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A constant market share analysis of the competitiveness of the Czech Republic's agrifood exports (2002–2020) to the European Union

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Abstract: We conducted a quantitative ex post analysis of the competitiveness of the Czech Republic's agrifood exports to other European Union (EU) Member States between 2002 and 2020, using the constant market share (CMS) methodology. The application of this methodology to Czech agrifood exports is novel, as it allows for analysing the export competitiveness variation and its components. Although the findings are consistent with those of previous studies in which the investigators used alternative methodological approaches, we make three contributions to the existing literature. Firstly, the Czech Republic experienced an overall increase in its competitiveness in agrifood exports between 2002 and 2020. Secondly, the high territorial specialisation of Czech agrifood exports to other EU Member States, combined with a general slowdown in the growth of EU markets, has had a significant effect on the growth dynamics of the country's agricultural exports. Thirdly, there is a problem with the specialisation profile of Czech agrifood exports in terms of commodity and territorial structure. The current composition does not allow the Czech Republic to reach its full potential for agrifood exports. These findings will help industrial, agricultural and trade policymakers to assess the nature of liberalisation and transformation of the Czech Republic's agricultural sectors, with a view to improving or designing structures and instruments for the promotion of agrifood exports.

Keywords: agriculture; agrifood sectors; EU-28 market; international trade; liberalisation; trade specialisation

During the past three decades, several critical economic factors have affected the competitive performance of the agrifood sectors in the European Union (EU). Factors like globalisation, changes in the demand for food safety and quality, the establishment of a single European market, the introduction of the euro in some EU Member States, integration into global value chains, the effect of new trade agreements and the financial crisis of 2008 all contributed to the changes in competitiveness (Bojnec and Fertő 2015, 2019; Harvey et al. 2017; Čechura et al. 2017; Fertő 2018; Mizik 2021; Pawlak et al. 2021; Hamulczuk and Pawlak 2022; Matkovski et al. 2022). These observations are supported by our data; the EU's (EU is considered as a bloc of 28 Member States) overall share in global agrifood (Standard International Trade Classification

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0 + 1 + 22 + 4) exports declined from 44.0% to 37.8%, and imports from 43.8% to 35.9%, between 2002 and 2020 (UNCTAD 2023). Despite the EU's share in agrifood export and import constituting approximately 40% (on average) of the global trade during the last two decades, the EU and some of its Member States remain important players in the global agrifood trade arena.

During the three decades after liberalisation in 1992, agrifood exports from the Czech Republic underwent several changes, many of them quite dramatic. Changes in the structure, volumes and value of agrifood products exported into the EU Member States resulted in changes in the trade balance and competitiveness of the of the Czech Republic's agrifood sector. Results from several studies help confirm these observations on the changes in agrifood trade during the Czech Republic's accession to the EU (e.g. Burianová 2010), the competitiveness of the Czech Republic's agrifood trade (e.g. Burianová 2010; Smutka et al. 2018; Rumankova et al. 2022) and the comparative advantage of the Czech Republic's agrifood trade (e.g. Smutka et al. 2012; Vondráček et al. 2022).

To contribute to this body of literature, we aimed to investigate the change in the value of the Czech Republic's agrifood exports into the other EU Member States (bloc of 28 countries) between 2002 and 2020 by using constant market share (CMS) methodology. The fact that CMS methodology had not yet been used to analyse the competitiveness of the Czech Republic's agrifood trade over an extended period makes this contribution and approach novel. This analysis is performed on data collected over a longer period (2002–2020), allowing for the inclusion of several external and internal changes and shocks that appeared in the economic environment of the EU agrifood markets. In addition, we isolated different components associated with the changes in the Czech Republic's agrifood exports and quantified their contributions.

The remainder of the article is structured as follows. First, we discuss CMS methodology and then describe the data set on which we apply the CMS methodology. Next, we present our results and discuss our findings and some associated policy implications. Finally, we provide some comments and make some suggestions regarding issues for future research.

Literature review. Investigators in existing agrifood trade studies report an increase in agricultural trade after the Czech Republic's accession to the EU. In addition, a significant portion of the Czech Republic's increase in imports (relative to that of other Central European countries) is linked to increased imports of processed goods. Smutka et al. (2018) also reported that a significant weakness of the Czech Republic seems to be its limited ability to generate added value, indicating that the Czech agrifood exports and imports were dominated by EU Member States.

Investigators in another set of studies analysed competitiveness from different vantage points. In addition to studying trade after the Czech Republic's accession to the EU, Burianová (2010) analysed the competitiveness and commodity structure of the Czech Republic's agricultural trade (2004–2008) by using revealed comparative advantage. The Czech Republic was most competitive in milk, sugar and sweets, oilseeds, and cereals. The financial crisis of 2008 did not affect the territorial and commodity structure and competitiveness of the Czech agrifood trade. This trade performance was instead affected by the decline in export growth. In an analysis of the competitiveness of the Czech Republic's agrifood trade with different groups of partners, by using revealed comparative advantage and product mapping methodology (2001–2015), Smutka et al. (2018) reported an increase in the Czech Republic's comparative advantage to EU Member States but a reduced comparative advantage in relation to non-EU Member States. They also suggested that the territorial structure of the Czech Republic's agrifood trade became more concentrated but that the commodity structure became more diversified over time. In contrast, Rumankova et al. (2022) used a combination of trade measures and strategic management measures to analyse the competitiveness of crop production in selected EU Member States compared with that in the Czech Republic. Their findings suggest that, in some cases, labour and capital factors were important (e.g. Netherlands and Belgium) and, in others (mainly new EU Member States), market competitiveness factors were important.

The investigators in this set of studies (e.g. Smutka et al. 2012; Vondráček et al. 2022) analysed competitiveness by looking at the Czech Republic's comparative advantage in its agrifood trade performance. These authors concluded that the Czech Republic increased its comparative advantage in (amongst others) cereals, live animals, oilseeds, tobacco, dairy, sugar, animal and vegetable fats, and beverages by using the Balassa and Lafay indexes to make inferences about the comparative advantage of the Czech Republic's agrifood trade. Smutka et al. (2012) analysed data from 2008 to 2011 and found no fundamental change in the Czech Republic's agrifood trade when investigating the Czech Republic's trade with six key trading partners. By taking a more focused approach,

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Vondráček et al. (2022) studied the changes in comparative advantages in the sugar market in the EU Member States and the specific position of Czech exports. They reported a significantly concentrated territorial structure for the Czech Republic's exports to EU Member States, particularly sugar beet and sugar exports. The number of scientific publications in which the authors analysed the effect of the COVID-19 pandemic on the competitiveness of Czech agriculture is still limited. In a recent article, Blažková et al. (2023) investigated the effects of the COVID-19 pandemic on small family farms in the Visegrad Group of countries. Their findings indicated several negative effects, such as a decrease in sales, delays in supply of inputs and minor problems with the availability of labour.

Investigators in several studies analysed the competitiveness of the Czech Republic's agrifood sectors and agrifood trade. These studies mostly involved the use of the revealed comparative advantage methodology (Burianová 2010; Smutka et al. 2012, 2018; Svatoš and Smutka 2012; Bajan et al. 2021; Kuzmenko et al. 2022; Rumankova et al. 2022; Vondráček et al. 2022). Indications are that CMS methodology had not yet been used to study the competitiveness of the Czech Republic's agrifood trade over an extended period. We reasoned that the skilful use of CMS methodology would be effective for analysing the trading patterns, trends and competitiveness of the Czech Republic's agrifood exports into the EU.

Historically, the value of using CMS methodology to assess and monitor countries' agrifood trade performance has been illustrated in various international studies. The traditional CMS model was first applied to the study of international trade by Tyszynski (1951). It has increasingly been used and refined, despite continued criticism of its theoretical and empirical modelling (Richardson 1971; Jepma 1986; Merkies and Van der Meer 1988; Milana 1988). Jepma (1986) proposed an alternative model to overcome some of the traditional model's shortcomings. However, investigators in research studies continue to use the 'tried and tested' traditional model (Ahmadi-Esfahani 2006) to analyse international trade-related research questions. Over the past almost three decades, the traditional CSM model was used to analyse:

i) the Japanese wheat market in the presence of import restrictions (Ahmadi-Esfahani 1995);

ii) the competitiveness of Canadian agrifood exports in Asia (Chen and Duan 2001);

iii) the competitiveness of Turkey, Spain, Italy, Greece and Tunisia in markets in the United States, Australia, Canada, Brazil and Japan (Türkekul et al. 2010);

iv) the trade behaviour and trends between the EU Member States (Bojnec and Fertő 2014);

v) the competitiveness of Spanish tomato exports compared with major competitors in the EU (Capobianco-Uriarte et al. 2017);

vi) the rice export performance of Vietnam compared with that of China (Lien and Nanwul 2018);

vii) the dynamic decomposition of factors influencing the export growth of China's wood forest products (Cao et al. 2018);

viii) factors affecting fluctuations in China's aquatic product exports to Japan, the United States, South Korea, Southeast Asia and the EU (Miao et al. 2021); and

ix) the competitive positioning of Mexican pork in Japan (Méndez-León et al. 2023).

Over and above the economic and financial trade performance information that CMS methodology generates, it is useful for informing policy decision-making and formulation. CMS methodology indicates the areas influencing a country's comparative export performance and reflects the dynamic interactions between countries included in the analysis, such as dynamic growth and the development of trade performance over time.

MATERIAL AND METHODS

CMS methodology postulates that a country's market share should remain constant, given the same level of competitiveness. Hence, any difference between the changes in exports of a country and the sum of exports of market competitors should be caused by the change in export composition or competitiveness of the country being analysed (Ahmadi-Esfahani 1995; Chen et al. 2000). Traditionally, in CMS methodology, a country's exports may succeed (or fail) to grow as rapidly as the world average for three reasons. Firstly, exports may be concentrated in commodities for which demand is growing relatively rapidly (or slowly). Secondly, exports may be going to relatively fast-growing (or stagnant) regions. Thirdly, the country in question may have been capable (or incapable) of competing effectively with other sources of supply (Leamer and Stern 1970).

CMS methodology is an accounting method for decomposing ex post the variations over time of a country's aggregated export share. The diagnostic of a country's export performance and trading patterns and its interpretation is based on the assumption that changes in the market share purely reflect competitive conditions (Ahmadi-Esfahani 2006).

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To analyse a country's export competitiveness, we used the market share (S) as the relationship between the country's exports to the relevant market relative to the exports of the competing countries to the relevant market:

$$S_{ij} = \frac{q_{ij}}{Q_{ij}} \rightarrow q_{ij} = S_{ij} \times Q_{ij} \quad (1)$$

where: S – focus country's share of the market; q – exports of a focus country; Q – exports of one or more countries that serve as a standard of comparison.

With the differentiation with respect to time and decomposition at discrete intervals [0,1], the equation is as follows:

$$\Delta q = s_{ij}^0 \Delta Q_{ij} + \Delta S_{ij} Q_{ij}^0 + \Delta s_{ij} \Delta Q_{ij} \quad (2)$$

After disaggregation of the export quantities into flows of various commodities and flows to various markets, the equation is as follows:

$$\Delta q = \sum_i \sum_j s_{ij}^0 \Delta Q_{ij} + \sum_i \sum_j Q_{ij}^0 \Delta s_{ij} + \sum_i \sum_j \Delta s_{ij} \Delta Q_{ij} \quad (3)$$

where: 0 represents the beginning and 1 represents the end of the discrete period; Δq – change in exports of the focus country over the period; ΔQ – change in exports of one or more countries that serve as a standard of comparison over the period; ΔS – change in the focus country's share of the market over the period.

The change in a country's exports on this first level of decomposition can be divided into the sum of three effects: structural effect (SE), competitive effect (CE) and second-order effect (SOE).

The notation $\Sigma_i \Sigma_j s_{ij}^0 \Delta Q_{ij}$ represents the SE or market size and describes the variations of exports that refer to the change in the quantity of exports of the reference. If this amount increases (or decreases), then even with a CMS, a given country's exports will increase (or decrease) in quantity (Bojnec and Fertő 2014). The notation $\Sigma_i \Sigma_j Q_{ij}^0 \Delta s_{ij}$ represents the residual effect or CE and shows the potential change in exports owing to a change in the exporting country's competitiveness. In other words, the CE indicates the portion of the change in exports attributable to changes in market share that occurred during the period. The positive or negative sign indicates the gain or loss of competitiveness in the analysed period (De Pablo Valenciano et al. 2017). The notation $\Sigma_i \Sigma_j \Delta s_{ij} \Delta Q_{ij}$ represents the SOE and indicates how well the exporting country has adapted its export share to use the import growth of its trading partner. A negative SOE means that the exporter has lost market share in markets that proliferated and gained market share in markets that contracted (Ahmadi-Esfahani 2006).

We further disaggregated the SEs, residual effects and SOEs (Jepma 1986), resulting in components of the change in exports that are more useful for economic analysis (Ahmadi-Esfahani 1995). In relation to the analysis in this study, the following equation illustrates the relationship between the first and second levels of analysis and the individual effects for the Czech Republic's trade performance:

$$\begin{aligned}\Delta q = {} & s^0 \Delta Q + \left(\sum_i \sum_j s_{ij}^0 \Delta Q_{ij} - \sum_i s_i^0 \Delta Q_i\right) + \\ & + \left(\sum_i \sum_j s_{ij}^0 \Delta Q_{ij} - \sum_j s_j^0 \Delta Q_j\right) + \\ & + \left[\left(\sum_i s_i^0 \Delta Q_i - s^0 \Delta Q\right) - \left(\sum_i \sum_j s_{ij}^0 \Delta Q_{ij} - \sum_j s_j^0 \Delta Q_j\right)\right] + \\ & + \Delta s Q^0 + \left(\sum_i \sum_j \Delta s_{ij} Q_{ij}^0 - \Delta s Q^0\right) + \\ & + \left(\frac{Q^1}{Q^0} - 1\right) \sum_i \sum_j \Delta s_{ij} Q_{ij}^0 + \\ & + \left[\sum_i \sum_j \Delta s_{ij} \Delta Q_{ij} - \left(\frac{Q^1}{Q^0} - 1\right) \sum_i \sum_j \Delta s_{ij} Q_{ij}^0\right]\end{aligned} \quad (4)$$

where: q – the Czech Republic's total exports of agrifood products to the EU; s – the Czech Republic's market share of agrifood exports in total EU imports; q_j – the Czech Republic's market share of agrifood exports in destination j; s_i – the Czech Republic's market share of commodity i in the total EU market; s_{ij} – the Czech Republic's market share of commodity i in destination j; Q – total EU imports of agrifood products; Q_j – total agrifood imports in destination j (one of the EU Member States); Q_i – the total EU imports of commodity i and Q_{ij} is the total imports of commodity i in destination j.

The equation addresses eight effects: growth effect, market effect, commodity effect, structural interaction effect, pure residual effect, statistic structural residual effect, pure SOE and dynamic SE.

The growth effect ($s^0 \Delta Q$) measures the part of the agrifood export change of the Czech Republic that is attributed to the general change in the EU imports, given that the Czech Republic's competitiveness and export structure are unchanged. The market effect $\left(\sum_i \sum_j s_{ij}^0 \Delta Q_{ij} - \sum_i s_{ij}^0 \Delta Q_{ij}\right)$ measures the influence

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that the destination markets can have on the focus country's exports. In other words, the change in export is due to the market distribution effect, reflecting the extent of the concentration of exports in faster-growing (or slower-growing) markets, relative to the benchmark. The commodity effect $\left(\sum_i \sum_j s_{ij}^0 \Delta Q_{ij} - \sum_j s_j^0 \Delta Q_j\right)$ indicates the extent to which the agrifood exports of the Czech Republic are concentrated in product groups with growth rates higher or lower than the average. The structural interaction effect $\left[\left(\sum_i s_i^0 \Delta Q_i - s^0 \Delta Q\right) - \left(\sum_i \sum_j s_{ij}^0 \Delta Q_{ij} - \sum_j s_j^0 \Delta Q_j\right)\right]$ indicates the extent to which the change in the Czech Republic's agrifood exports is due to the interaction of the market distribution effect and the commodity composition effect—that is, whether the Czech Republic sells agrifood products in markets where demand is increasing (or decreasing) relatively quickly. The pure residual effect (ΔsQ^0) measures the increase (or decrease) in the Czech Republic's agrifood exports attributable to a general increase (or decrease) in competitiveness. The statistic structural residual effect ($\Sigma_i \Sigma_j \Delta s_{ij} Q_{ij}^0 - \Delta sQ^0$) reflects the effect of changes in the Czech Republic's agrifood export structure on export performance. The pure SOE $\left[\left(\frac{Q_1}{Q_0} - 1\right) \sum_i \sum_j \Delta s_{ij} Q_{ij0}\right]$ measures the effect of changes in the size of the EU's demand on the Czech Republic's exports, given that the structure of the EU's demand is unchanged. Lastly, the dynamic structural residual effect $\left[\sum_i \sum_j \Delta s_{ij} \Delta Q_{ij} - \left(\frac{Q_1}{Q_0} - 1\right) \sum_i \sum_j \Delta s_{ij} Q_{ij0}\right]$ explains the interaction of the Czech Republic's market share with changes in the structure of the EU's demand.

We obtained statistical data from databases of the United Nations Conference on Trade and Development from 2002 to 2020, allowing for an analysis over an extended period, which includes the analysis of four subperiods. Firstly, we analysed the whole period (2002–2020); secondly, the pre-Great Recession subperiod and the Czech Republic joining the EU (2002–2008); thirdly, the post-Great Recession subperiod (2008–2014); and fourthly, the late post-Great Recession recovery before the COVID-19 pandemic (2014–2020). We calculated the values at current prices in USD.

We performed the analysis at the three-digit code level for 46 agrifood products traded (Standard International Trade Classification 0 + 1 + 22 + 4). The Czech Republic's agrifood export destinations are other EU Member States. The number of EU Member States changed during the analysed period, which is why we chose a methodological approach that considers these Member States as part of the EU bloc, even if they had not yet been members in a given year.

We acknowledge the limitations of CMS methodology, such as the limited scope of factors used, the constant trade policy assumption, exclusion of nonmarket factors, the reliance on historical data and the lack of causality in the analysis (Ahmadi-Esfahani 2006). This article contributes to the body of knowledge on empirical trade performance analyses by skilfully expanding on the application possibilities of CMS methodology in analysing Czech agrifood trade performance.

RESULTS AND DISCUSSION

From 2002 to 2020, the Czech Republic's total agrifood trade balance was negative. During this time (Table 1), the Czech Republic's agrifood trading partners were mostly other EU Member States (accounting for 90% of exports), specifically, Slovakia, Germany, Poland, Italy, Austria and Hungary. These six countries constituted approximately 80% of the Czech Republic's agrifood exports to the EU.

The average year-on-year increase in the Czech Republic's agrifood exports to other EU Member States was +10.9% between 2002 and 2020. Over the subperiods, the average year-on-year growth in the Czech Republic's agrifood exports to other EU Member States was +27.2% (2002–2008), +6.0% (2008–2014) and +1.2% (2014–2020). The Czech Republic is a small open economy constituting only approximately 1.4% of the EU's agrifood imports. From 2002 to 2020, the Czech Republic's agrifood market share in the total EU's agrifood imports grew from 0.53% to 1.39%, partly because of several market liberalisation steps that started *de facto* from 1992, suggesting an increase in the competitiveness of Czech agrifood exports. The most exported agrifood products to the other EU Member States were alcoholic beverages, manufactured tobacco, milk and cream, cereal preparations, edible products, animal feedstuff and wheat. These products constituted approximately half of the Czech Republic's agrifood exports to the other EU Member States.

The highest gains in the Czech Republic's agrifood market share were in Slovakia (38.9%), Hungary (5.8%), Poland (4.7%), Austria (4.7%), Croatia (2.1%), Bulgaria (2.0%), Romania (2.0%), Slovenia (1.8%), Germany (1.4%) and Lithuania (1.2%). In the rest of the EU's Member

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Table 1. The Czech Republic agri-food export (total and to other EU Member States) 2002–2020

CZ agri-food export		2002	2004	2006	2008	2010	2012	2014	2016	2018	2020
To the world	mill. USD	1 493.9	2 261.0	3 336.9	5 898.0	5 125.5	7 398.0	8 443.3	8 027.9	8 351.8	9 026.1
To EU states		1 291.8	1 989.3	2 997.8	5 471.0	4 728.4	6 817.5	7 753.9	7 374.6	7 678.4	8 318.5
Share EU/world	%	86.5	88.0	89.8	92.8	92.3	92.2	91.8	91.9	91.9	92.2

Source: Authors' calculations based on UNCTAD (2023)

States, the Czech Republic's market share was less than 1.0% (Figure 1). These results indicate still strong existing links between the Czech Republic and Slovakia in mutual agrifood trade, as well as the interconnectedness of the agribusiness structures between the countries. Also, the Czech Republic has a relatively high market share in markets of neighbouring (or nearby) countries.

From 2002 to 2020, the Czech Republic increased its market shares in most of the EU Member States (20 of 27) and mostly in Hungary [+3.5 percentage

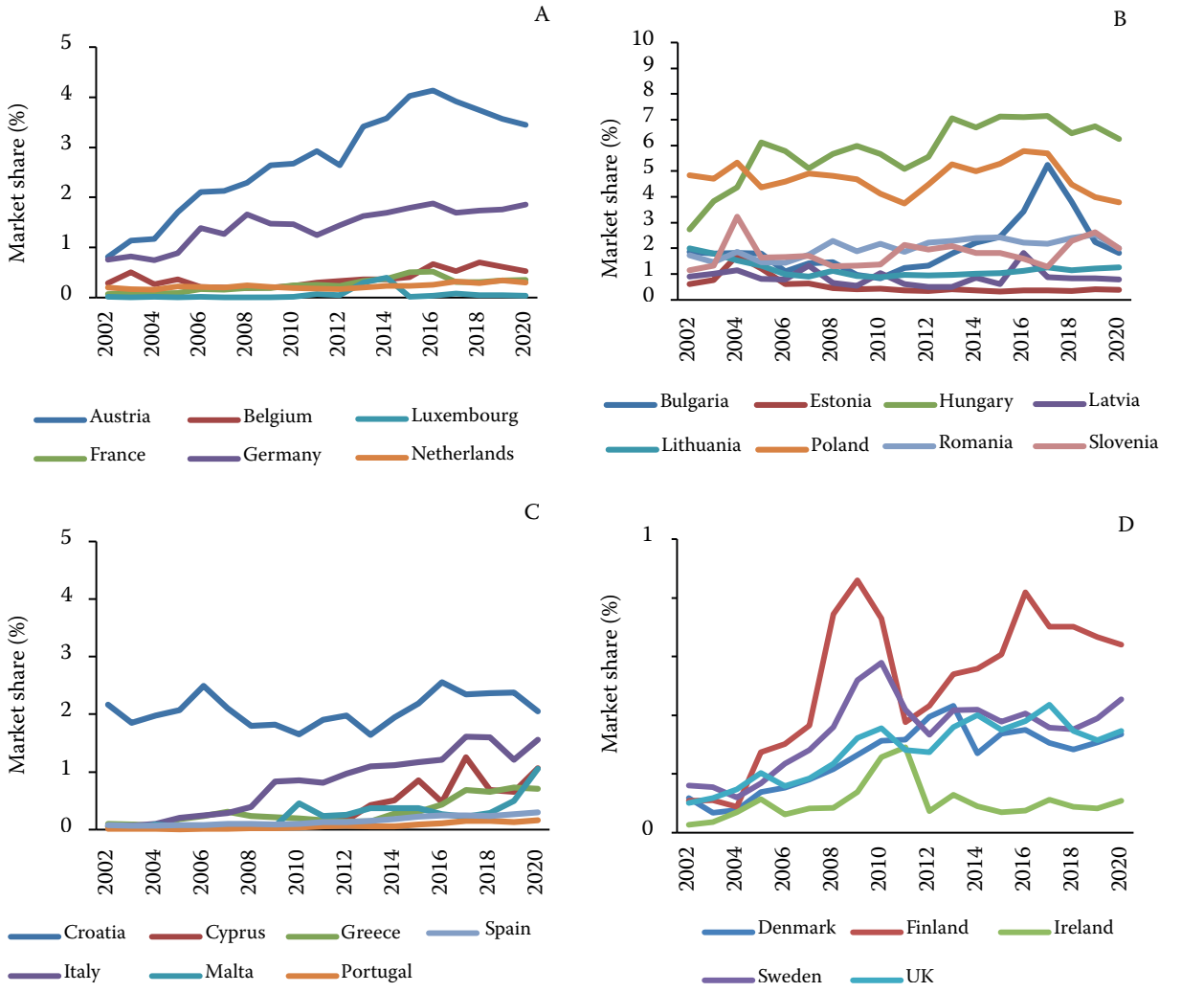

Figure 1. Market shares of the Czech Republic in (A) central, (B) eastern, (C) southern, and (D) northern EU Member States, 2002–2020

Slovakia is not included in part (B) because of the high value of the market share (about 39%)
Source: Authors' calculations based on UNCTAD (2023)

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points (p.p.)], Austria (+2.6 p.p.), Italy (1.5 p.p.) and Germany (1.1 p.p.). However, during the same time, the Czech Republic also sacrificed part of its market share in some Member States (seven of 27), mostly in Slovakia (–2.61 p.p.) and Poland (–1.06 p.p.) and in the Baltic countries of Estonia (–0.24 p.p.), Lithuania (–0.74 p.p.) and Latvia (–0.11 p.p.). The changes in market share followed different dynamics during the period under review and differed during particular subperiods.

The remainder of the results and discussion section is divided into two parts. First, we discuss the CMS analysis results for the period between 2002 and 2020 (Table 2), and then we discuss the CMS analysis results for the three subperiods: *i*) the pre-Great Recession and the Czech Republic joining the EU (2002–2008), *ii*) the post-Great Recession (2008–2014), and *iii*) the late post-Great Recession recovery before the COVID-19 pandemic (2014–2020) (Table 3).

From 2002 to 2020, the Czech Republic's agrifood exports to other EU Member States showed an average year-on-year change of +USD 390.4 million (Table 2).

The first level of CMS analysis estimates structural, competitiveness, and SOEs. The positive and dominant SE (+USD 297.1 million; +76.1%) was potentially the main reason for the increase in the value of the Czech Republic's agrifood exports to other EU Member States from 2002 to 2020. This effect suggests that three-quarters of the increase in the Czech Republic's agrifood exports in this period can be attributed mainly to the increasing demand for agrifood products. The Czech Republic could substantially increase its agrifood exports through keeping its market share constant.

The positive competitiveness effect (+USD 154 million; +39.5%) indicated an increase in competitiveness during the period of analysis. The intensity of the competitiveness effect was not as prominent as the contribution of the SE, potentially adding +USD 154.0 million (+39.5% in relative terms) to the increase in the Czech Republic's agrifood exports to other EU Member States.

The SOE's potential contribution to the changes in the Czech Republic's agrifood exports to other EU Member States was negative (–USD 60.7 million; –15.6%). A negative SOE means that the Czech Republic lost market share in the EU's fast-growing agrifood markets and gained market share in the EU's slow-growing agrifood markets. In a comparison of the export values for 2002 (the start of the analysis period) with the export values for 2020 (the end of the analysis period), the Czech Republic's market share declined from 3.9% to 2.4% in the fast-growing group. The fast-growing markets were mostly from Central and Eastern Europe: Romania (17.6%), Latvia (+16.3), Poland (+14.8%), Lithuania (+14.4%), Bulgaria (+11.9%), Slovakia (+11.1%), Slovenia (+10.7%), Croatia (+9.2%), Portugal (+8.3%), Hungary (+8.2%), Sweden (+7.9%), Austria (+7.4%), Estonia (+7.2%), Netherlands (+6.8%), Spain (+6.5%), Greece (+6.4%) and Italy (+6.3%). Results from the same analysis also suggested that the Czech Republic's market share had increased from 0.4% to 1.1% in the slow-growing group.

Table 2. Results of constant market share (CMS) analysis of Czech Republic's agri-food exports to the EU

2002–2020	Value (mill. USD)	%
Beginning of the period	1 291.8	–
End of the period	8 318.5	–
Year-on-year change	390.4	100.0
First level of analysis		
Structural effect	297.1	76.1
Competitiveness effect	154.0	39.5
Second order effect	–60.7	–15.6
Second level of analysis		
Growth effect	172.9	44.3
Market effect	120.2	30.8
Commodity effect	31.4	8.1
Structural interaction effect	–27.5	–7.0
Pure residual (general competitiveness) effect	206.9	53.0
Static structural residual (specific competitive) effect	–52.9	–13.5
Pure second-order effect	–2.2	–0.6
Dynamic structural residual	–58.5	–15.0

Source: Authors' calculations based on UNCTAD (2023)

To interpret these effects at the first level of decomposition, we analysed the second-level decomposition. In the second level of analysis, the SE consisted of four sub-effects: growth, market, commodity and structural interaction effects (Table 2). The second level of CMS decomposition further suggested that in the decomposition of the SE, a positive and dominant portion of the change in agrifood exports of the Czech Republic to other EU Member States was attributable to growth and market effects.

The growth effect measures the change in the Czech Republic's agrifood exports owing to the change in the total EU agrifood imports. The effect was positive and potentially contributed +USD 172.9 million (+44.3% in relative terms) to the increase in the Czech Repub-

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Table 3. Results of Czech Republic's constant market share (CMS) analysis in agri-food exports to the EU

Components of CMS	2002–2008		2008–2014		2014–2020	
	(mill. USD)	%	(mill. USD)	%	(mill. USD)	%
Beginning of the period	1 291.8	–	5 471.0	–	7 753.9	–
End of the period	5 471.0	–	7 753.9	–	8 318.5	–
Year-on-year change	696.5	100.0	380.5	100.0	94.1	100.0
First level of analysis						
Structural effect	617.9	88.7	148.1	38.9	125.3	133.1
Competitiveness effect	97.1	13.9	317.0	45.5	48.0	51.0
Second order effect	–18.5	–2.7	–84.6	–22.2	–79.1	–84.1
Second level of analysis						
Growth effect	381.8	54.8	90.9	23.9	46.1	49.0
Market effect	213.2	30.6	67.3	17.7	80.1	85.1
Commodity effect	77.2	11.1	7.4	1.9	9.8	10.4
Structural interaction effect	–54.3	–7.8	–17.5	–4.6	–10.8	–11.4
Pure residual effect	274.8	39.5	281.2	73.9	64.7	68.8
Static structural residual effect	–177.7	–25.5	35.9	9.4	–16.7	–17.8
Pure second-order effect	13.0	1.9	3.6	0.9	–23.2	–24.7
Dynamic structural residual	–31.5	–4.5	–88.2	–23.2	–55.9	–59.4

Source: Authors' calculations based on UNCTAD (2023)

lic's agrifood exports. This finding was expected because of the general increase in the EU trade amongst Member States after market liberalisation.

The market effect reflects the effect of the Czech Republic's market distribution on its export performance. The market effect potentially contributed +USD 120.2 million (+30.8% in relative terms) to the increase in the Czech Republic's agrifood exports. On average, between 2002 and 2020, exports to fast-growing EU markets constituted 68.0% of the Czech Republic's agrifood exports to other EU Member States. During the same period, exports to slow-growing EU Member States constituted 32% of the Czech Republic's agrifood exports.

The commodity effect shows the compatibility between the Czech Republic's agrifood exports and the products imported into the EU markets with faster growth. The commodity effect was positive (+USD 31.4 million; +8.1%), implying that the Czech Republic concentrated its agrifood exports to the EU on the fast-growing commodities.

The commodity groups revealing faster-than-average growth were, for example, animal and vegetable fats and oils (+9.4%), other cereal meal and flours (+8.5%), maize (+8.2%), other cereals (+8.0%) and fixed vegetable fats oils (+7.9%). The fast-growing commodities, on average, constituted 53.9% of the Czech Republic's agrifood exports. This finding suggests that, in the Czech Republic's agrifood export dynamic, the territorial shape and composition of the Czech Republic's agrifood exports contributed to the change more than the product's shape and composition did.

The structural interaction effect indicates the extent to which the change in the Czech Republic's agrifood export was attributable to the interaction of the market distribution effect and the commodity composition effect. Despite the market and commodity effects having separately contributed positively to the Czech Republic's change in agrifood exports, the mutual interaction was attributable to a potential decline in –USD 27.5 million (–7.0% in relative terms). This finding is a powerful testimony to the sensitivity of CMS methodology and needs to be investigated more intensively to fathom further its usefulness and contribution to export trade analysis.

Amongst the effects at the second level of analysis, the pure residual effect (general competitiveness effect) was the strongest and contributed the most to the growth of the Czech Republic's agrifood exports (+USD 206.9 million; +53.0%). This effect indicated a general increase in the competitiveness of the Czech Republic's agrifood exports into the EU markets. The static structural residual (specific competitive) effect was slightly negative (–USD 52.9 million; –13.5%). The static structural residual effect was negative when a specific product's competitiveness in the structure

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of the Czech Republic's agrifood export (reflected by market share) did not favour the Czech Republic's agrifood export. Therefore, although the Czech Republic increased its competitiveness in agrifood export in general, the composition of exported products slowed down the growth of the Czech Republic's agrifood export in total.

The pure SOE measures the effect of changes in the size of the EU's demand on the Czech Republic's exports, assuming the structure of the EU market demand is unchanged. The effect was negative (–USD 2.2 million; -0.6%), which means that despite improving the Czech Republic's competitiveness in agrifood exports, there was still inconsistency with the change in the extent of the EU agrifood markets. However, although negative, the size and effect of were minimal.

The dynamic structural residual effect explains the interaction of the Czech Republic's market share with changes in the structure of the EU market demand. The effect was negative (–USD 58.5 million; –15.0%), meaning the EU market demand was not growing rapidly for those agrifood products whose share of the Czech Republic's export was increasing. This is an important finding, suggesting a problem with the specialisation profile in the structure of the Czech Republic's agrifood exports.

Up to this point, the results of the CMS analysis of the changes in agrifood trade during the extended period (2002–2020) have suggested that the structural and competitiveness effects were positive and the SOE was negative. In the last part of the results and discussion, the further decomposition of the CMS analysis will continue and be focussed on the three subperiods. The analysis of these three subperiods revealed changes in the significance of the individual effects over time and, thus, a change in their influence on shaping the growth of agrifood exports (Table 3).

The results of the analysis suggest that the importance of the SE was decreasing, whereas the importance of the competitiveness effect was increasing. This shift means that the changes in the Czech Republic's agrifood exports to EU Member States were becoming less intensively shaped by the change in the size of the agrifood imports to the EU market but were instead shaped by changes in the Czech Republic's competitiveness (an increase in the market share). A negative structural interaction effect was becoming more prominent, which means that the Czech Republic has lost market share in thriving markets and gained market share in shrinking markets. This finding suggests that the Czech Republic's agrifood exports to other EU Member States were not adequately aligned and that the potential of the Czech Republic's agrifood exports was not being achieved.

The SE was again decomposed into four sub-effects: growth, market, commodity and structural interaction effects. When we compared the pre-Great Recession subperiod (2002–2008) with the post-Great Recession subperiod (2008–2014), the results showed a slowdown in agrifood imports from EU Member States from +15.3% per year to +2.7%. The average contribution of the growth effect decreased from USD 381.8 million (54.8%) to USD 90.9 million (23.9%) per year. During the last subperiod between 2014 and 2020, the growth in the agrifood imports of EU Member States declined even more to +0.8% per year. The average contribution of the growth effect decreased in absolute terms to +USD 46.1 million. However, according to the small average year-on-year value changes in the Czech Republic's agrifood exports, the effect had a fairly high relative contribution of 49.0%. The results of the analysis of the growth effect demonstrate the link between the growth of demand in EU markets and the growth of Czech agrifood exports. Given the high territorial specialisation of Czech agrifood exports to the markets of other EU Member States, the dynamics of Czech agrifood exports will continue to be highly dependent on the dynamics of import markets in the EU.

The market and commodity effects during the subperiod between 2002 and 2008 and the subperiod between 2008 and 2014 were positive, but there was a decline in their contribution to the Czech Republic's growth in agrifood exports. In relative terms, the market effect declined from 30.6% to 17.7%, and the commodity effect almost ceased to play a role (declining from 11.1% to 1.9% of the average year-on-year value of change). In the last period (between 2014 and 2020), the growth in the Czech Republic's agrifood exports became the slowest, compared with that in the other subperiods included in the analysis. In this context, the market effect became the most contributing effect amongst all the CMS effects, with a relative importance of 85.1%. The commodity effect's relative importance increased slightly to 10.4%. This dynamic suggests a process of adjustment in the territorial and commodity structure of the Czech Republic's agrifood exports to other EU Member States. In the post-Great Recession subperiod (between 2008 and 2014), traditional (pre-Great Recession) export markets and commodities were the ones that experienced below-average growth rates. Despite the further slowdown in market growth and continued stagnation during the following period (between 2014

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and 2020), Czech agrifood exports increased through targeting faster-growing markets (territorially and partly in terms of commodities). However, there is still room for improvement because the structural interaction effect was small but negative.

After the decline in the growth of agrifood imports of the EU Member States, the pure residual (general competitiveness) effect became more prominent and one of the main contributors to the changes in the Czech Republic's agrifood exports in the post-Great Recession subperiod (between 2008 and 2014) and the late post-Great Recession recovery subperiod (between 2014 and 2020). The higher general competitiveness effects contributed 73.9% and 68.8%, respectively, of the average year-on-year changes in the value of the Czech Republic's food exports to the EU market during the subperiod from 2008 to 2014 and the subperiod from 2014 to 2020.

The static structural residual (specific competitive) effect revealed mixed results. In the precrisis subperiod, the specific CE contributed –USD 177.7 million (–25.5%), and then +USD 35.9 million (+9.4%) and –USD 16.7 million (–17.8%), respectively, in the post-Great Recession subperiod and late post-Great Recession recovery subperiod. This effect would be positive when a specific product's competitiveness favours the country's exports. Like the structural interaction effect, this result suggests room for possible improvement and a possible way to increase the Czech Republic's agrifood exports.

The pure SOE suggested a slightly positive but minimal change during the first and second subperiods and a negative change (with a –24.7% contribution) in the last subperiod. This effect would be negative when the change in export competitiveness of the Czech Republic's agrifood products is inconsistent with the size of the EU agrifood market.

The dynamic SE was negative in all three subperiods. When we compared its relative contribution, the dynamic SE became more prominent throughout the period (between 2002 and 2020). Its relative contributions were –4.5%, –23.2% and –59.4% in the first, second and third subperiods. Negative values suggest that the EU market demand for agrifood commodities grows, whereas the share of the Czech Republic's export to the region is declining. These two effects revealed another potential bottleneck slowing the increase in the Czech Republic's agrifood export to the other EU Member States.

CONCLUSION

In this article, we separated the different components of the changes in the Czech Republic's agrifood exports to the EU Member States and identified the magnitude of the influence of the change in competitiveness and other determinants during the period between 2002 and 2020. The analysis results show that several external and internal changes and shocks in the business environment of the EU agrifood market affected the exports during the identified subperiods during the total 19-year period.

Given the specialisation of the Czech Republic's agrifood exports into the EU market, the SE at the first level of the CMS analysis and the growth effect at the second level indicated the influence of the import dynamics of the EU Member States on changes in Czech agrifood exports. The slowdown in the EU Member States' agrifood imports had a direct effect on the growth rate of the Czech Republic's agrifood exports. As long as the Czech agrifood trade into the EU market remains so specialised, export dynamics will continue to be affected. These findings support the Strategy of the Ministry of Agriculture of the Czech Republic with a view to 2030 (Ministry of Agriculture of the Czech Republic 2023). One of the objectives of this strategy (Objective C1) is to increase export performance, particularly for higher value-added products, and to seek new markets outside the EU. Priority should be given to identifying, promoting and facilitating access to fast-growing markets with the possibility of adequate and effective access.

The results of the competitiveness effect analysis make an important contribution by confirming an improvement in the overall competitiveness of Czech agrifood export to other EU Member States. In addition to the dynamics of EU Member States' agrifood imports, changes in competitiveness play an important role in the Czech Republic's efforts to increase its agrifood exports. The changes in competitiveness partly compensated for the slowdown in the EU Member States' agrifood imports and the effect on the Czech Republic's agrifood exports; however, we must also emphasise that the positive contribution of the competitiveness effect increased over the period considered.

We also found effects in the CMS analysis that reveal factors that negatively contribute to (and slow down) the Czech Republic's agrifood exports into the EU market. The territorial and commodity specialisation of Czech agrifood exports to other EU Member States' markets does not always exploit the full growth potential of these markets. Given the lack of options available to the Czech Republic, as an EU Member State, to support its agrifood exports to the EU market, the use of soft instruments and indirect instruments

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(e.g. export advisory and information services, business contacts and statistics, infrastructure and human resources) should be improved to increase compliance in the structures of Czech export and EU import.

Our study is also subject to the general limitations of CMS methodology. Although CMS methodology is predominantly descriptive, it could provide important insights into the formulation of hypotheses for future research and complement other methods of empirical trade analysis.

In addition to the contribution that this article makes to the existing literature on agricultural trade and competitiveness, we believe that the study also makes a practical contribution. The results of the analysis are particularly useful and relevant to the policy decision-making process and the design of policy recommendations, as they support a more evidence-based approach to policy formulation. The findings of this study can help inform industrial, agricultural and trade policymakers when assessing the nature of liberalisation and structural transformation of the agribusiness sectors in the Czech Republic and their potential benefits and risks. This analysis also creates the need and opportunity for further research on the subject. We suggest conducting similar comparative studies of the export dynamics of other EU Member States (such as using the adapted CMS model) to analyse the EU market for specific commodities that influence the Czech Republic's agrifood export performance.

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