model is one approach to identifying the causes of changes in exports (Ahmadi-Esfahani, 2006). The CMS model was first applied to trade in manufactured commodities by Tyszinski (1951), and then Rigaux (1971) gave an early example of its application to agricultural trade. It has again became popular for agricultural trade analysis in recent decades (e.g. Ahmadi-Esfahani, 1995; Ahmadi-Esfahani and Jensen, 1994; Ongsritrakul and Hubbard, 1996; Chen and Duan, 2001; Fertő 2004; Fogarasi, 2008).

The basic presumption underlying the CMS model is that the share of a country in a market should remain constant given the same level of competitiveness. Hence, any difference between the actual change in exports of the particular ('focus') country and the sum of the market competitors should be caused by a change in export composition or competitiveness (Chen and Duan, 2001).

The objective of this paper is to account for the sources of changes in the agri-food (in general) and dairy (specifically) exports of the EU-27 to the global markets. A sector level analysis for dairy exports is conducted to compare national agri-food exports with possible sector differences for dairy exports, which is still one of the most important agri-food and export sectors in most of the 27 EU Member States. The period 2000-2011 is firstly analysed by comparing data for 2000-2002 and 2009-2011 (i.e. three year averages), and is then divided into two sub-periods 2000-2002/2004-2006 and 2004-2006/2009-2011, i.e. before and after the 2004 EU enlargement.

Methodology

The EU Member State agri-food export share in total global agri-food exports is calculated as:

$$Xi\% = \left(Xi / \sum_{i=1}^{n} Xi \right) 100$$

where $X_i\%$ is the share (in per cent) of the value of agri-food exports X_i of the EU Member State i in total global value of agri-food exports $\sum_{i=1}^{n} Xi$, where n is the number of countries in the world.

In the traditional CMS models, there are only two effects to explain the changes in export growth: the structural effect and the residual effect. The former describes the hypothetical change in expected exports, while the latter is the difference between the actual and the expected change. One can derive these effects more formally (Ahmadi-Esfahani, 1995). Market share can be defined as follows:

$$S = q / Q \tag{1}$$

where S is the particular country's share of the reference market, q is the particular country's exports and Q is the exports of the reference. Manipulating equation (1) yields: $q = SQ$. Differentiating with respect to time one can obtain:

$$\Delta q = S\Delta Q + Q\Delta S \tag{2}$$

where Δ is the change in the variable over time. The first expression on the right hand side is the structural effect and second is the residual effect. Equation (2) is valid only for an infinitely short time period. If the CMS model is applied at discrete intervals, the equation may be written in several ways utilising start and end of period variables. However, some applications (e.g. Ahmadi-Esfahani, 1995; Ahmadi-Esfahani and Jensen, 1994; Chen and Duan, 2001) offered the following specification:

$$\Delta q = \underset{\text{structural effect}}{S^0 Q} + \underset{\text{residual effect}}{\Delta S Q^0} + \underset{\text{second-order effect}}{\Delta S \Delta Q} \tag{3}$$

where 0 is starting period.

Disaggregating the export values into flows of various commodities and flows to various markets, equation (3) becomes:

$$\Delta q = \sum_i \sum_j S_{ij}^0 \Delta Q_{ij} \quad + \quad \sum_i \sum_j \Delta S_{ij} Q_{ij}^0 \quad + \quad \sum_i \sum_j \Delta S_{ij} \Delta Q_{ij} \tag{3a}$$

$$\underbrace{}_{\text{structural effect}} \quad \underbrace{}_{\text{residual effect}} \quad \underbrace{}_{\text{second-order effect}}$$

where Q_{ij} is the reference's exports of commodity i to market j.

The three structural components of the market share are calculated with this expression. Firstly, the size of the market or structural effect refers to the change in quantity of exports of the reference. If this grows (falls), then even with a constant market share S^0, a given country's exports will increase (decrease) in quantity by $S^0 \Delta Q$. The other two components have different implications for the sources of export growth. The residual effect also can be called the competitive effect (Chen and Duan, 2001). It means that the change in exports occurs due to a change in the exporting country's competitiveness. The second-order effect can be interpreted as a change in exports due to the interaction of the change in exporting country's competitiveness and the change in the exports of the reference.

The CMS models, as represented in equations (3) and (3a) are applied to the change in EU-27 agri-food (in general) and dairy (specifically) exports to the global market over the period 2000-2011. CMS analysis has been carried out separately for each EU Member State. To avoid the bias of CMS estimations due to sensitivity of the base year, the base period is the average of 2000-2002 for the whole analysed period and for the first period and the average of 2004-2006 is used for the second period.

The CMS models are calculated for the 27 EU Member States using detailed trade data at the six-digit World Cus-toms Organization's Harmonized System (HS-6) level for the years 2000-2011. The United Nations International Trade Statistics UN Comtrade database (UNSD, 2013) is used as data source. Intra-EU trade is included in the CMS analysis for the individual Member States.

It should be noted that agri-food trade between the prospective Member States and the established (EU-15) Member States was already liberalised, except for certain sensitive agri-food products, before the former's accession to the EU. The second sub-period includes also the effects of the global financial and economic crisis of 2008 onwards, which is not analysed.

Results

Agri-food export shares in the 27 EU Member States in global agri-food exports and CMS analysis for agri-food exports and separately for dairy exports are employed to analyse how the Member States performed in global markets in association with the EU enlargements in the period 2000-2011.

EU-27 shares in global agri-food exports

According to the agri-food export shares (USD equivalent) in the world markets, the EU-27's overall share in global agri-food exports declined from 47.22 per cent in 2000 to 41.32 per cent in 2011. However the EU-27 as a whole and some of its Member States have remained important players in global agri-food exports (Figure 1). The focus of our analysis here is a comparison of the global market shares of individual Member States between the periods 2000-2002 and 2009-2011. The first interesting result is that the market shares of 13 Member States (as well as to a lesser extent
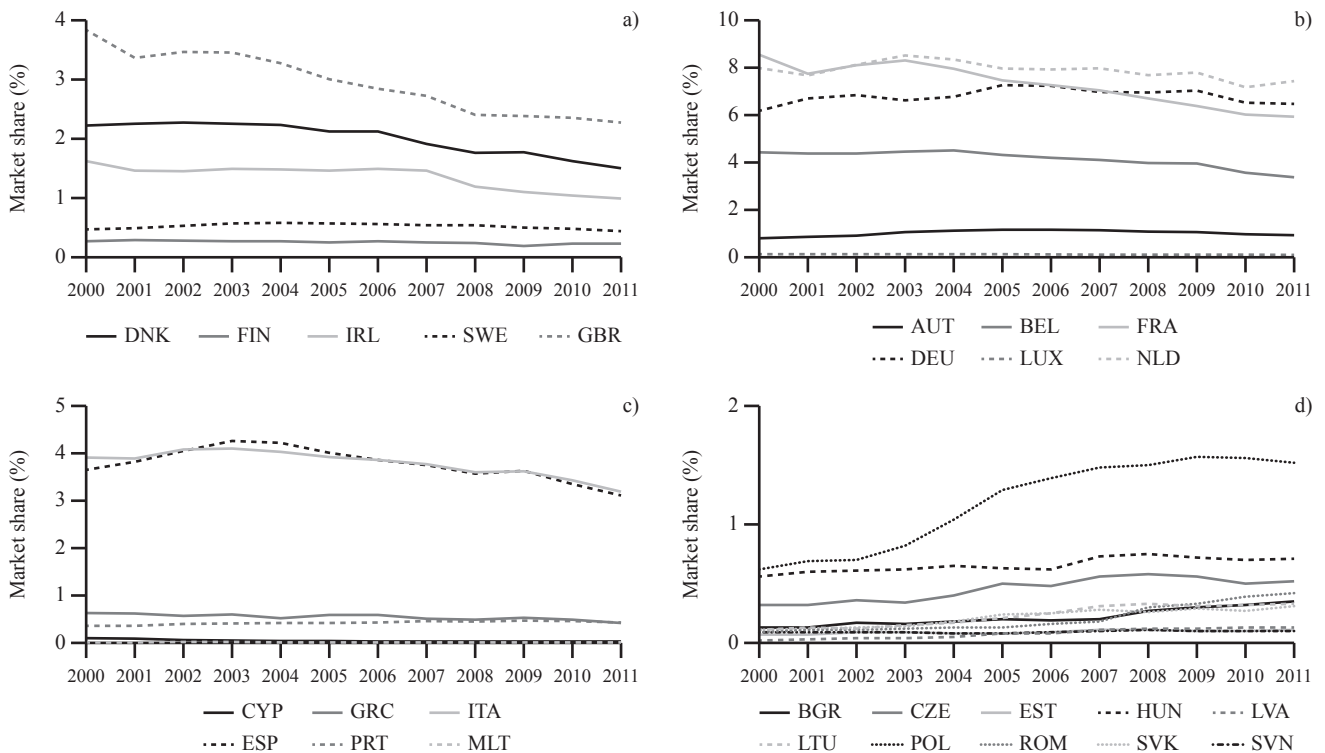

Figure 1: Market shares of (a) northern, (b) central, (c) southern and (d) eastern EU Member States in global agri-food exports, 2000-2011.
Source: Own calculations based on UNSD (2013) Comtrade database with World Trade Integration Solution (WITS) software

Malta) have declined over time. The Netherlands, Germany, France, Belgium (Figure 1b), Spain and Italy (Figure 1c) have recorded the highest export shares but some EU Member States with strong agri-food sectors, including Denmark (Figure 1a), France, Netherlands (Figure 1b) and Spain (Figure 1c), have performed poorly in terms of maintaining their market shares over this period.

The second finding is that 10 of the 13 countries with increasing market share are the Eastern EU Member States (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia) (Figure 1d). The additional three are the established EU Member States Austria, Germany and Portugal. However these 13 Member States accounted for only 29 per cent of the total EU-27 share in the global market in the period 2009-2011. Amongst the Eastern EU Member States, Poland, Hungary and the Czech Republic have had the highest export shares.

Constant market share analysis for agri-food exports

The CMS models highlight some important components to explain changing market shares (Table 1). The EU-27 agri-food export performance can be explained mainly by the structural effects. In other words the growth of agri-food exports is based on the increase in global demand. However,

both residual and second order effects are negative, implying a fall in competitiveness. The negative second order effects suggest that the influence of the interaction of the change in EU-27's competitiveness and the change in the global imports has been unfavourable.

The results suggest that the impact of various components of the CMS estimations considerably differ by EU Member State. The structural effects dominate the CMS models in 21 of 27 Member States. Interestingly, those Member States where the impact of structural effects is less than the positive residual and second order effects, for example Bulgaria, Latvia, Lithuania, Poland, Romania and the Slovak Republic, were able to increase their market share. Furthermore, Member States with declining market share report negative residual and second order effects. In other words, large structural effects cannot compensate for the impact of negative residual and second order effects, resulting in a fall in market shares.

The crucial role of the structural effect, except for Cyprus, which is negative, and to a lesser extent of smaller values for some Eastern EU Member States such as Latvia, Lithuania, Poland and the Slovak Republic, can be seen in the middle part of Table 1 for the 2000-2002/2004-2006 sub-period. The residual and second order effects are particularly important for the above-mentioned Eastern EU Member States.

During the 2004-2006/2009-2011 sub-period the size of the structural effect has become greater for most of the

Table 1: Constant market share model for agri-food exports of 27 EU Member States.

| | CMS component (per cent) | | | | | | | | |
| | 2000-2002/2009-2011 | | | 2000-2002/2004-2006 | | | 2004-2006/2009-2011 | | |
	Structural	Residual	Second order	Structural	Residual	Second order	Structural	Residual	Second order
Austria	80	8	12	51	31	18	192	-65	-27
Belgium	139	-15	-24	104	-2	-1	228	-91	-37
Bulgaria	33	26	42	51	32	18	29	50	20
Cyprus	-3717	1443	2373	-179	179	101	257	-112	-46
Czech Republic	52	18	30	49	33	18	67	23	10
Denmark	179	-30	-49	113	-8	-5	608	-360	-147
Estonia	64	14	22	78	14	8	56	31	13
Finland	152	-20	-32	115	-9	-5	250	-106	-44
France	166	-25	-41	124	-15	-9	294	-137	-56
Germany	98	1	1	82	11	6	125	-18	-7
Greece	152	-20	-32	124	-16	-9	212	-79	-32
Hungary	75	9	16	83	11	6	70	21	9
Ireland	199	-37	-62	106	-4	-2	-7193	5175	2118
Italy	128	-11	-18	101	-1	-1	184	-60	-24
Latvia	17	31	51	23	49	28	27	52	21
Lithuania	28	27	45	34	42	24	36	46	19
Luxemburg	142	-16	-26	106	-4	-2	239	-98	-40
Malta	243	-54	-89	140	-26	-15	-10386	7441	3045
Netherlands	110	-4	-6	95	3	2	135	-25	-10
Poland	32	26	42	30	45	25	54	32	13
Portugal	74	10	16	73	17	10	79	15	6
Romania	19	31	50	50	32	18	15	61	25
Slovak Republic	29	27	44	28	46	26	50	36	15
Slovenia	86	5	9	118	-11	-6	63	26	11
Spain	125	-10	-16	88	8	4	233	-95	-39
Sweden	110	-4	-6	72	18	10	244	-102	-42
United Kingdom	223	-47	-77	167	-43	-24	496	-281	-115
EU-27	118	-7	-11	95	3	2	162	-44	-18

Note: The components of the CMS analysed are normalised to sum to 100
Source: own calculations based on WITS database

27 EU Member States. Among outliers with extreme negative values for the structural effect are Ireland and Malta. The residual and second order effects are more often negative for the EU-15 Member States and positive for the Eastern EU Member States.

Constant market share analysis for dairy exports

The CMS models for dairy exports largely highlight similarities in components to explain changing market shares (Table 2). The structural effect, which is caused by the increase in global demand, dominates the CMS models for dairy exports of the EU Member States. The impact of the positive structural effect is consistently less than the positive residual and second order effects only for Bulgaria, Latvia and Romania.

Both residual and second order effects are negative for Belgium, Denmark, Finland, France, Ireland, Malta, the Netherlands, Spain, and particularly for the UK, implying a fall in competitiveness and the unfavourable change in the global imports for dairy exports from these countries. The results for Austria, Germany and Sweden are mixed. Eastern EU Member States, e.g. Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia, have positive residual and second order effects, implying an increase in competitiveness and the favourable change in the global imports for dairy exports from these

countries. Hungary has improved competitiveness and the global trading conditions since the EU enlargement in dairy exports as both residual and second order effects have shifted from negative to positive values.

Discussion and conclusions

The paper analyses the evolution of market shares in the global agri-food and dairy exports during the period 2000-2011. The agri-food global market shares have declined in thirteen EU Member States and have remained at similar levels for Malta. Most of the countries with an increasing agri-food market share are Eastern EU Member States. This finding is largely consistent with previous findings using different methodological approaches. The EU enlargement has encouraged agri-food exports of Eastern EU Member States to both intra-EU (Bojnec and Fertő, 2008, 2009a, 2010, 2012a) and extra-EU global markets.

The CMS analysis suggests that the structural effects are more important than residual and second order effects in the structure of agri-food and dairy exports. While the structural effect is mostly positive for all EU Member States, the residual and second order effects are more often positive for the Eastern EU Member States and after the EU enlargements more often negative for the EU-15 Member States. This finding provides some new optimism for the agri-food sector in the

Table 2: Constant market share model for dairy product exports of 27 EU Member States.

| | CMS component (per cent) | | | | | | | | |
| | 2000-2002/2009-2011 | | | 2000-2002/2004-2006 | | | 2004-2006/2009-2011 | | |
	Structural	Residual	Second order	Structural	Residual	Second order	Structural	Residual	Second order
Austria	67	21	12	67	21	12	173	-54	-19
Belgium	155	-35	-20	155	-35	-20	132	-24	-8
Bulgaria	41	38	22	41	38	22	38	46	16
Cyprus	54	30	17	54	30	17	40	45	15
Czech Republic	43	36	21	43	36	21	66	25	9
Denmark	132	-20	-12	132	-20	-12	209	-82	-28
Estonia	92	5	3	92	5	3	70	22	8
Finland	123	-15	-8	123	-15	-8	102	-1	0
France	136	-23	-13	136	-23	-13	154	-40	-14
Germany	99	1	0	99	1	0	156	-42	-14
Greece	55	29	16	55	29	16	62	29	10
Hungary	201	-64	-37	201	-64	-37	45	41	14
Ireland	121	-13	-8	121	-13	-8	175	-56	-19
Italy	82	12	7	82	12	7	85	11	4
Latvia	30	45	26	30	45	26	40	45	15
Lithuania	56	28	16	56	28	16	64	27	9
Luxemburg	69	19	11	69	19	11	74	19	7
Malta	211	-71	-40	211	-71	-40	230	-97	-33
Netherlands	122	-14	-8	122	-14	-8	123	-17	-6
Poland	29	45	26	29	45	26	82	13	5
Portugal	97	2	1	97	2	1	76	18	6
Romania	41	38	21	41	38	21	27	55	19
Slovak Republic	23	49	28	23	49	28	92	6	2
Slovenia	62	24	14	62	24	14	47	39	13
Spain	108	-5	-3	108	-5	-3	281	-135	-46
Sweden	68	20	12	68	20	12	121	-16	-5
United Kingdom	135	-22	-13	135	-22	-13	1880	-1328	-452
EU-27	105	-3	-2	105	-3	-2	134	-25	-9

Note: The components of the CMS analysed are normalised to sum to 100
Source: own calculations based on WITS database

Eastern EU Member States, which after the initial transitional downturn have recovered and are catching up with their agri-food and dairy exports to the intra-EU and the global markets.

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