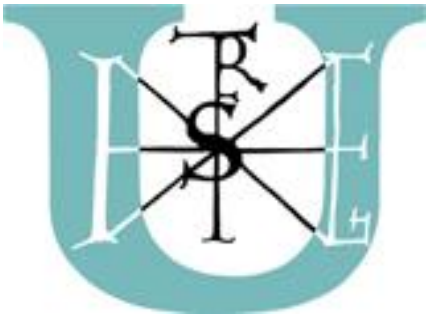

SZENT ISTVÁN UNIVERSITY

Doctoral School of Management and Business Administration

COMPETITIVENESS OF THE FOREIGN TRADE OF BEEF SECTOR

DOCTORAL (PhD) DISSERTATION

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1. INTRODUCTION

TOPICALITY

On the pasture lands of Hungary high quality beef can be produced by extensive rearing. Extensive rearing refers to a natural fattening method – thus, another BSE epidemic and consequently, the loss of trust on the side of the consumers can be avoided. On the other hand, extensive rearing provides employment for the residents of rural Hungary.

Hungarian cattle and beef export was substantial until the 1980s. The number of cattle in Hungary was continually dropping, and the significance of its export also declined. Nowadays, however, such processes have started which can contribute to the proliferation of our cattle and beef export. Export to Turkish, Russian and other non-EU countries has started to boom. In my dissertation, I investigate the export trade of cattle used as beef cattle from various perspectives. The direct production properties of these cattle breeds, which indicate the profitability of the animals, are their meat performance abilities. The economic significance of this property is a key issue in the case of animals bred for beef production (Stefler et al., 1995).

The European Union accession in 2004 appeared as an outstanding opportunity not only to Hungary but also to the East-Central European countries: beef cattle rearing was the mostly supported sector by the Union. Almost all impact studies done during the negotiation phase of the EU accession gave a positive opinion about the expected effects.

The investigation of the effects of the EU accession is still a topical issue, since problems resulting from the adoption of the subsidy system and the competitiveness of agriculture have still had a lasting effect even today; and the analysis of the challenges posed by the financial and economic crisis of 2008 raises further questions for investigation. Negotiations, however, have not been concluded with the EU accession; those working in agriculture still have to continuously follow the changes of the agrarian system of the EU. Being up to date is of utmost importance in order to be able to take advantage of arising opportunities so that competitiveness can grow.

The notion of competitiveness, as summarised by Rapkin (1995) is: "the competitiveness of a nation is the benchmark which shows to what extent it is able to create marketable products and services for the world market under perfect terms of competition (...)". Thus, it is always connected to some kind of economic performance. Reaching the competitive edge is never to the disadvantage of another country, but it is the development of a country compared to its previous state (Lengyel, 2003). Competitiveness can be approached by

trans-border, industrial sector, or corporate levels (Lengyel, 2000). In my dissertation, I have conducted the competitiveness investigations on the level of countries, namely on a macro-level, more specifically by using ex post type indices. I examined the external trade competitive position of cattle and beef within and outside the EU28 from various perspectives. I extended the comparative and competitiveness analyses to the V4 countries: Hungary, Poland, the Czech Republic and Slovakia, since we share a similar historical and economic background.

In my study, I have examined the cattle and beef target countries of Hungary within and outside the EU. Its topicality is based on the substantial Turkish cattle export of 2011-2012, which shed light on the importance of target markets outside the EU28; furthermore, the commercial risk of losing thereof. I have compared the characteristics of export to the EU as well as third countries.

I consider the analysis of agriculture from any perspective of great importance because its situation deteriorated at first in the era after the political transformation due to privatisation, and the loss and transformation of its buyers markets. After the EU accession as a part of catching up, compliance to accession conditions meant considerable expenses, especially in the stock-breeding sectors. From another perspective, the role of agrarian sector today is not only to produce sufficient quantities and qualities of food, but also to help rural areas catch up, to prevent rural inhabitants from migrating to cities, sustainable development, to preserve biodiversity, and to create a competitive agriculture.

Cattle and beef is only a small segment of the foreign trade of Hungary. However, comparing the findings of the analyses to the other Visegrad Four countries can yield such additional information which can be used to improve the foreign trade position of the Hungarian cattle breeders.

AIMS

The aim of my research is to gain a comprehensive insight into the competitiveness of foreign trade of cattle and beef from Hungary and the V4 countries, and to explore its role and magnitude in the EU28 market.

In the case of Hungary, I also examined the import of cattle and beef target countries, and their importance of their export to countries outside the EU.

For this reason, I formulated the following, more detailed aims:

I. Literature review:
    1. Reviewing the state of beef production on the world market, and the markets of the European Union and Hungary. Studying the state and significance of beef import-export.

2. Clarifying the notions of competitiveness and comparative advantage. Presenting the relevant critical remarks. Presenting the indices formulated by researchers.
3. Brief presentation of the main cattle and beef export target countries of Hungary.

II. Aims of the secondary research:

1. The application of the indices for measuring comparative and competitive advantage which were discussed in the literature review. The analysis of cattle and beef export-import of the V4 countries in a competitive environment within the EU28 markets.
2. The investigation of the substantiality of Hungarian cattle and beef in countries which import Hungarian cattle and beef within the EU28.
3. The investigation of the substantiality of non-EU target countries.

2. METHOD AND MATERIAL

2.1. SPECIFYING DATA SOURCES

I based my dissertation on an in-depth interview method for formulating my research questions. I contacted farmers and experts in marketing beef. In-depth interviews are a widely used method in extensive exploration of the research topic in the preliminary phase of research. The researcher asks open-ended questions based on an interview schedule which can be asked in any order. This method is suitable for developing and testing hypotheses, exploring individual opinions, and exploring idiosyncratic information of individuals (Majoros, 2004).

In my doctoral research, I used data of the Eurostat as a secondary database for the period between 1999 and 2014.

The database of the Eurostat takes the SITC (5-digit) categories (used by the UNO) for the basis of investigation of foreign trade. This categorises livestock according to species, moreover, in some cases, according to cross-bred and pure-bred livestock. The main focus of my research is on cattle trade within the category of live animal trade, in addition, on the trade of beef within the category of refrigerated and frozen goods trade. Data contain trade of cattle and beef only which were sold for slaughter crossing borders, irrespective of whether it was beef cattle or the by-product of dairy industry. In the database, import is on cif parity, export is on fob parity[1]

Upon the expansion of the European Union in 2004, the interpretation of certain aspects of foreign trade changed for the V4 countries. Markets of the member states can be divided not only into domestic and external (third country) markets but also internal EU markets can be put into a distinct group. International literature calls this "intra EU trade", and it also appears as a distinctly handled data queue in the database of Eurostat. The reliability of the data queue falls short of that of data before 2004, since firms engaged in foreign trade declare the exported and imported quantities on a voluntary basis. In contrast, sales turnover crossing borders was registered by customs authorities before 2004 (König, 2007).

The reliability of data is further reduced by the series of VAT fraud, which attracted wide publicity in the media, whereby goods were transported, sometimes "on paper only", within the EU member states. In the uncovered cases,

1 Cif: the market value of imported goods on the customs border of the importing country, including all incurred freight costs to the customs border, and the insurance costs during transportation. Fob: the market value of exported goods on the customs border of the exporting country including incurred costs of transportation and insurance of goods to the customs border.

only facts whether meat or meat products were involved in the fraud were registered by the National Tax and Customs Administration of Hungary (NTCA). I found the following evaded VAT amounts on meat which also appeared in Hungarian press:

- 400 million HUF in 2015; Slovakia, Poland, Austria and Romania were the involved countries (web1, 2015)
- In December, 2014, the NTCA found 5 billion HUF worth of tax evasion involving Pagony Meat Ltd. (web2, 2015)
- In February, 2004 several billion HUF was frozen on the bank account of a company by the NTCA due to suspicion of tax evasion (web3, 2015)

This is not a comprehensive list, it only illustrates the magnitude of the fraud.

The accession to the European Union and the CAP reform contributed to the establishment of the possibility of the internal market, where, in theory, only differences due to comparative advantages have an effect on price formation. However, the introduction and the continuous increase of subsidies, and the opening of markets towards the EU, and the various buyer habits distort the study; hence the gained results have some limitations.

2.2. COMPETITIVENESS ANALYSES

I performed the competitiveness analyses on the data of the Eurostat database, in the Visegrad Four countries.

One of the simplest indices in the study is the import export coverage index (Török, 1996; Csáki, 2004):

$$C = \frac{X_i}{M_i}$$

where: X_i - export of product i, M_i – import of product i.

The interpretation of the index is: the export of a given product is what percentage of its import. If it takes a greater value than 1, this indicates an export surplus, thus, the investigated country is the net exporter of product i.

The method for the analysis of comparative advantage was first published by Balassa in 1965 (RCA – Balassa-index), which was later applied in several studies (Vollrath 1991; Laursen 1998; Fertő – Hubbard 2001; De Benedictis – Tamberi, 2004; Jámbor 2009).

The essence of this method is that the share of product export of a given country is examined in the entire export of the given country, which is compared with the share of product export of the reference countries in their entire export.

$$RCA_{ij} = \frac{\frac{EX_{ij}}{EX_{it}}}{\frac{EX_{nj}}{EX_{nt}}}$$

where:

EX – export
i – i country
j – j commodity
n – countries of EU27
t – all commodities

If the RCA takes a greater value that 1, the examined countries have a comparative advantage in the given product. If the value is below 1, than we talk about comparative disadvantage. According to Török (1996), an RCA value greater than 1 indicates only a quasi comparative advantage, since the country exports more of product j than expected. Bahar et al. (2012) also agree that the Balassa index only shows that a given country exports more (RCA>1) or less (RCA<1) of product j to the market under investigation compared to the reference countries.

The index has been widely criticized due to its asymmetrical values (Fertő, 2003) but Hinloopen and van Marrewjik (2001) developed a method which makes the index symmetrical. However, in my dissertation, I applied the index, whereby Larsen (1998) provided a correction which makes the index symmetrical: I used the RSCA, or Revealed Symmetric Comparative Advantage.

$$RSCA = \frac{RCA - 1}{RCA + 1}$$

The value of RSCA ranges from -1 to 1. The interpretation of the index is the following: if the RSCA is positive, the country has revealed comparative advantage in that product; if the value is negative, then it has a comparative disadvantage in the given product.

Based on this, Vollrath (1991) created 3 different specifications of the index, which was used for the analysis of international competitiveness of agriculture:

1. The relative trade advantage index (RTA):

$$RTA_{ij} = RXA_{ij} - RMA_{ij}$$

where:

$$RXA_{ij} = RCA_{ij} \qquad RMA_{ij} = \frac{\frac{IM_{ij}}{IM_{it}}}{\frac{IM_{nj}}{IM_{nt}}}$$

(IM – import)

The relative trade advantage (RTA) index, takes both the export side and the import side into consideration. The relative trade advantage index is originated from the difference between relative export advantage (RXA) – which is, in effect, the Balassa-index – and the relative import advantage (RMA). The RMA index is, in fact, the opposite of the import side of the Balassa-index (Fertő, 2003).

2. Logarithm of relative export advantage: lnRXA

   With the help of the logarithm, the index assumes a symmetrical value to the x axis. Vollrath corrected the asymmetrical "defect" of the index developed by Balassa.

3. Relative competitiveness (RC):

$$RC_{ij} = \ln RXA_{ij} - \ln RMA_{ij}$$

The aforementioned three indices indicate competitive advantage in case of a positive value, whereas in case of a negative value they indicate a competitive disadvantage. The advantage of the latter two indices lies in their logarithmic form, since in this case, the indices are symmetrical to the x axis. The advantage of the RTA and the RC indices compared to the Balassa-index is that they contain trade distortions, both their export and import sides (Fertő, 2006).

In the following, I applied the Gehlhar and Pick formula (2002), which is defined as Unit Value Difference (UVD, its unit of measure is EUR/kg).

$$UV_{ij}^{EX} = \frac{EX_{ij}}{Q_{ij}^{EX}}$$

$$UV_{ij}^{IM} = \frac{IM_{ij}}{Q_{ij}^{IM}}$$

$$UVD_{ij} = UV_{ij}^{EX} - UV_{ij}^{IM}$$

where:

UV – Unit value

IM – Import

Q – Quantity in natural unit of measurement

The other symbols mean the same as in Formula 1.

The positive UVD value means whether the unit value of export exceeds the unit value of import. Based on the UVD and trade balance (TB), the following categories can be generated:

1st category: UVD < 0 and TB > 0 success in price competition

2nd category: UVD > 0 and TB < 0 weak in price competition

3rd category: UVD > 0 and TB > 0 success in quality competition

4th category: UVD < 0 and TB < 0 weak in quality competition

The disadvantage of the UVD index is that it can compare two-way trade only between two countries. In order to loosen this assumption, the original UVD was modified as shown below:

$$MUVD = \frac{\sum(UV_{ij}^{EX} * Q_{ij}^{EX})}{\sum Q_{nj}^{EX}} - \frac{\sum(UV_{ij}^{IM} * Q_{ij}^{IM})}{\sum Q_{nj}^{IM}}$$

The MUVD (Modified Unit Value Difference) index examines the in-group trade of a country, namely what amounts a given country (Hungary) exports on average, and in what values it imports towards the investigated group on average. Prices were weighed with the amount of export/import in order to gain a realistic picture.

However, it must be noted that its interpretation slightly differs from the UVD index due to the greater number of trade partners. The Modified Unit Value Difference index describes the difference between the average price of export and import of a given product between multiple countries (it was investigated in the EU-27 member states; its unit of measurement is in EUR).

The Grubel-Lloyd index is suitable for measuring trade within a sector. Completing the competitiveness measures, their characteristics can be deduced from its results. Higher values suggest economic integration and advancement in development between the examined countries (Fertő – Hubbard, 2001; Nagy, 2009).

$$GL-index = 1 - \frac{\left| X_i - M_i \right|}{(X + M_i)}$$

The values range from 0 to 1, values close to 0 refer to trade between sectors, values close to 1 refer to trade within a sector. The bigger the difference between the export and import of a sector, the closer the value of the index is to 0, which refers to trade between sectors (Molnár, 2002).

2.3. THE STUDY OF EXPORT TARGET COUNTRIES

I have studied to which EU28 countries Hungary exports cattle and beef.

According to my findings, the most significant export target countries are the following: Austria, Greece, Croatia, Italy, the Netherlands, Romania, Sweden and Slovenia. I did the detailed analysis on the aforementioned countries.

First, I did a separate analysis to see the country of origin of the imported cattle and beef broken down into certain time periods (1999-2003, 2004-2008, 2009-2014). Then I examined the selected countries, how prominent Hungary was in cattle and beef import in the given country within the EU28 in the selected time periods, compared to the other exporting countries. As the next step, I identified the intensity of the concentration of Hungarian cattle and beef export. For this, I used the Herfindahl-Hirschmann index (Fertő, 2006; Nyárs, 2005).

$$H = \sum_{i=1}^{n} Z_i^2 \quad \text{Z – share of the sum of values (\%)}$$

The maximum value of the index is 1, which suggests total concentration. In fact, the index is none other than the arithmetic mean of shares of the sum of values weighted by themselves.

2.4. APPLIED STATISTICAL ANALYSES

The LDA is a statistical procedure which belongs to the group of dimension reducing methods. It enables the comparison of groups under investigation with the application of multiple scalar variables. After the analysis, it becomes apparent whether the data groups differentiate, and it also shows which variables play a role in the differentiation of the data groups (Ripley, 1996; Venables and Ripley 2002).

By performing the LDA, my aim was to find which variables have a crucial role in the balance of foreign trade in the V4 countries. Furthermore, another goal was to determine whether distinct categories could be created based on time periods according to distinct countries, namely pre-accession (1999-2003), post-accession and pre-crisis (2004-2008) and post-crisis (2009-2014). As an initial step, I used data of all four countries from the selected periods to support the differences between the countries. Afterwards, I ran the analysis according to distinct countries in order to demonstrate that a given country showed different characteristics in foreign trade in the pre-accession, post-accession and pre-crisis, and post-crisis periods.

The variables were standardized in case of both LDA runs prior to the test. In addition, pre-analysis was performed. Standardization was done by division by column average, so that the variables of differing magnitudes can contribute to the model with the same scale. I used one-way multi-variance analysis (one-way MANOVA) and Wilks' lambda test in order to show that there is a difference between the means of groups under investigation (Krzanowski, 1988).

I performed the LDA runs and the completion of the related figures with the help of R software package (mass, vegan and ellipse package) (R Development Core Team, 2014).

I specified the 5% significance level accepted by social sciences (Szűcs, 2002) as the reliability criterion of procedures, applied models during the variance analysis.

3. RESULTS

3.1. CHANCES OF COMPETITION OF THE V4 COUNTRIES IN THE FOREIGN TRADE DISTRIBUTION OF BEEF IN THE EU27

During the investigation of the chance of competition of the V4 countries, the first applied index was the **import export coverage index**. I projected the gained values to a logarithmic scale due to its asymmetric values. The Czech Republic and Poland were net exporters throughout the examined period examining cattle and beef foreign trade together. The peak data of 2011 in case of Poland and the Czech Republic were caused by the temporary decline of import. Regarding Poland, the import of pure-bred cattle dropped in this year, while in the Czech Republic the import of beef dropped considerably.

Regarding the accession in 2004, the values of the import-export coverage index in Hungary, the Czech Republic and Slovakia deteriorated, which was caused by the significant growth of import relative to export. Hungary became the net importer in the examined range of products from 2011, and Slovakia in 2011. This decline started showing an improving tendency in both countries in 2012. In 2013, Slovakia became the net exporter again.

Regarding beef trade and the meat market of living and slaughtered animals in total, only Poland had a detectable comparative advantage among the V4 countries based on the **RSCA** index in the period of 2004-2014. The 2004 accession brought an improvement in all four examined countries. However, the indices show deterioration from the following year in Hungary, the Czech Republic and Slovakia.

During the years of the economic crisis, Hungary shows the greatest recession. The Czech and Slovakian indices show an increase after the decline caused by the economic crisis. Even though the Polish market lost from its comparative advantage, it was able to retain it. The year of 2012 brought an improvement with regard to the RSCA index in all countries except Slovakia; and in 2013, the value of the index dropped only in the Czech Republic.

The **relative trade advantage index** (RTA) takes the import and also the export sides into consideration in contrast with the RSCA index. Poland has a competitive advantage in the examined years; the positive effects of the 2004 accession to the Union are clearly visible. Furthermore, the decline due to the recession is also observable in 2009-2011, whose rate was exceeded by the improvement of 2012, then the growth continued in 2013. In 2014, however, the value of the RTA index dropped.

Regarding Hungary, the years between 1999 and 2001 were a favourable period. In the following years, a slow decline started which resulted in negative values

from 2010. The year of 2012 brought a slight growth for Hungary also, which continued in 2013, but it could not exceed the value of 0. Thus, competitive disadvantage was characteristic. The value of the RTA index decreased again in 2014.

The accession to the Union caused a declining tendency in the values of the RTA index in Slovakia from 2004. The value of the index is negative in 2011 and 2012; however, it gained a competitive advantage again in 2013. The index of the Czech Republic shows a stagnant value at the beginning of the examined period. The accession and the recession moved the index into a negative direction, which could grow in 2012, but declined again in 2013. Although the country did not have a competitive disadvantage in these years, the Czech market could not gain a significant advantage either.

The **logarithm of relative trade advantage** (lnRXA), as its name suggests, takes only the export side into consideration. In the foreign trade of beef, examining the meat market of living and slaughtered animals in total, only Poland had a competitive advantage in the EU28 market among the V4 countries in 2004 and after 2004. The values of the InRXA support the results of the RTA analysis, namely that the 2004 accession did not bring an improvement in all of the countries. The indices deteriorated in two cases, in Hungary and Slovakia. A slight improvement is visible in the market in the Czech Republic, but it could not attain a competitive advantage according to this index. The recession had the most adverse effect on the values of Hungary, but there was an improvement in 2012-2013, as it is also reflected on the Polish and Slovakian indices. The year of 2013 did not bring about a positive change only in the Czech Republic.

The index of **relative competitiveness** (RC) takes both export and import sides into consideration. Based on this, it can be said that Poland and the Czech Republic had a competitive advantage throughout the examined years. The peaks in 2011 are the result of logarithm of low-value relative import advantage (RMA) indices.

The negative effects of the 2008 recession are clearly observable in the deterioration of the values of the indices. Hungary had a competitive disadvantage until 2010-2014 according to the index, while Slovakia had one only in 2011-2012 and 2014. In 2012, all four countries showed a minimal improvement in the values of the RC index. In 2013, the Hungarian and Slovakian values of indices improved, while the values of Polish and Czech index slightly deteriorated.

The RSCA index and the indices created by Vollrath do not provide sufficient information about competitiveness; therefore I performed the analysis with the MUVD index in order to gain a more objective result. The **Modified Unit Value Difference index** (MUVD) shows how big the difference is between the unit mean values of export and import in beef foreign trade within the EU28 markets.

A negative tendency can be observed in all four examined countries until 2010. The Czech Republic has a negative MUVD index from 2003; Slovakia has one from 2003 which shows that the export average prices were lower than the average import prices. The MUVD values of Hungary also show a negative tendency from 2005 to 2010 with the exception of 2008. The MUVD values of Poland also show a negative tendency in the examined period: the index is negative in 2003 and from 2006 to 2010. Despite the fact that Poland has a comparative advantage in the examined market, the price of import is gradually increasing compared to the price of export.

The Czech negative peak of 2008 was caused by a Slovakian import with a considerably high price in the cattle trade.

The values of the MUVD index improved in 2011 in the case of Poland, it took a positive value, which means that the unit value of export exceeded the unit value of import. The index values of Poland were stagnant between 2011 and 2014. Hungary is still in a negative range. In the Czech Republic, a slight improvement is visible from 2012 to 2014. In Slovakia, the values of the MUVD index were continuously falling after 2010 which continued until 2014.

As the next step of my research, I examined the **balance of foreign trade** to gain a more comprehensive insight into the markets under investigation. The accession to the EU had evidently a positive effect on Poland. The rate of export significantly grew compared to the rate of import. Within export, especially foreign trade of beef increased significantly.

A negative trend line can be drawn to the balance of foreign trade of Hungary in the examined years. There were positive expectations after the accession in 2004 for a short period of time, but after a sudden fall in 2005,the beef foreign trade index was continuously negative, which could be compensated for less and less by the trade of cattle. This is especially definitive after the recession, with the narrowing down of the market, whereby the balance of foreign trade of cattle also takes a negative value, which results in the drastic negative fall in 2011. In 2012 the foreign trade of beef becomes positive again, which improves the balance of foreign trade on the whole, but it does not turn it into active. In 2013 the balance of foreign trade is positive, which is due to the fact that the foreign trade of cattle has a positive balance again. However, the balance of beef becomes negative. In 2014 the total balance of foreign trade is negative again, since the export of cross-bred cattle decreased, and the import of pure-bred cattle and beef increased considerably.

After the examination of the Czech beef market, it is not possible to define a clear trend for the examined period. The accession to the Union did not bring about an improvement: the foreign trade of cattle gradually moved into a positive direction; however, the total result is negatively affected by the frequent, strongly negative values of beef. The balance of foreign trade is active in all the examined

years. In 2012 the Austrian and German export grew significantly, and dropped in 2013 and 2014.

The accession to the union facilitated some positive changes for Slovakia with regard to the balance of foreign trade. However, the recession of 2008 negatively affected the balance. The trade of cattle became stronger with the accession and showed a positive stable value even during the crisis. On the other hand, the balance of beef took a powerful negative tendency after the accession in 2004, which shifted the total value into a negative direction. In 2013 there was only a slight improvement in the foreign trade of Slovakian cattle and beef foreign trade which proved to be temporary. The value of the 2014 balance deteriorated.

In the following, I have examined the **Gehlhar and Pick correlation**. Hungary is successful in quality competition until 2004, and in price competition in 2005-2007. It is successful again in quality competition in 2008, and in price competition in 2009. It becomes poor in quality competition in 2010, and price competition in 2011. Afterwards, it weakens in quality competition in 2012-2014.

According to the Gehlhar and Pick classification, Poland is successful in quality competition of beef market of the EU28 until 2002, and it is successful in price competition in 2003, and again in quality competition until 2005. Between 2006 and 2010 it is successful in price competition, and then between 2011 and 2014, since the MUVD index is positive, again in quality competition.

The Czech Republic is successful in quality competition until 2003 according to the Gehlhar and Pick classification, except in 2001 when it is successful in price competition. Between 2004 and 2014, it is successful again in price competition.

According to the Gehlhar and Pick classification, Slovakia is successful in quality competition until 2001, then in price competition between 2002 and 2010. In 2011-2012 it is poor in quality competition and then, in 2013-2014 it is successful again in price competition.

Furthermore, trade within sector was analysed in the four countries with the help of the **Grubel-Lloyed index**. The values were approaching 0 in Poland in the examined years, which means that trade between sectors was forming, since cattle and beef plays an important role in the examined sector. Polish cattle and beef are horizontally differentiated products between 2005-2008, and 2010-2014, since the unit value of export stays within 15% in comparison to that of import. This suggests that products of almost the same quality are exchanged in export and import, which makes it possible that import is redeemed by self-produced beef.

The index values of the Czech Republic and Slovakia show a considerable decline in 2001 and 2002, which means that trade within sector is transformed into trade between sectors. It can be concluded that trade within sector

strengthened in these two countries and in Hungary after the accession, which is the way towards economic integration and development.

The examined products are vertically differentiated in Slovakia excluding the years of 2009 and 2010, which means that the price of export is 15% higher compared to the prices of import. Supposing that a higher product price means a higher quality product, the quality of the Slovakian beef does not reach the quality demanded by the market. Cattle and beef compared to each other were horizontally differentiated based on the unit value of price in the Czech Republic in 2001, 2003, 2004, 2006, 2010, 2013 and 2014. In Hungary, cattle and beef were horizontally differentiated in 2004-2008 and 2011-2012, which means they were each other's perfect substitutes according to the export and import unit price.

The **linear discriminant analysis** strongly separated Poland from the other V4 countries. The property vectors also support the findings: Poland stands out regarding the number of cattle, balance of foreign trade, the export of beef and cross-bread cattle, and the import of pure-bred cattle. Slovakia's position is the worst according to the same index. Then, data points belonging to Hungary (Slovakia and Hungary were not differentiated based on the 95% reliable confidence interval ellipses) and the Czech Republic are located the nearest to the origin. According to this, the Czech results are the closest to the average of the V4s. The cross-bred cattle import, beef import and pure-bred cattle export variables did not affect the proposed model, since they did not help in the differentiation of the countries.

3.2. CATTLE AND BEEF EXPORT TARGET COUNTRIES OF HUNGARY WITHIN THE EU

The export concentration of Hungarian cattle and beef was analyzed with the help of the Herfindahl-Hirschmann-index (HHI) (Figure 33). Pure-bred cattle trade is the most concentrated; in 2002-2003 this was taken over by cross-bred cattle export, and in 2012 by beef export. During the examined period, the export of Hungary was mainly limited to Austria, Croatia, Romania, and Greece. The lower value of 2002 was caused by an ad hoc export, when there were larger quantities to Estonia and Romania, and export decreased to Germany and the Czech Republic. Later the list of export countries expanded. After 2004, the decrease of HHI was caused by the exploitation of the market opportunities, the possibility to deliver to the EU. Consequently, there was pure-bred cattle export towards more, new target countries such as Bulgaria, Italy, Slovakia, Slovenia and Poland – export was in every year and on a regular basis. The peak values in 2011 were caused by the substantial Greek export.

The export of cross-bred cattle is less concentrated, and delivery is done on a regular basis to multiple countries, such as Austria, Germany, Greece, Croatia, Italy and Slovenia. Hungary also exports cross-bred cattle to Holland, Romania and Spain less regularly. Export to Croatia was substantial in 2002 and 2003, which gives the higher HHI values. After 2004, the exported quantities increased to the aforementioned, infrequent target markets. The biggest quantities are exported to Austria, the prominence of Croatia has slightly decreased; furthermore, Greek export was considerable until the recession.

Cattle foreign trade is less concentrated owing to the fact that Hungary exports to multiple countries; and the single batches are not extraordinarily high. As a result, the values are more balanced. The main export target countries are Austria, Bulgaria, Denmark, Italy, Holland and Sweden.

The total HHI index usually has the lowest value, which suggests that cattle and beef shipments get to different target markets, fragmenting the foreign market in general.

3.3 CATTLE AND BEEF EXPORT TARGET COUNTRIES OF HUNGARY OUTSIDE THE EU

I analysed the concentration of Hungarian cattle and beef export also in the target countries outside the Union with the help of the **Herfindahl-Hirschmann-index** (HHI). Hungarian cattle and beef export to non-EU countries was concentrated in 1999-2003 and 2011-2012. At the beginning of the examined period, export was substantial to Croatia, and there were smaller exported quantities to Russia and Lebanon. In 2011 and 2012 the Turkish export was so considerable that the HHI values show a high degree of concentration. In this period there were exports to Lebanon, Belarus, Russian and Croatia worth several million Euros. However, Turkish export greatly exceeded the rate of this. Export was temporary towards the examined countries with the exception of Croatia, and Russia from 2003 until the end of the examined period.

Having analysed the balance of foreign trade, the export of cross-bred cattle is the most prominent towards countries outside the EU. Starting from 2005 and until 2011, the export of pure-bred cattle could also continuously grow. However, this tendency changed direction in the following years, and export was decreasing until 2014. Export was considerable primarily to Russia, Belarus, then in 2011 to Turkey; in 2013-2014 Azerbaijan imported from Hungary in greater amounts.

There is no cattle or beef import from countries outside the Union. The only exception was in 2013-2014: cross-bred cattle arrived from Croatia to Hungary, but in effect, this does not classify as import outside the Union, since Croatia is a member state from 1 July 2013.

As there is no import from these countries, the C, RSCA, RTA, InRXA, RC, MUVD, and GL indices are not applicable. Instead of the MUVD index, I calculated the average price weighted by quantity based on the export data. The price of export to Russia and Belarus is the highest during the examined period. The lowest prices are the export prices of Lebanon. Despite the prominence of the Turkish export, it is only higher than the average price only in 2013, which is, in that year, lower than in the previous and following years due to the Croatian and Lebanese prices. In the examined period, the Croatian average prices were growing gradually until 2011, and then decreasing until 2014.

The export average prices are generally higher towards the countries outside the Union, than the average prices of cattle and beef export within the Union – the average price outside the EU is higher in 2002-2003 and 2006-2014.

The MUVD index can be calculated in the case of Croatia for 2013-2014, which is negative. Consequently, imported cross-bred cattle are more expensive than the value of exported ones.

Similarly to the trade within the EU, the export of cross-bred cattle is characteristic. Regarding the average prices in countries where Hungary exports regularly and/or in big quantities (Turkey, Croatia), the average price is lower compared to the other countries.

4. NEW AND NOVEL SCIENTIFIC RESULTS

1. The complex introduction and overview of indices of comparative advantage and competitiveness analyses

In my study, I have summarised the comparative advantage and competitiveness indices, which are relevant from an agricultural perspective, in a novel, complex fashion. I have presented the possible limitations of indices; moreover, I proposed possible solutions to the limitations.

2. The introduction of the Modified Unit Value Index (MUVD - Modi)

In my dissertation, I modified the Unit Value Difference index (UVD) used by Gehlhar and Pick in order to make it possible to show the difference between the export and import average price of a selected product between multiple countries. The new MUVD (Modified Unit Value Difference) index analyzes trade within group of the selected country, i.e. in what amount the examined country exports and imports a specific product in the given group. The formula is the following:

$$MUVD = \frac{\sum (UV_{ij}^{EX} * Q_{ij}^{EX})}{\sum Q_{nj}^{EX}} - \frac{\sum (UV_{ij}^{IM} * Q_{ij}^{IM})}{\sum Q_{nj}^{IM}}$$

where: UV - Price, EX - export, IM - Import, Q – Quantity in natural unit of measurement

3. From the years before the accession until today (1999-2014) the foreign trade of cattle and beef was evaluated in the Visegrad Four countries. Poland is the only country among the examined group of countries which gained a considerable advantage in cattle and beef foreign trade in the period after the accession.

I analysed the effects of the EU accession on the foreign trade of cattle in the V4 countries with the help of comparative advantage and competitiveness analyses. Price competition became pronounced in all four countries. Hungary and Slovakia were badly affected by the crisis, their cattle export dropped. These changes were less severe in the Czech Republic, and Poland did not suffer a significant decline.

In my study, the findings of the applied indices all support that the winner of the accession to the European Union is Poland. Not only the value and quantity of exported cattle and beef is significant, but also the amounts of incoming products were limited. Its advantage was further increased by the fact that it exports beef while it imports cattle in a small quantity – it conducts trade between sectors with regard to beef and cattle. According to the Gehlhar-Pick classification, on the whole, it has a successful quality competition or successful price competition on the examined market.

4. Complex study of the export target countries of Hungarian cattle and beef

I showed with scientific methods that our significant target countries are not only the neighbouring countries. Despite the fact that Hungary delivers considerable amounts, Hungarian cattle and beef usually do not have a crucial amount in the import of target countries. Furthermore, I verified that cattle and beef export to the target markets outside the EU28 is significant. In addition, export was concentrated to Croatia in 1999-2003 and to Turkey in 2011-2012.

In the examined sector, the fact that the Hungarian cattle and beef target markets are concentrated only for short periods, and the balance of trade is falling, shows the problem of long-term market maintenance. This is further supported by the statistical analysis, which shows with property vectors that despite the growth of trade activity, Hungary was affected by unfavourable processes. Due to the economic crisis, Hungary lost significant target markets within the Union; furthermore, serious problems arose in the delivery to Turkey which resulted in the loss of market.

5. CONCLUSION AND RECOMMENDATIONS

Summarising the findings of my research, it can be concluded that the previous optimistic expectations concerning the effects of the accession to the Union on the beef cattle sector were not met. Among the Visegrad Four countries, only Poland was able to take the advantage of the opportunities created by the opening of the markets, and could resist the influx of cattle and beef.

Revisiting my hypothesis proposed at the initial stage of my research, it can be concluded that **H1 hypothesis**, which suggests that the accession to the Union of the V4 countries will result in the increase of comparative and competitive advantages in the case of the examined products on the EU28 market, **is only partly confirmed. Comparative and competitive advantage increased only in Poland** with the EU accession. In Hungary, the Czech Republic and Slovakia, there was only a temporary improvement in 2004, but in the following years, comparative disadvantage was growing. Only Poland could increase its beef export among the Visegrad Four.

In the three other examined countries, it was cattle export which was characteristic, and the import of beef. Regarding Hungary and Slovakia, the RSCA and InRXA indices show that they export less of the examined product compared to the reference countries. The Czech Republic exports more than the average of the reference countries, but this does not cover the internal needs – as Veznik et al. (2013) demonstrated – so the large extent of beef import deteriorates the values of the indices. With the exception of Poland, the examined countries are net importers of products whose consumptions could be covered by internal production. After the accession, the turnover of foreign trade grew in terms of value and quantity in the case of the examined products, as concluded by Vásáry et al. (2012) concerning agrarian-foreign trade in the V4 countries on the EU27 market.

With the unfolding of the financial and economic crisis, there was a recession in all of the examined countries to some extent. However, the recession did not necessarily start in 2008 in all of the countries: there was an improvement in the values of the indices of Poland from 2009, then there was a somewhat decreasing tendency from 2010. Hungary and Slovakia suffered the greatest loss among the four examined countries. Poland could retain its strong position in spite of a slight loss.

It must be noted that the only characteristics which the V4 countries have in common is that in all four countries, **distinct periods can be clearly differentiated**: pre-accession (1999-2003), post-accession, pre-crisis (2004-2008) and post-crisis (209-2014), which was explored with the help of the **linear discriminant analysis.** Different imported and exported goods are characteristic

in different periods, and naturally, the effects of this fact are reflected in all of the examined indices.

I consider my **H2 hypotheses confirmed**, since the Gehlhar-Pick classification showed price competition in all of the examined countries on the examined markets. Moreover, the values of the MUVD index show that the V4 countries **attempted to gain a bigger share on the EU market by reducing the export prices**, and to stay in the market**.** While the export prices decreased, the prices of import increased. This was the reason why the problem, that the value of exported cattle and beef did not cover the value of import, further escalated in Hungary the Czech Republic and Slovakia. This could be solved by satisfying internal demand with domestically produced products. Another solution could be the export of beef instead of cattle, which means a higher added value. The only change in the Gehlhar-Pick classification was in Poland: it started to direct its export towards quality competition regarding cross-bred cattle and beef. However, this reversed by 2013.

Further examining the foreign trade of cattle and beef, **I partly proved my H3 hypothesis**, namely that trade between sectors gradually transformed into trade within sector in the foreign trade of cattle and beef of the Visegrad Four countries. With the exception of Poland, the Grubel-Lloyd index indicated the transformation of trade between sectors into trade within sector, which also suggests that values of export greatly exceeded values of import. However, these findings have to be treated with caution, since, in the case of Hungary and the Czech Republic between 2010 and 2012, the values approaching zero are the result of the high rate of import.

Comparing the values of the MUVD and Grubel-Lloyed indices of Poland, it can be concluded that cattle and beef were **horizontally differentiated products** in 2005-2008 and 2010-2014. In other words, products of nearly the same quality were exchanged in export and import. The examined products were vertically differentiated in Slovakia with the exception of the years 2009 and 2010, which means that the quality of the Slovakian cattle does not reach the quality demanded by the market. Cattle and beef in relation to each other were horizontally differentiated based on the unit value of price in the Czech Republic in 2001, 2003, 2004, 2006, 2010, 2013, and 2014; and in Hungary in 2004-2008 and 2011-2012.

Based on the data available and the calculated indices, it can be stated that **Poland could take advantage of the new opportunities in the cattle and beef market which opened up with the accession to the Union.** It was able to find its export target countries, and it could maintain good relations with them during the time of the crisis. In addition, it sold high quality products to the international market. Among the examined products, beef is the most substantial one which already went through some minimal processing, so the value received is higher than that

of cattle. In general, the 2004 accession brought positive changes for the Czech Republic. It was able to grow its foreign trade towards the EU28 countries, and could sell cross-bred cattle at a good price which is the most prominent product among the examined ones. Regarding cattle and beef export, the EU accession brought losses for Slovakia, which can be partially explained by the assumption that a lower price means lower quality meat. The import of beef is so significant that it could not be counter-balanced by the export of cross-bred cattle. The internal demand for beef should be satisfied with its own production, which is also advisable for Hungary.

The most important goal in cattle and beef foreign trade **in Hungary, the Czech Republic, and in Slovakia** is the production and export of products of high added value which were produced from domestic raw materials. At present, the opposite of this is realized: **the import of processed products and the export of mass products are characteristic.** Poland is the only country which could achieve this goal in the foreign trade of cattle and beef.

My following hypotheses are connected to the further examination of Hungarian cattle and beef foreign trade. **I rejected my H4 hypothesis,** since the Hungarian Herfindahl-Hirschmann-index has a low value, which suggests that **cattle and beef shipments are delivered to various target markets**, so, on the whole, foreign market is fragmented. Hungary delivers cattle primarily to Austria, Greece, Germany, Italy, Slovenia, and Romania. It delivers beef to Austria, Bulgaria, Denmark, Italy, the Netherlands, and Sweden. Upon the accession, export opened up to countries further from Hungary – such as the Netherlands and Denmark – and the quantities towards older target countries grew.

Hungarian beef is not only delivered to the neighbouring member states in considerable quantities, so **I proved the first part of my H5 hypothesis.** The most important target markets of Hungary in cattle and beef foreign trade regarding the years between 1999 and 2012 and the delivered quantities are: Austria, Greece, Croatia, the Netherland, Italy, Romania, Sweden, and Slovenia. The strengthening of delivery to further countries occurred not necessarily after the accession to the EU. It was before 2004, when Hungary delivered significant quantities of beef to Sweden, after that only occasionally, and not in considerable quantities – Poland and the Netherlands took its place.

Having examined **the second part of my H5 hypothesis, I confirmed** that even though **the exported quantities are considerable amounts for Hungary, these are only a small segment of the total import for the importer countries.** Consequently, it can be assumed that our bargaining position is weak. I have studied the role that Hungary and the other member states play in the beef import of the previously discussed countries. Before the accession, Hungarian beef was mainly delivered to Slovenia, the Netherlands, and Italy. This amounts to only 1-2% of the two latter countries. Hungarian beef import exceeds 52% on the

Slovenian market, which was 13% of the Hungarian export in general in 1999-2003. Hungary exported substantial quantities to Romania also: it amounted to more than 50% of the purchased cattle and beef. With the accession to the Union, export strengthened towards Austria and the Netherlands. However, countries which joined the Union at the same time as Hungary were important competitors, thus, export decreased to Italy Romania, and Slovenia. From the beginning of the crisis, the imported quantities increased in all of our export target countries, but the Hungarian export grew only to a moderate extent.

The examination of beef import of the individual countries showed that Poland gained a considerable ground. It exported beef to the markets of Austria, Sweden, and Italy, but its significance dropped in Slovenia.

Having studied Hungary's export target countries outside the Union, **I partly confirmed my H6 hypothesis**, which says that Hungary's cattle and beef export to non-EU countries is concentrated. I proved the first part of my hypothesis with the help of the Herfindahl-Hirschmann index: our cattle and beef foreign trade **was concentrated in the direction of Croatia in 1999-2003 and of Turkey in 2011-2012.** But in the other years which were studied, we cannot speak of concentrated target countries. Regarding the average prices, the export prices of cattle and beef which were exported to countries outside the union were higher in 2002-2003 and 2006-2014. With the further increase of export, Hungary is able to achieve a higher profit on unit cattle and beef, than by selling in countries of the EU28. Thus, my recommendation is that Hungary should increase its export to countries outside the union. More specifically, export should be increased to the Russian market, because the average prices were the highest there. Furthermore, trust should be regained on the Turkish market, since higher prices and export in bigger quantities can bring extra profit. Export of beef should be increased to the non-EU market as opposed to the export of cattle.

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