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Vlada Vitunskiene, Evaldas Serva[*]
Aleksandras Stulginskis University, Lithuania

Shifts in Lithuania's Agri-food Industry Export Competitiveness: a Comparative Analysis Versus High- and Medium-high Technology Manufacturing Industries[**]

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Keywords: *agri-food; manufacturing; end-use category; export*

Abstract: *Given the rising importance of global value chain, this paper analyses long-run shifts in export competitiveness of Lithuania's agri-food industry compared to high and medium-high-technology industries in the context of Lithuania's export vertical specialization. The combination of two complementary parameters of competitiveness i.e. Balassa (1965) index of Revealed Comparative Advantage (RCA) and Total Effect (TE) index proposed by Nyssens and Poullet (cited in Amador and Cabral, 2008, p. 202) were used. The matrix of both indexes builds on the scheme of analytical tool "products mapping" suggested by Widoto (2009). Our analytical tool is applied for the empirical analysis of export flows of goods by*

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[*] Contact: vlada.vitunskiene@asu.lt, evaldas.serva@asu.lt, Aleksandras Stulginskis University, Studentu St. 11, LT-53361 Akademija, Kauno r., Lithuania

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three end-use categories within aggregate agri-food industry the same as four manufacturing industries classified by R&D intensities, i.e. high-, medium-high-, medium-low- and low-technology industries. The OECD's STAN Bilateral Trade Database by Industry and End-use category at the same time was applied to empirical analysis. The findings based on detailed analysis indicated significant differences in export competitiveness and its gains or losses in a long-term period among different reporting Lithuania's industries and different goods by end-use category.

Introduction

The agri-food industry in Lithuania is export-oriented and plays an important role in Lithuania's economy. In recent years, 45% of processed food products in Lithuania have been exported, and the total export value of agri-food products accounted for approximately 19% of Lithuanian grand total exports of goods in value terms in 2013. Given the rising importance of global value chains (OECD, 2011) around which the world trade and production are increasingly structured (Backer & Miroudot, 2012), it should be observed that Lithuania's export of agri-food goods was from consumption goods and intermediate inputs, which respectively accounted for 72% and for over 28% on average over the last five-year 2009–2013. During the two decades, the weight of consumption goods in total agri-food export has experienced an upward trend, whereas intermediate goods a downward trend, by +12.3% and −12.4% points in absolute change, respectively over the 1994–2013 period. In Lithuania's whole export of goods, vice versa the weight of consumption goods was the least, whereas that of the intermediates was the greatest (respectively, with a share on average 25% and 60% of the total export of goods in 2009–2013). The remaining share of Lithuania's export of goods was from capital goods, mixed end-use and miscellaneous goods, 9%, 5% and 1%, respectively, on average in 2008-2013.

The economic literature cites several definitions of Global Value Chains (GVCs). GVCs can be explained as follows. As stated by OECD (2011), according to Porter and Gereffi definition, "a value chain generally describes the full range of firms' activities from the conception of a product to its end use and beyond". The value chain includes activities such as design, production, marketing, distribution and supply to the final consumer, which can be undertaken by a single firm or divided among different firms and can be concentrated within one location or spread out over different geographical locations. It has been emphasized that the past decades have witnessed a strong trend towards the international dispersion of value chain

activities, hence the name GVCs. It has been argued that different stages in the production process are increasingly located across different countries and intermediate inputs are produced in one country and then exported to other countries for further production into the final consumption good (ibid). Consequently, international trade increasingly consists of the imports and exports of intermediates in addition to trade in final consumption goods.

In the economic literature, the term GVCs has been associated with different concepts such as "global production sharing", "international fragmentation", "vertical specialisation", "multistage production", "subcontracting", "offshoring" and "outsourcing" (OECD, 2011), "global commodity chain", "global production networks" (Henderson *et al*., 2002), etc. Neilson *et al.* (2014) hold the view that global value chains (GVCs) and global production networks (GPNs), as interrelated approaches, have been particularly useful as explanatory frameworks for understanding the global market engagement of firms, regions and nations. According to Backer and Miroudot (2012), the concept of GVCs was introduced in the early 2000s and has been successful in capturing several characteristics of the world economy: (i) the increasing fragmentation of production across countries; (ii) the specialisation of countries in tasks and business functions rather than specific products; and (iii) the role of networks, global buyers and global suppliers.

The international fragmentation forces countries to specialize in different activities in the production process (production of intermediate goods, final assembly, etc.) and countries just like firms increasingly become specialised in specific functions within these GVCs (OECD, 2011). Zhu, Yamano and Camper (2011) note that the globalisation has been characterised by significant structural changes in trade patterns during recent decades, i.e. the rapid growth of trade in intermediate goods as a result of vertical specialisation. Given this context, these authors draw attention to the issue that traditional trade statistics aggregated by product classifications may not fully reveal the country's comparative advantages. They argued that rather than simply considering international trade as a set of bilateral flows from one country to another, it is more interesting to show the structure of GVCs. Therefore, in this article, the export competitiveness of Lithuania's agri-food and other reporting industries are investigated in the context of vertical specialization using flows of export goods by end-use categories, i.e. intermediate, household consumption and capital goods.

Most authors emphasize that the competitiveness indicators are not universally endorsed. Drawing attention to this fact, O'Brien (2010) partly attributes this issue to a weak conceptual basis of competitiveness indicators. He suggests that the vast array of definitions of competitiveness can

sometimes lead to confusion as to the purpose and relevance of competitiveness indicators. Sarker and Ratnesena (2014) note that, when the focus is on trade success, competitiveness can be measured with the real exchange rate, comparative advantage indices and export or import indices; on the other hand, when competitiveness is viewed as a process or potential, cost competitiveness can be measured based on various cost indicators as well as productivity and efficiency measures. The initial aim of this research is to examine how well Lithuania's agri-food industry shifts in export competitiveness position on international markets in comparison to its high- and medium-high technology industries over long time, specifically in recent years from the beginning of the economic crisis in 2009. It should be noted that focusing on trade success, previous competiveness studies on the agri-food sector in Lithuania include Jasinskaite and Masalskis (2001), Ferto and Hubbard (2003), Vitunskiene and Serva (2005, 2006), Jucevicius *et al.* (2010), Drozdz and Miskinis (2011), Saboniene *et al*. (2013), Startiene and Remeikiene (2014), Bojnec and Ferto, (2014). In all of these studies excluding the last, the competitiveness was measured using Revealed Comparative Advantage (RCA) index and in Bojnec and Ferto's study focused on constant market share (CMS) model. The focus of this paper is on two approaches to competitive performance of the Lithuania's agri-food industry and on two complementary parameters of competitiveness, i.e. Revealed Comparative Advantage (RCA) and Total Effect (TE) respectively.

The data on bilateral flows of export goods provided by the OECD's STAN databases for bilateral trade in goods by industry and end-use (BTDIxE) ISIC Rev. 3 edition 2013 was applied to analyse quantitative measuring of the shifts in competitiveness in agri-food and reporting manufacturing industries. The sample includes 86 nations. This dataset accounted for more than 95% of the entire world's export in value. The research included nearly past couple of decades from 1994 to 2012.

Methods and Empirical Background

Sarker and Ratnesena (2014) hold the view that the competition can be domestic, among farms or industries within the country, or international, in which case, comparisons are made between countries, therefore the competitiveness is a relative measure and beyond this general understanding. However, as it has already been emphasized, there is no agreement on how competitiveness should be measured. Durand and Giorno (1987) argued that the variety of competiveness definitions lead to its different indicators, each with its own particular application. In addition, several measures of

competitiveness may be adopted depending on the purpose to which the proposed indicator is to be put or on specific further assumptions. For example, to assess the export competitiveness in a particular industry or particular goods and to compare the countries competitiveness on international markets indicators of comparative advantage and export market shares are often used (e.g. Banterle, 2005; OECD, 2011). In this article, the shifts in export competitiveness of reporting industries could be analysed from two points of view, i.e. Revealed Comparative Advantage (RCA) and Total Effect (TE). Respectively, both of these variables (i.e. RCA and TE indexes) should be adopted to build an analytical tool.

Nowadays, there are many empirical measures of competitiveness based on revealed comparative advantage. Its concept has been grounded on conventional international trade theory that is widely used in practice, as stated by Hinloopen and Van Marrewijk (2001). The principle of comparative advantage postulates that a country will export the goods in which it has its greatest comparative advantage and import those in which it has the least comparative advantage (Widodo, 2009). The RCA index has been applied in numerous reports and academic publications as a measure of international competitiveness or export specialisation. According to the original formulation by Balassa (1965), the RCA formula can be expressed mathematically as follows:

$$RCA_{ic} = \frac{X_c^i / \sum_s X_c^i}{\sum_{rc} X_{rc}^i / \sum_i \sum_{rc} X_{rc}^i},$$

where: RCA_{ic}represents revealed comparative advantage of reporting country *c* for industry i; and X_c^i denote the export of reporting country in industry *i*; $\sum_i X_c^i$ the grand total export of reporting country. The subscript $\sum_{rc} X_{rc}^i$ refers to the export of the industry *s* and $\sum_i \sum_{rd} X_{rd}^i$ refers to the grand total export for the rest of the counties *rc*, i.e. all countries without reporting country *c*. RCA index is the measure of export specialisation or revealed comparative advantage (disadvantage) in the reporting industry for reporting country. The RCA index takes values higher than zero. If the value of the RCA exceeds unity, the country has a comparative advantage in the reporting industry, i.e. in which the country is relatively more specialized in terms of exports. When the value of the RCA equals unity, the country has a neutral comparative advantage in international trade or its performance is the same as the average performance of the rest of the counties. If the value of the RCA is less than unity, the country has a comparative disadvantage in the industry, in which the country is not specialized in terms of exports. According to the classification suggested by Hinloopen

and Van Marrewijk (2001) the RCA index is divided into 4 classes that are interpreted as follows:

- class a [>0; <1] covers all industries without a comparative advantage;
- class b [>1; <2] relates to industries with weak comparative advantage;
- class c [>2; <4] relates to industries with medium comparative advantage; and
- class d [>4] covers industries with strong comparative advantage.

One more alternative view on measuring competitiveness suggested by Bowen and Perlman (1984 cited in Chen & Duan, 2001, p. 5) focusing on the shifts in an exporting country's market shares as *ex post* reflections of changes in competitiveness can be analysed. Although shifts in export market shares are not entirely determined by changes in competitiveness, they nonetheless provide an accepted measure of changes in an exporting country's competitiveness vice versa the rest of exporting countries (Chen & Duan, 2001). According to the view expressed by Together (1990), "a competitive industry is one that possesses the sustained ability to profitably gain and maintain market share in domestic and foreign markets".

To infer Lithuania's agri-food and other reporting industries in competitiveness from shifts of their exports share in the world market the indicator of Total Effect (TE) from the Constant Market Share (CMS) model will be used. According to the definition suggested by Nyssens and Poullet (1990 cited in Amador & Cabral, 2008, p. 202), the TE (i.e. total change in the particular country's share in the world market) is the difference between the growth of total exports of manufactured goods of this country and the growth of total exports of manufactured goods of the rest of the countries. The following mathematical expression gives this identity:

$$TE = AGX_{c,i}^{t} - AGX_{rc,i}^{t},$$

where: $AGX_{c,i}^{t}$ denotes the measures of weighted trend (compound growth rates) of exports X for the reporting country c and reporting industry i in value from time t_0 to time t (over the particular period). The annual export growth rate between time t_0 and time t (in this case five years) can be expressed mathematically as follows:

$$AGX_{c,i}^{t} = 100 \times \left[\left(\frac{X_{c,i}^{t}}{X_{c,i}^{t_0}} \right)^{1/(t-t_0)} - 1 \right],$$

$AGX_{rc,i}^{t}$ is the equivalent notion for the rest of the counties *rc* exports, i.e. all countries without reporting country *c*.

The TE index shows the annual change of reporting country's exports share on the world market in relative term. This index includes values between $-\infty$ and $\pm\infty$ (in per cent), with positive values indicating increasing importance of the reporting country industry on the world market. If the annual growth rate of exports for reporting country is higher than that of rest of the counties, the TE will be positive and correspond to a market share gain in reporting country. This means that the country has increased its export market share and this may reflect increasing competitiveness of country's industry. Vice versa, when the growth in exports of reporting country is lower than that of rest of the counties, the TE will be negative and correspond to a market share loss of the reporting country, that is to say, the country's export market share has decreased and this may reflect decreasing competitiveness in country's industry.

In order to reveal the shifts trajectory in export competitiveness of Lithuania's reporting industry, in a next step, the analytical technique constructed by combining both previously described variables RCA and TE indexes and using the matrix of analytical tool termed "Product Mapping" proposed by Widodo (2009) was employed. An illustrative example of an application of "Product Mapping" can be found in Oelgemoller (2013) who analyses the competitiveness of Greece, Ireland, Portugal and Spain at the industry level; and Ishchukova and Smutka (2013), who studied the case of competitive performance in the Russian agricultural sector. Both indicators of Revealed Symmetric Comparative Advantage (RSCA) and Trade Balance Index (TBI) were applied in both mentioned studies.

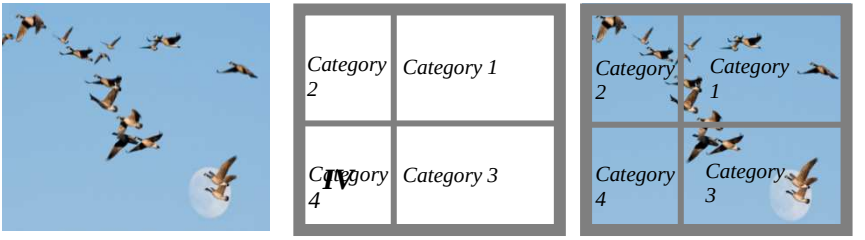
The dynamic comparative advantage paradigm termed "Flying Geese" (FG)[1] was integrated in Widodo's analytical tool "Product Mapping". The FG paradigm of dynamic comparative advantage originated in the 1930s with what Kaname Akamatsu called the "ganko keitai" (a flock of flying geese) phenomenon of industrial development in catching-up economies (Kasahara, 2004). As Kanta Ray *et al.* (2004) note, the FG model motivates empirical research to progress beyond the narrow confines of static comparative advantage to a systemic examination of dynamic comparative advantage. Up to nowadays, the FG model has undergone various modifications.

The illustration of the synthesis of both "Flying Geese" model and analytical tool "Product Mapping" in Figure 1 can be explained as follows. As

[1] The term "flying geese" (FG) came from the graphic presentation of three time-series curves for a particular product, with the time dimension on the horizontal axis. The first curve represents import; the second is for production in a national economy; and the third for export. The sequential appearance of these curves on a graph resemble geese flying in orderly ranks, each forming an inverse "V", like geese flying in formation (Kasahara, 2004).

described by Widodo (2009), imagine we are sitting in a room. Outside, there are flying geese (panel *a* in Figure), which corresponds with the exports flow of goods for a reporting country in a reporting industry from time t_0 to time t (over the reporting period). The room has a window (panel *b*) that corresponds with the analytical tool for industries mapping, i.e. two variables (RCA and TE) composition effect matrix. Through the window, we see flying geese (panel *c*) which, in our research, corresponds with the trajectory of shifts in the Lithuanian export competitiveness in reporting industry as a result affected by changes of both variables at the same time. In other words, the flying geese flock in terms of RCA change is paralleled with a similar flying geese formation in terms of TE change. In our research, the FG refers to a dynamic situation in RCA-TE composition matrix built on the Widodo's analytical tool "Product Mapping". Therefore, both variables have been introduced to develop the product/industry mapping as the RCA-THE composition effects matrix the interpretation of which is provided in figure 2 below. In this article, the terms "product mapping" and "industry mapping" and similarly the terms "product map" and "industry map" are used interchangeably.

Figure 1. The composition of "Product Mapping" and "Flying Geese"



a) Flying Geese

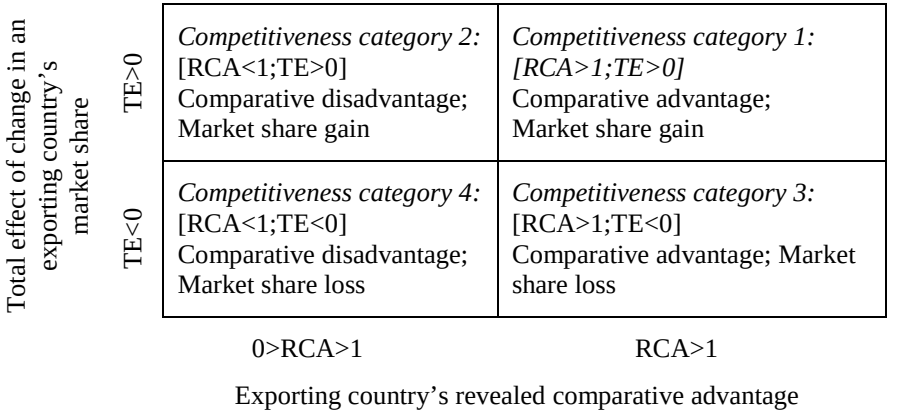
b) Window: analytical tool "Product Mapping"

c) Flying Geese framed in the analytical tool "Product Mapping"

Source: Authors' own drawing following Widodo (2009), Photograph' source: http://www.pbase.com/cogard/flying_ducks_geese__shorebirds%20for%20the%20geese%20flying.

According to a possible composition of RCA-TE in product map, products (or industries) could be classified into four categories of export competitiveness by advantage/disadvantage and by gain/loss in export market share as depicted in four RCA-TE composition matrix cells in Figure 2.

Figure 2. Product mapping: the matrix illustrate of possible allocation effects of RCA-TE composition



Source: own work.

Category 1 consists of products (or industries) with comparative advantage and gain in export market share. Products (or industries) in this category have export-specialization and growing share in the world market. Category 2 consists of products (or industries) with comparative disadvantage and gain in export market share, i.e. although they have no export-specialization but their export market share is growing. Vice versa, Category 3 consists of products (or industries) with comparative advantage and loss of export market share, in other words, that were specialized in exporting products (or industries), which are losing share in the world market. Category 4 consists of products (or industries) with comparative disadvantage and loss of export market share, that is to say, these products (or industries) are not export-specialized and are losing share in the world market.

The OECD's structural analysis (STAN) databases for bilateral trade in goods by industry and end-use (BTDIxE) at the same time applied to the empirical analysis. The analysis focused on the entire agri-food industry that aggregates primary economic activities of agriculture and hunting (hereinafter the agriculture) and manufacturing of food products, beverages and tobacco (hereinafter the food products manufacturing) based on the ISIC Revision 3 classification (OECD, 2014). For comparative evaluation, four manufacturing industries were classified according to direct R&D intensity, i.e. high technology, medium-high technology, medium-low technology and low-technology industries based on the ISIC Revision 3 classi-

fication were included as well. Naturally, agriculture like food products manufacturing is classified as the low-technology industry. The industries of primary and manufactured goods included in the analysis are profiled in Table 1.

Table 1. Primary and manufactured industries included in the analysis by BTDIxE classification

Industry (Symbol)	**ISIC Rev. 3**
Primary	
Agriculture, hunting (Agri)	01
Manufacturing	
High-technology (HITECH)	2423, 30, 32, 33, 353
Medium-high technology (MHTECH)	24 excl. 2423, 29, 31, 34, 352, 359
Medium-low technology (MLTECH)	23, 25, 26, 27to28, 351
Low-technology (LOTECH)	15to16, 17to19, 20, 21to22, 36to37
Food, beverages and tobacco (Food)	15to16
Low-technology excluded Food, beverages and tobacco (LOTECH ex Food)	17to19, 20, 21to22, 36to37
Primary and Manufacturing aggregation	
Agriculture, hunting and Food, beverages and tobacco (Agri-Food)	01, 15to16

Source: authors' preparation by the Bilateral Trade Database by Industry and End-use (BTDIxE), edition 2013, OECD (2014).

The data presented in Annex indicate that the weight of reporting agri-food industry in total Lithuania's export of goods in value has had an upward trend in the last decade and averaged 18% over the 2009–2013 sub-period compared to 12% over the 1999–2003 sub-period. The weight of medium-high and medium-low technology industries has had an upward trend as well. Their share in total export of goods increased on average from 19% to 24% and from 27% to 32% respectively if compared between the same times sub-periods. By contrast, the share of high technology industries in Lithuania's total export of goods in value decreased from 8% at an average over the 1994–1998 sub-period to 6% at an average over the 2009–2013 sub-period.

In the BTDIxE database, the trade flows are divided into nine categories of goods, including the three main end-uses categories (i.e. capital goods, intermediate inputs and consumption) and broken down by economic activities based upon the ISIC Revision 3 (OECD, 2014). In this research, the

analysis is based on bilateral flows of all exported goods as well as three main end-use category goods identified in BTDIxE separately, i.e. intermediate, household consumption and capital goods. As noted, the breakdown of trade in goods according to their end-use adds a new dimension to the traditional commodity-based trade statistics and provides a link to National Accounts Input-Output Tables, in which flows of goods and services are reported according to end-users (ibid). As Feenstra (1998) noted, rather than assigning goods by their production process, these categories assign them according to their use by purchasers.

In the System of National Accounts (SNA), there are generally three basic kinds of domestic end-use categories such as industrial intermediate inputs, consumption (by households and public sectors) and fixed capital formation. In BTDIxE, using the OECD developed the correspondence table to link Harmonised Systems (HS) classifications of trade in goods codes with Broad End-use Categories (BEC), bilateral flows of exports and imports are classified into intermediate goods, household consumption goods and capital goods (OECD, 2014). As Zhu, Yamano, and Cimper (2011) note, the BT DIxiE allows insights into the patterns of trade in intermediate goods between countries to track global production networks and supply chains as well as helps to address other trade-related policy issues such as trade in value added and tasks.

The data on bilateral flows of exports goods extracted from the OECD STAN databases for Bilateral Trade in Goods by Industry and End-use (BTDIxE) ISIC Rev. 3 edition 2013 for the time-period 1994–2012. The sample includes 86 nations those together representing more than 95% of the entire world export in value. For calculation Lithuania's RCA and TE indicators, the set of the "rest countries" covers the following 85 countries whereof:

- all 27 EU countries excluding Lithuania (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden and United Kingdom);
- selected 13 OECD countries other than EU economies (Australia, Canada, Chile, Iceland, Israel, Japan, Korea, Mexico, New Zealand, Norway, Switzerland, Turkey and United States);
- selected 45 non-OECD economies (Algeria, Argentina, Bangladesh, Belarus, Bolivia, Bosnia and Herzegovina, Brazil, Cambodia, China, Chinese Taipei, Colombia, Costa Rica, Ecuador, Egypt, El Salvador, Guatemala, Honduras, Hong Kong, India, Indonesia, Iran, Kazakhstan, Kuwait, Malaysia, Moldova, Morocco, Nicaragua, Nigeria, Oman, Par-

aguay, Peru, Philippines, Qatar, Russian Federation, Saudi Arabia, Serbia, Singapore, South Africa, Thailand, Tunisia, Ukraine, United Arab Emirates, Uruguay, Venezuela and Viet Nam). Note that together all "rest countries" accounted for more than 95% of the whole world export in value.

Results

Calculated at the industry level by goods classified by end-use category, the RCA and TE indexes in value terms and industries mapping graphs presented in Tables 2-5 provide rich information on shifts in export competitiveness in Lithuania's agri-food industry and reporting manufacturing industries over long research period from 1994 to 2012 subdivided into four sub-periods. In all tables, the annual rate of export growth is presented as well. These data enable to look at export growth trends at Lithuania's and reporting set of the "rest countries" (RC) levels. Both indexes and annual export growth rate are calculated at an average term over each of the first three five-year sub-period and over last four-year sub-period as specified in all tables below. A graphical representation of both competitiveness indicators (RCA and TE) best depicts a shift trajectory in Lithuania's reporting industries export competitiveness that has occurred over the past couple of decades. The graphs are constructed using data in average terms for each research sub-period that is mentioned above. The most interesting findings are summarized below by exports of total goods and by each of the main end-uses categories of intermediate inputs and final products, i.e. intermediate goods, household consumption goods and capital goods.

Table 2 summarises the results on the exports of total goods among all reporting industries. As an indication of the long-term shift in export competitiveness throughout the period of investigation 1994–2012, graphic expression of "industries map" illustrates that shifts between competitiveness categories' cells in RCA-TE matrix did not take place to any significant extent for all reporting industries. As it can be seen, only the agri-food industry (Agri-Food) and high technology industries (HITECH) have experienced a shift between vertical categories' cells in the matrix. In both cases, these shifts were affected by gains in export market share. The agri-food industry as well the food sub-industry (Food) had a shift from competitiveness Category 3 in the first research sub-period (1994–1998) to competitiveness Category 1 in the second and successive research sub-periods (i.e. in the years from 1999 to 2012). Simultaneously, the HITECH industries shifted from competitiveness Category 4 to Category 2 (see Agri-Food, Food and HITECH curves in Table 2). It suggests that both industries

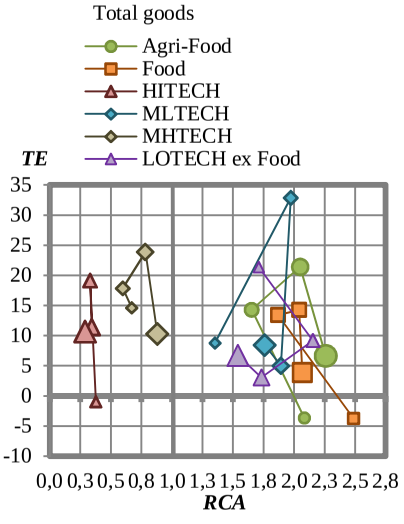
showed an upward trend in annual relative change of export market share over the 1999–2012 while a downward trend over the 1994–1998 sub-period was established. However, this upward trend slowed considerably in HITECH industries in the years 2004–2012 and in agri-food in the years 2009–2012 (see values of the TE index given in Table 2). Over the end four-year period 2009–2012 the beginning of which coincides with the economic crisis, the export market share in Agri-Food industry increased at an average by 6.7% per year in terms of relative change, whereas HITECH and medium-high technology (MHTECH) industries shares rose at an average by 10.3% and 10.7% per year, respectively.

Furthermore, RCA indices presented in Table 2 indicate a medium revealed comparative advantage in agri-food industry as well as Food sub-industry, except for a weak comparative advantage established for the 1999-2003 year sub-period. An important fact is that the trend seemed to be increasing, the RCA index average =1.65 over the 1999–2003 sub-period rose to =2.26 over the 2009-2012 sub-period what reflected its potential. By contrast, the HITECH and MHTECH industries displayed a revealed comparative disadvantage over the entire considered period (RCA index <1). Additionally, the RCA for MHTECH industry increased from an average =0.60 in the sub-period 1999-2003 to an average =0.88 in the sub-period 2009–2012, whereas for HITECH industries, the RCA index fell from an average =0.38 in the sub-period 1994–1998 to an average =0.29 in the sub-period from1999 to 2012.

In addition, a location in the "industries map" of the other reporting manufacturing industries, like medium-high technology (MHTECH) and medium-low technology (MLTECH) industries and low-technology industries excluding food products (LOTECH ex Food), did not shift between competitiveness categories' cells in both vertical or horizontal terms (see Graph in Table 2). Despite a high variation of relative annual change rate of exports market share (like export annual growth rate) low variation was found in each of these industries.

The results of RCA and TE calculation by the exports of intermediate goods among all reporting industries are compiled in Table 3. In addition, it should be observed that nearly three-fifths of the overall Lithuanian export of goods in value was from intermediate goods (accounted for over 59% in the last decade from 2004 to 2013). Exports in intermediates took place mostly among medium-low technology and medium-high technology industries and represented respectively 95% and 57% of the total export flows in each industry over the last five years from 2009 to 2013. The weight of the intermediates in total export value in agri-food industry showed downward trends throughout the period of investigation. Intermediates share in the total export value of agriculture fell from 60% over the

Table 2. Shifts in Lithuania's export competitiveness in agri-food and manufacturing industries, 1994-2012: in total exports of goods

Industries Map	Indicators	1994-1998	1999-2003	2004-2008	2009-2012
	*Agri-Food: Agriculture, Hunting, Food Products, Beverages and Tobacco*				
	Annual export growth in value in LT (%)	0.2	20.6	36.8	19.2
	Annual export growth in value in the RC (%)	3.9	6.3	15.4	12.5
	Total effect in export market share, TE (%)	-3.6	14.3	21.4	6.7
	RCA index (an average)	2.08	1.65	2.05	2.26
	Food: Food Products, Beverages and Tobacco				
	Annual export growth in value in LT (%)	0.6	19.6	29.1	15.4
	Annual export growth in value in the RC (%)	4.3	6.2	14.9	11.5
	Total effect in export market share, TE (%)	-3.7	13.4	14.3	3.9
	RCA index (an average)	2.49	1.87	2.04	2.07
	LOTECH ex Food: Low-Technology Industries excluded Food Products, Beverages and Tobacco				
	Annual export growth in value in LT (%)	27.1	14.6	12.2	15.8
	Annual export growth in value in the RC (%)	5.8	5.4	9.1	9.1
	Total effect in export market share, TE (%)	21.4	9.2	3.1	6.7
	RCA index (an average)	1.71	2.15	1.73	1.53
	MLTECH: Medium-Low Technology Industries				
	Annual export growth in value in LT (%)	16.1	40.9	26.2	24.9
	Annual export growth in value in the RC (%)	7.3	8.1	21.2	16.4
	Total effect in export market share, TE (%)	8.8	32.9	5.0	8.5
	RCA index (an average)	1.35	1.97	1.89	1.76
	MHTECH: Medium-High Technology Industries				
	Annual export growth in value in LT (%)	22.0	24.8	36.7	23.3
	Annual export growth in value in the RC (%)	7.4	6.9	12.9	13.0
	Total effect in export market share, TE (%)	14.6	17.9	23.9	10.3
	RCA index (an average)	0.67	0.60	0.78	0.88
	HITECH: High Technology Industries				
	Annual export growth in value in LT (%)	10.0	25.6	21.2	19.6
	Annual export growth in value in the RC (%)	10.9	6.5	9.7	8.9
	Total effect in export market share, TE (%)	-0.9	19.2	11.4	10.7
	RCA index (an average)	0.38	0.33	0.34	0.29

Note: the larger the legend mark is the later sub-period it indicates (i.e. the smallest legend mark indicates the sub-period of 1994-1998 up to the largest mark the indicating sub-period of 2009-2012).

Source: authors' calculation based on the data from STAN Bilateral Trade Database by Industry and End-use category, OECD (2014).

1994–1998 sub-period to 47% over the 2009–2013 sub-period, while in food products manufacture, intermediates share fell from 30% to 16% at the same time (see the data presented in Annex). This trend indicates that vertical specialization of Lithuania's agri-food industry in the context of GVCs is falling constantly.

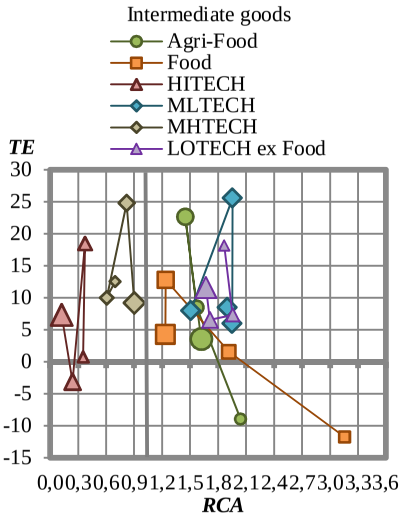
The "industries map" Graph in Table 3 indicates that the most significant shifts in export competitiveness of intermediate goods export took place in Agri-Food and HITECH industries. Both industries experienced a shift between vertical competitiveness categories cells in RCA-TE matrix. Like in the case of total goods export described above, the export competitiveness of intermediates in agri-food industry as well in food sub-industry shifted from Category 3 to Category 1, whereas in HITECH industries it shifted from Category 4 to Category 2 (see Agri-Food, Food and HITECH curve in Table 3). In both industries, these shifts were affected by gains of export market share. The agri-food industry showed a downward trend in intermediates' export market share over first sub-period and an upward trend over the rest three sub-periods, with an average annual change rate of 8.9% (1994–1998) and +8.5% (1999–2003), +22.7% (2004–2008) and +3.6% (2009–2012), respectively. Meanwhile, HITECH industries showed a downward trend in market share of intermediates export in sub-period 2004–2008 (valued at −2% of average annual change rate) and an upward trend over the rest sub-periods under investigation (values of the TE index are given in Table 3).

In the last sub-period the beginning of which coincides with the economic crisis in 2009, export market share gains were twice higher in HITECH, MHTECH and MLTECH industries (average annual change rate +7.3%, +9.2% and +8.5%, respectively) than in agri-food industry (average annual change rate +3.6 %).

RCA indices presented in Table 3 indicate a weak revealed comparative advantage for intermediate goods of agri-food industry as well as food sub-industry, except for a medium revealed comparative advantage at the beginning of the research period. In agri-food industry, RCA index average =2.04 in sub-period 1994–1998 fell to =1.45 in sub-period 2004–2008, but rose to =1.62 in the last sub-period 2009–2012. By contrast, the HITECH and MHTECH industries displayed a revealed comparative disadvantage throughout the period of investigation (RCA index <1). In MHTECH industry, the RCA rose from =0.70 on the average over the 1999–2003 sub-period to =0.91 on the average over the 2009–2012 sub-period, whereas for HITECH industries, the RCA index fell from =0.35 to =0.12 in average at the same time.

Table 3. Shifts in Lithuania's export competitiveness in agri-food and manufacturing industries, 1994-2012: in intermediate goods

Industries Map



Note: the larger the legend mark is the later sub-period it indicates (i.e. the smallest legend mark indicates the sub-period of 1994-1998 up to the largest mark the indicating sub-period of 2009-2012).

Indicators	1994-1998	1999-2003	2004-2008	2009-2012
Agri-Food: Agriculture, Hunting, Food Products, Beverages and Tobacco				
Annual export growth in value in LT (%)	-6.1	15.3	41.8	20.9
Annual export growth in value in the RC (%)	2.8	6.8	19.1	17.3
Total effect in export market share, TE (%)	-8.9	8.5	22.7	3.6
RCA index (an average)	2.04	1.57	1.45	1.62
Food: Food Products, Beverages and Tobacco				
Annual export growth in value in LT (%)	-7.7	8.7	31.8	20.5
Annual export growth in value in the RC (%)	4.0	7.1	19.0	16.2
Total effect in export market share, TE (%)	-11.7	1.6	12.8	4.3
RCA index (an average)	3.15	1.92	1.24	1.23
LOTECH ex Food: Low-Technology Industries excluded Food Products, Beverages and Tobacco				
Annual export growth in value in LT (%)	23.7	11.4	13.3	19.1
Annual export growth in value in the RC (%)	5.5	4.1	6.7	7.5
Total effect in export market share, TE (%)	18.2	7.3	6.5	11.6
RCA index (an average)	1.86	1.96	1.71	1.69
MLTECH: Medium-Low Technology Industries				
Annual export growth in value in LT (%)	15.5	34.0	27.9	26.4
Annual export growth in value in the RC (%)	7.5	8.4	22.0	17.9
Total effect in export market share, TE (%)	8.0	25.6	6.0	8.5
RCA index (an average)	1.51	1.95	1.95	1.90
MHTECH: Medium-High Technology Industries				
Annual export growth in value in LT (%)	20.4	17.2	38.3	22.4
Annual export growth in value in the RC (%)	7.8	7.2	13.6	13.2
Total effect in export market share, TE (%)	12.5	10.0	24.8	9.2
RCA index (an average)	0.70	0.61	0.82	0.91
HITECH: High Technology Industries				
Annual export growth in value in LT (%)	11.7	23.8	4.3	16.9
Annual export growth in value in the RC (%)	10.9	5.4	7.4	9.5
Total effect in export market share, TE (%)	0.8	18.5	-3.1	7.3
RCA index (an average)	0.35	0.37	0.24	0.12

Source: authors' calculation based on the data from STAN Bilateral Trade Database by Industry and End-use category, OECD (2014).

Table 4 presents the results of RCA and TE indexes calculation by the exports of household consumption goods among all reporting industries. In addition, it should be observed that almost a quarter of total Lithuania's export of goods was from household consumption. Export of these goods takes place mostly among low-technology industries including the food products manufacturing and represented respectively 68% and 84% of the total export flows in each industry over the 2009–2013 sub-period. The weight of household consumption goods in total export had an upward trend in both economic activities of reporting agri-food industry, i.e. in food product manufacturing and agriculture respectively, +17.4% and +22.8% points in change over the throughout the period of investigation 1994–2013 (see the data presented in Annex).

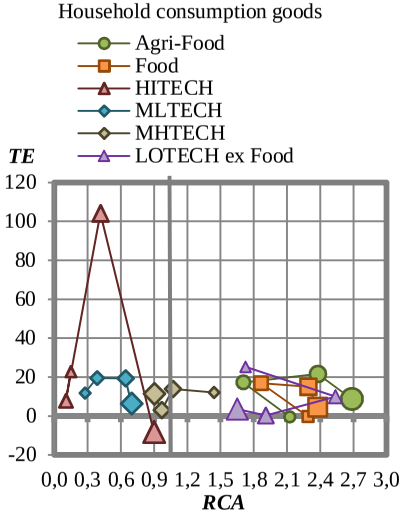
"Industries map" Graph in Table 4 illustrates how the competitive position of the Lithuania's intermediate goods export has altered. As it can be seen, the shifts in competitiveness did not take place to any significant extent for all reporting industries, except for HITECH industries during the 2004–2008 sub-period. The agri-food and HITECH industries experienced a shift between vertical competitiveness categories' cells in RCA-TE matrix, whereas MHTECH industry shifted between horizontal categories' cells. These shifts were affected by gains in export market share in first case and by losses in revealed comparative advantage in second case.

The intermediates export competitiveness of agri-food industry as well as that of food sub-industry shifted from Category 3 over the first research period (1994–1998) to Category 1 over the second and successive research sub-periods (1999–2012). The TE index values in Table 4 show a strong upward trend in Lithuanian agri-food industry share in export market of household consumption goods over the 1999–2012 year period, with an average annual change rate of +17.2%, +21.6% and +8.9% respectively through each of successive sub-period. Additionally, the revealed comparative advantage in this industry showed an upward trend too, with the RCA index averaged of =2.58 for the 2009-2012 sub-period compared to =1.70 over the 1999–2003 period.

The graph in Table 4 illustrates the shift of HITECH industries export competitiveness from Category 2 during first three sub-periods of investigation (1994–1998) to Category 4 during the last sub-periods. The TE index values in Table 2 indicate a very wide range of variation in the annual change rate of these Lithuania's industries share in export market of household consumption goods throughout the period of investigation, especially during the last two sub-periods with an average annual change rate of +104.1% and −8.2% respectively. This suggests that Lithuania's HITECH industries lost export market share during the last four-year period. Despite this they experienced upward trends in RCA, with a rise from =0.10 on

Table 4. Shifts in Lithuania's export competitiveness in agri-food and manufacturing industries, 1994-2012: in household consumption goods category

Industries Map	Indicators	1994-1998	1999-2003	2004-2008	2009-2012
	Agri-Food: Agriculture, Hunting, Food Products, Beverages and Tobacco				
	Annual export growth in value in LT (%)	4.0	23.2	35.0	18.4
	Annual export growth in value in the RC (%)	4.4	6.0	13.4	9.6
	Total effect in export market share, TE (%)	-0.5	17.2	21.6	8.9
	RCA index (an average)	2.12	1.70	2.38	2.68
	Food: Food Products, Beverages and Tobacco				
	Annual export growth in value in LT (%)	4.2	22.8	28.6	14.4
	Annual export growth in value in the RC (%)	4.4	5.9	13.6	9.8
	Total effect in export market share, TE (%)	-0.2	16.8	15.0	4.6
	RCA index (an average)	2.29	1.86	2.29	2.37
	LOTECH ex Food: Low-Technology Industries excluded Food Products, Beverages and Tobacco				
	Annual export growth in value in LT (%)	30.8	16.1	10.5	13.5
	Annual export growth in value in the RC (%)	5.6	6.2	10.1	9.9
	Total effect in export market share, TE (%)	25.3	9.9	0.3	3.6
	RCA index (an average)	1.73	2.54	1.91	1.65
	MLTECH: Medium-Low Technology Industries				
	Annual export growth in value in LT (%)	17.9	25.7	29.0	20.0
	Annual export growth in value in the RC (%)	6.1	6.2	9.6	13.6
	Total effect in export market share, TE (%)	11.8	19.5	19.4	6.4
	RCA index (an average)	0.28	0.38	0.64	0.70
	MHTECH: Medium-High Technology Industries				
	Annual export growth in value in LT (%)	17.9	21.7	12.9	20.8
	Annual export growth in value in the RC (%)	5.8	7.9	10.0	9.4
	Total effect in export market share, TE (%)	12.1	13.9	3.0	11.4
	RCA index (an average)	1.44	1.07	0.97	0.90
	HITECH: High Technology Industries				
	Annual export growth in value in LT (%)	26.1	14.3	129.3	-2.6
	Annual export growth in value in the RC (%)	3.3	6.5	25.1	5.6
	Total effect in export market share, TE (%)	22.8	7.8	104.1	-8.2
	RCA index (an average)	0.15	0.10	0.41	0.90



Note: the larger the legend mark is the later sub-period it indicates (i.e. the smallest legend mark indicates the sub-period of 1994-1998 up to the largest mark the indicating sub-period of 2009-2012).

Source: authors' calculation based on the data from STAN Bilateral Trade Database by Industry and End-use category, OECD (2014).

average over the 1999–2003 sub-period to =0.90 on average over the 2009–2012 sub-period. Additionally, RCA index lower than one, displays a revealed comparative disadvantage in HITECH industries of household consumption goods export throughout the period of investigation.

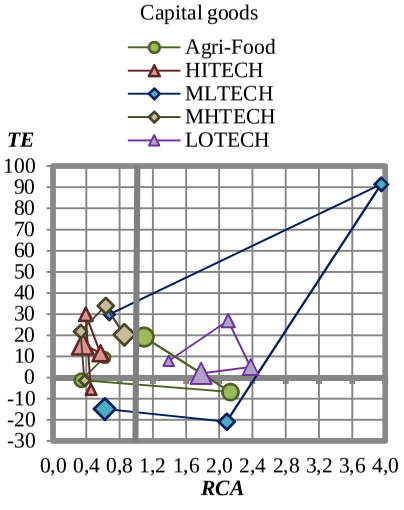
The graph in Table 4 illustrates the shift of HITECH industries export competitiveness from Category 2 during first three sub-periods of investigation (1994–1998) to Category 4 during the last sub-periods. The TE index values in Table 2 indicate a very wide range of variation in the annual change rate of these Lithuania's industries share in export market of household consumption goods throughout the period of investigation, especially during the last two sub-periods with an average annual change rate of +104.1% and −8.2% respectively. This suggests that Lithuania's HITECH industries lost export market share during the last four-year period. Despite this they experienced upward trends in RCA, with a rise from =0.10 on average over the 1999–2003 sub-period to =0.90 on average over the 2009–2012 sub-period. Additionally, RCA index lower than one, displays a revealed comparative disadvantage in HITECH industries of household consumption goods export throughout the period of investigation.

As mentioned above, the MHTECH industry location shifted between horizontal export competitiveness categories cells, i.e. from Category 1 in the first half of the research period to Category 2 in the second half of the research period (see Graph in table 4). This suggests that Lithuania's competitiveness in MHTECH industries shifted from comparative advantage to comparative disadvantage.

Table 5 summarises the RCA and TE results and their allocation matrix for the exports of capital goods among all reporting industries. Foremost, it should be observed that the weight of capital goods in total Lithuanian exports of goods averaged 9% over the 1994–2013 period. Export of capital goods took place mostly among high technology and medium-high technology industries and accounted respectively for 30% and 24% of total export flows of each industry over the last five-year period i.e. from 2009 to 2013. The weight of capital goods in agricultural export was very poor and accounted for less than 0.5% (see the data presented in Annex).

Graph in Table 5 illustrates a shift of agri-food industry between all four export competitiveness categories' cells in RCA-TE matrix. Both RCA and TE indexes in same Table indicate an upward trend in export competitiveness in agricultural capital goods export. On the one hand, Lithuania has experienced a shift from comparative disadvantage over the first half of the research period to weak comparative advantage in the remaining half of the research period. On the other hand, export market share of capital goods trended from negative relative change rate (−1.1% and −6.7% per year in 1999–2003 and 2004–2008 respectively) to positive relative change rate

Table 5. Shifts in Lithuania's export competitiveness in agri-food and manufacturing industries, 1994-2012: in capital goods

Industries Map	Indicators	1994-1998	1999-2003	2004-2008	2009-2012
	*Agri-Food: Agriculture, Hunting, Food Products, Beverages and Tobacco*				
	Annual export growth in value in LT (%)	13.9	9.4	2.1	31.8
	Annual export growth in value in the RC (%)	4.3	10.5	8.8	12.5
	Total effect in export market share, TE (%)	9.6	-1.1	-6.7	19.2
	RCA index (an average)	0.62	0.34	2.13	1.09
	LOTECH ex Food: Low-Technology Industries excluded Food Products, Beverages and Tobacco				
	Annual export growth in value in LT (%)	16.4	30.9	25.3	17.6
	Annual export growth in value in the RC (%)	8.5	3.9	20.3	15.6
	Total effect in export market share, TE (%)	7.9	27.0	5.0	2.0
	RCA index (an average)	1.39	2.11	2.38	1.78
	MLTECH: Medium-Low Technology Industries				
	Annual export growth in value in LT (%)	36.5	97.7	0.1	-11.6
	Annual export growth in value in the RC (%)	6.7	6.2	20.9	3.3
	Total effect in export market share, TE (%)	29.8	91.4	-20.8	-14.8
	RCA index (an average)	0.67	3.95	2.09	0.62
	MHTECH: Medium-High Technology Industries				
	Annual export growth in value in LT (%)	5.8	27.4	48.9	34.6
	Annual export growth in value in the RC (%)	7.2	5.5	15.0	14.4
	Total effect in export market share, TE (%)	-1.4	21.8	33.9	20.3
	RCA index (an average)	0.38	0.33	0.63	0.86
	HITECH: High Technology Industries				
	Annual export growth in value in LT (%)	2.8	34.6	25.7	25.8
	Annual export growth in value in the RC (%)	8.3	4.6	14.1	9.8
	Total effect in export market share, TE (%)	-5.5	30.0	11.6	16.0
	RCA index (an average)	0.46	0.39	0.57	0.35

Note: the larger the legend mark is the later sub-period it indicates (i.e. the smallest legend mark indicates the sub-period of 1994-1998 up to the largest mark the indicating sub-period of 2009-2012).

Source: authors' calculation based on the data from STAN Bilateral Trade Database by Industry and End-use category, OECD (2014).

(+19.2% per year in 2009–2012). Whereas, as it can be seen in the same Graph, both HITECH and MHTECH industries locations shifted vertically from Category 4 to Category 2. This suggests a comparative disadvantage (RCA index<1,) in these industries for capital goods export throughout the period of investigation, with strong upward trends in average annual change rate over the last three research sub-periods (TE index>1) as compared to negative change rate over the first research sub-periods (TE index>1), for details, see Table 5.

Conclusions

This article adopts an industrial approach to assessing export competitiveness in Lithuania's agri-food industry by comparing manufacturing industries according to their technological intensity, more specifically, high and medium-high-technology industries. The agriculture like food products manufacturing was classified as the low-technology industry. Dual classification of export flows of goods by industry's technological intensity and end-use category designed in BTDIxE was adapted. The classification of trade flows by end-use categories allowed analysing Lithuania's export competitiveness in the context of vertical specialization that can involve either intermediate goods or final goods. The composition of two indexes, i.e. RCA and TE were used to assess the shifts in export competitiveness over a long almost twenty-year period. According to possible compositions of RCA-TE in "product mapping" analytical tool, industries were classified into four categories of export competitiveness by revealed comparative advantage/disadvantage and by export share gain/loss in the world market.

The agri-food industry in Lithuania is export-oriented, has a significant and an increasing weight in the Lithuania's exports and accounted for nearly one-fifth of Lithuania's whole exports of goods in recent years. Detailed analysis results suggest that there has been a downward trend of export share of intermediate inputs in relative to upward trend of export share of consumption goods in total exports of this industry in last twenty-year period. There is an opposite trend in relative to the whole rest courtiers. It indicates that the Lithuanian agri-food industry is less and less involved in the global food value chains whose importance is rising progressively.

A more detailed analysis indicated significant differences in export competitiveness and its gains or losses in a long-term period among different reporting Lithuania's industries and different goods by end-use category.

During the considered period, both agri-food industry and food sub-industry had a medium comparative advantage in export of consumption goods (except for a weak comparative advantage in the 1999–2003 sub-period) and weak comparative advantage in export of intermediate inputs. Although a loss of export market share of both end-use categories of agri-food goods was recorded during the first sub-period (1994–1998), the competitive position subsequently improved with an upward trend of annual change rate of market share over the rest sub-periods under investigation. These suggest a clear trend of improvement in export competitiveness of agri-food industry.

The findings on HITECH and MHTECH industries revealed different results. Both industries had a comparative disadvantage with an upward trend in consumption goods export of HITECH and intermediates export of MHTECH and downward trend in intermediates export of HITECH and consumption goods export of MHTECH. However, it is important to note that both industries were competitive in terms of the total market share effect, i.e. they showed an upward trend in annual change of market share during the considered period, with the exception of two cases of downward trend in HITECH industry.

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Appendix

Annex 1. Share of industries and end-use categories in Lithuanian total export of goods

	1994-1998	1999-2003	2004-2008	2009-2013	2013
by industry					
GRAND TOTAL	100%	100%	100%	100%	100%
Agriculture, Hunting	3.5%	2.5%	4.3%	7.0%	7.8%
Total Manufacturing	89.7%	91.9%	91.9%	89.4%	89.1%
High Technology Industries	7.8%	7.7%	7.3%	5.9%	6.1%
Medium-High Technology Industries	21.8%	18.7%	23.8%	24.8%	24.4%
Medium-Low Technology Industries	19.4%	27.1%	31.7%	31.6%	31.6%
Low-Technology Industries	40.7%	38.3%	29.1%	27.1%	27.0%
Food products, Beverages and Tobacco	16.0%	9.8%	10.0%	11.4%	11.4%
Agriculture, Hunting, Food products, Beverages and Tobacco	19.4%	12.3%	14.3%	18.3%	19.2%
by end-use category of goods in industry					
GRAND TOTAL					
Intermediate goods	59.0%	57.3%	59.4%	59.3%	58.4%
Household consumption goods	28.5%	28.2%	24.5%	25.4%	26.1%
Capital goods	6.5%	8.8%	10.2%	9.0%	9.6%
Other goods (mixed end-use and miscellaneous)	6.0%	5.8%	5.9%	6.3%	5.9%

Annex 1 continued

	1994-1998	1999-2003	2004-2008	2009-2013	2013
Agriculture, Hunting					
Intermediate goods	60.1%	67.1%	51.2%	47.1%	45.2%
Household consumption goods	39.5%	32.6%	47.8%	52.7%	54.7%
Capital goods	0.4%	0.3%	1.0%	0.2%	0.1%
Other goods (mixed end-use and miscellaneous)	0.0%	0.0%	0.0%	0.0%	0.0%
Total Manufacturing					
Intermediate goods	56.3%	54.7%	58.3%	59.3%	58.6%
Household consumption goods	30.2%	29.7%	24.3%	24.3%	24.4%
Capital goods	7.2%	9.5%	11.0%	10.0%	10.7%
Other goods (mixed end-use and miscellaneous)	6.3%	6.0%	6.3%	6.5%	6.3%
High Technology Industries					
Intermediate goods	46.2%	55.0%	31.6%	17.5%	16.2%
Household consumption goods	1.7%	1.1%	5.9%	16.0%	10.2%
Capital goods	29.6%	27.1%	39.5%	29.9%	31.1%
Other goods (mixed end-use and miscellaneous)	22.5%	16.8%	23.1%	36.6%	42.4%
Medium-High Technology Industries					
Intermediate goods	53.9%	53.3%	56.3%	57.0%	54.8%
Household consumption goods	14.4%	11.8%	8.0%	6.6%	7.4%
Capital goods	14.2%	12.8%	19.0%	23.7%	27.2%
Other goods (mixed end-use and miscellaneous)	17.4%	22.0%	16.6%	12.7%	10.6%
Medium-Low Technology Industries					
Intermediate goods	94.7%	85.5%	91.6%	95.0%	95.6%
Household consumption goods	1.5%	1.5%	1.8%	2.0%	2.5%
Capital goods	3.7%	12.6%	6.2%	2.4%	1.4%
Other goods (mixed end-use and miscellaneous)	0.2%	0.4%	0.5%	0.6%	0.5%
Low-Technology Industries					
Intermediate goods	41.2%	33.9%	30.1%	28.9%	28.4%
Household consumption goods	57.8%	64.4%	67.2%	68.4%	68.7%
Capital goods	1.0%	1.6%	2.5%	2.1%	2.1%
Other goods (mixed end-use and miscellaneous)	0.0%	0.0%	0.3%	0.6%	0.7%
Food products, Beverages and Tobacco					
Intermediate goods	29.7%	22.1%	14.2%	16.0%	16.4%
Household consumption goods	70.3%	77.9%	85.8%	83.9%	83.5%
Other goods (mixed end-use and miscellaneous)	0.0%	0.0%	0.0%	0.1%	0.1%

Source: authors' calculation based on the data from STAN Bilateral Trade Database by Industry and End-use category, OECD (2014).