

# Trade Performance and Competitiveness of the Slovak Wood Processing Industry within the Visegrad Group Countries

Rezultati trgovine i konkurentnost slovačke drvoprerađivačke industrije unutar zemalja Višegradske skupine

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**ABSTRACT •** *The aim of this paper is to analyse trade performance and competitiveness of the Slovak wood processing industry sectors and their comparison with the Visegrad group countries. The competitiveness is studied for the products of primary wood processing, namely coniferous and non-coniferous sawnwood, wood based panels, wood pulp, paper and paperboard products. A set of trade performance and competitiveness indicators is used to analyse the position and changes in competitiveness of the respective countries in 2003-2012. In particular, Trade Specialisation Index, Export/Import Ratio, Standard Grubel-Lloyd Index, Revealed Comparative Advantage and Vollrath's Revealed Competitive Advantage Indexes were used to identify comparative advantages and trade specialisation for individual forest product categories and a specific country's performance. Within the group of analysed countries, Slovakia has revealed comparative advantage in most of the products, in particular in the trade with coniferous sawnwood, non-coniferous sawnwood, wood based panels and paper and paperboard products. Results of the analysis also pointed out that intra-industry specialisation is increasing with the level of value added to products.*

**Key words:** *trade performance, competitiveness, wood products, Visegrad group*

**SAŽETAK •** *Cilj je rada bio analizirati učinkovitost trgovine i konkurentnost slovačke drvoprerađivačke industrije i usporediti ih sa zemljama Višegradske skupine. Konkurentnost je analizirana na proizvodima primarne prerade drva, i to na proizvodima piljenog drva četinjača i ostaloga piljenog drva, pločama na bazi drva, celulozi, papiru i proizvodima od kartona. Skup pokazatelja uspješnosti trgovine i konkurentnosti upotrijebljen je za analizu pozicije i promjene konkurentnosti pojedinih zemalja u razdoblju od 2003. do 2012. godine. Konkretno, indeks specijalizacije trgovine, omjer izvoza i uvoza, standardni Grubel-Lloydov indeks, indeks otkrivene komparativne prednosti i Vollrathov indeks otkrivene konkurentne prednosti upotrijebljeni su za identifikaciju komparativnih*

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*prednosti i trgovinsku specijalizaciju za pojedine kategorije šumskih proizvoda i uspješnost određene zemlje. Unutar skupine analiziranih zemalja za Slovačku je utvrđena komparativna prednost za većinu proizvoda, osobito u trgovini piljenog drva četinjača i ostalog piljenog drva, ploča na bazi drva, celuloze, papira i proizvoda od kartona. Rezultati analize također su pokazali da specijalizacija unutar industrije povećava razinu dodane vrijednosti proizvoda.*

**Ključne riječi:** *uspješnost trgovine, konkurentnost, proizvodi od drva, zemlje Višegradske skupine*

## 1 INTRODUCTION

### 1. UVOD

#### 1.1 Competitiveness

##### 1.1. Konkurentnost

Timber companies must continually strive to improve or at least maintain their market share (Oblak and Glavonjić, 2014). Globalisation as the process of international integration is affecting all industries, including forest based industry. As there are new products with lower prices available on the market, new strategies and advantages are required to face international competitors. These, among other, include new business models, improvement of productivity, innovations and cooperation in terms of technology, outsourcing and supply chain. The process of globalisation has led to the gradual reduction in trade barriers, and competitiveness has become a key issue in international markets since it can be considered as the major source of export development. The issues of competitiveness have also ascended high on the agenda of national governments and of the EU. In case of environmentally sensitive markets, the competitiveness of forest products can be influenced by factors related to the origin of wood material from sustainable and renewable sources (Kaputa, 2013; Paluš and Kaputa, 2009).

Wolff *et al.* (2007) state that the concept of competitiveness is rather complex as the term is used at different levels of aggregation with different meanings. The concepts of competitiveness can be distinguished at the level of products, business units or firms, as well as at industry and national or regional level. Jansik *et al.* (2014) state that the main difference between the competitiveness of business units and national economies is in the ultimate objective. For a company, it is the success or survival of a company, while for the economy the objective is to raise living standards. In this sense, competitiveness is a comparative concept of the ability and performance of a firm, subsector or country to sell and supply goods or services in a given market. A nation's competitiveness can be described as the degree to which it can, under free and fair market conditions, produce goods and services that meet the test of the international markets, while simultaneously maintaining and expanding the incomes of its people over the longer term. In a broader context, Latruffe (2010) defines competitiveness in two perspectives: (i) as the ability to face competition and to be successful when facing competition, and (ii) as the ability to sell products that meet demand requirements and, at the same time, ensure profits over time that enable the firm to thrive.

Consumers are, nowadays, very demanding and they require as much as possible information about the

product to be sure about its quality (Oblak and Glavonjić, 2014). Due to growing global demand for wood and wood products, it is crucial to be competitive on international market in order to make use of the potential gains of increased demand. A country that best utilises its given resources within a particular sector may enjoy a significant comparative advantage in respective international markets. According to Noor *et al.* (2008), the concept of comparative advantage is derived from traditional theory of international trade, while the term competitiveness goes beyond comparative advantage as no country can be competitive in every economic activity. Porter (1990) claims that productivity is the only meaningful concept of competitiveness. According to Kagochi (2007), some of the underlying factors that influence competitiveness include technology, human capital, product quality and differentiation, exchange rate, and other external factors.

Traditional trade theory understands international competitiveness via the comparative advantage of nations: A nation engages in trade and gains a comparative advantage not because it can produce a good or service absolutely cheaper, but because it is relatively more efficient than other nations in producing this good or service (Ricardo, 1911). The theory proved that each nation would benefit from specializing in the product in which it enjoys a comparative advantage, that way raising the total global output of each product and improving the situation of all participating nations (Carvalho *et al.*, 2009). The Heckscher-Ohlin theorem (Ohlin, 1933) assumes that especially the relative endowments of production factors, such as natural resources, labour and capital, determine a nation's comparative advantage. The theorem states that each country exports the commodity which requires for its production relatively intensive use of the factor relatively abundant in that country (Gonuguntla, 2007). The measurement of competitiveness in this sense stresses a country's performance on international markets and refers e.g. to trade flows, net exports, or countries' shares of the world market (Wolff *et al.*, 2007).

There have been several indicators developed to measure the competitive situation of a specific sector or country. According to Gries and Hentschel (1994), these can be classified into (i) result-oriented indicators that reveal the realised competitive situation of a sector or country from the ex-post perspective (indicators such as terms of trade, revealed comparative advantage, constant market shares, etc.), and (ii) determinant-oriented indicators that are based on the assumption of a correlation between the determinants and the competitive situation of a country (indicators such as

the legal and institutional framework of a country, its infrastructure, social security system, private and public expenditure for research and development, etc.).

## 1.2 Literature review

### 1.2. Pregled literature

Many studies using the result-oriented indicators to evaluate competitiveness of forest based and related agricultural sectors have been elaborated in different countries. Carvalho *et al.* (2009) used the revealed comparative advantage (RCA) and relative position in the market (RPM) indices to evaluate competitiveness of Brazilian wood pulp in the international market and observed that Brazil ranked among the top countries for competitiveness in the international market of wood pulp. Gonuguntla (2007) used the RCA index to analyse New Zealand's forestry sector comparative advantage in some forestry products. The study showed that New Zealand's comparative advantage decreased in low value products but increased in high value products within the forestry sector. Prasad (2004) used the revealed comparative advantage (RCA) index and revealed symmetric comparative advantage (RSCA), to measure Fiji's competitiveness in comparison to a set of reference countries. A comprehensive study on the competitiveness in the global forest industry sector with the emphasis on the German forest industry was elaborated by Dieter and Englert (2007). The study considered competitiveness of different wood commodities according to the level of processing using the revealed comparative advantage (RCA) index and the constant market share (CMS) analysis. The highest values of competitiveness indicators were shown by Russia for raw wood, Finland for semi-finished wood products and by Poland for finished wood products. The market share analysis also delivered the result that most of the leading timber exporters in absolute terms show only low export growth rates and vice versa. Mäkelä (2009) studied the competitiveness of the Russian forest industry and the influence of export taxes on competitiveness of individual wood commodities. He realised that the Russian forest sector is competitive primarily in products with a low added value. Noor *et al.* (2008) used the approach of revealed comparative advantage to analyse the strength of Malaysia in exporting the wood and forest products to world market. The results showed that Malaysia has the comparative advantage based on the performance of exporting wood and forest products to Europe. A similar study was elaborated by Zhang *et al.* (2012), who evaluated the competitiveness of Chinese industries, including the competitiveness of wood products. The competitiveness of US household and office furniture industry and its comparison with the major world furniture exporters was studied by Song and Gazo (2013).

## 1.3 Slovak forestry and wood processing industry

### 1.3. Slovačko šumarstvo i drvoprerađivačka industrija

In general, forest industry in Slovakia is divided into the forestry and wood processing industry. A long history of the forest industry is based on the rich wood resources and mining history. The total area of forests

is almost 2 mil. ha and the growing stock in the Slovak forests was 452 mil. m<sup>3</sup> in 2012. Total felling in 2012 was 8.2 mil. m<sup>3</sup>. In spite of the sufficient domestic wood processing capacities (mainly for softwood logs), a significant part of roundwood production was exported (over 2.4 mil. m<sup>3</sup> in 2012). The primary wood processing industry consists of three main sectors represented by sawmilling, wood based panels and pulp and paper sector. The secondary wood processing industry is represented by furniture sector. Due to the low domestic consumption of final products, the whole industry is strongly export-oriented. The primary processing sectors have been traditionally using the domestic wood resources; however the increasing pulp and paper production resulted in a growth in imports of hardwood pulp wood in the latest years. Sawmilling sector is very heterogeneous and mostly oriented to production of low value construction coniferous sawnwood (Paluš and Parobek, 2013). In 2012, the Slovak sawmills produced 1.56 mil. m<sup>3</sup> of sawnwood, out of which 40 % was exported. Wood based panel industry is represented mainly by particle board producers that produced 0.53 mil. m<sup>3</sup> of boards in 2012. At the same time over 64 % of production was exported and nearly 0.23 mil. m<sup>3</sup> of particle board imported to Slovakia. Pulp and paper industry is one of the most powerful sectors in the Slovak economy (Šupin, 2011). In 2012, the production of the main paper categories - printing and writing paper was 0.54 mil. tons, out of which nearly 96 % was exported. The future development of the industry is dependent on the level of utilisation of wood resources, investments into wood processing capacities and innovation activities of the industry (Loučanová, 2004). It is a generally accepted fact that socioeconomic development greatly depends on investment and, therefore, long-term development can only be achieved through investment, because well targeted investment activity is the primary assumption for all aspects of competitiveness (Ojurovic *et al.* 2013).

The objective of this paper is to analyse trade performance and competitiveness of the Slovak wood processing industry sectors and their comparison with the Visegrad group (V4) countries for the products of primary wood processing with the use of a set of trade performance and competitiveness indicators.

## 2 METHODS

### 2. METODE

Trade performance and competitiveness of the Slovak (SK) wood processing industry was examined in comparison with other Visegrad group countries (V4), namely Poland (P), Czech Republic (CZ) and Hungary (H). As for the definition of forest products, the FAO classification of forest products (FAO, 2014a) was used to set up the main categories of products according to the type and level of processing and added value (Table 1). Particular products and product groups included in the analyses were coniferous sawnwood, non-coniferous sawnwood, wood based panels, wood pulp, paper and paperboard.

**Table 1** Categories of examined wood products  
**Tablica 1.** Kategorije istraživanih drvnih proizvoda

Category <i>Kategorija</i>	Product groups <i>Skupina proizvoda</i>	Products included <i>Proizvodi</i>
Semi-finished mechanical wood products <i>polugotovni mehanički drveni proizvodi</i>	Sawnwood / <i>piljeno drvo</i>	Coniferous sawnwood / <i>piljeno drvo četinjača</i> Non-coniferous sawnwood / <i>piljeno drvo osim četinjača</i>
	Wood based panels / <i>ploče na bazi drva</i>	Veneer / <i>furnir</i> Plywood / <i>furnirske ploče</i> Particle board / <i>iverice</i> Fibreboard / <i>vlaknatiće</i>
Semi-finished chemical wood products <i>polugotovni kemijski drvni proizvodi</i>	Wood pulp / <i>drvena pulpa</i>	Chemical wood pulp / <i>kemijska drvena pulpa</i> Semi-chemical wood pulp / <i>polukemijska drvena pulpa</i> Mechanical wood pulp / <i>mehanička drvena pulpa</i> Dissolving wood pulp / <i>otopina drvene pulpe</i>
	Paper and paperboard / <i>papir i karton</i>	Newsprint / <i>roto-papir</i> Printing and writing paper / <i>papir za printanje i pisanje</i> Other paper and paperboard / <i>ostali papiri i karton</i>

The study adopts the widely accepted trade and competitiveness indicators (*Trade Specialisation Index, Export/Import Ratio, Standard Grubel-Lloyd Index, Revealed Comparative Advantage, Vollrath's Revealed Competitive Advantage Indexes*) based on forest products trade data in 2003 and 2012 available from the FAO Forest Products Statistics (FAOSTAT, 2014b) and the UN Comtrade Database (UN, 2014).

**Trade Specialisation Index**

According to Balassa (1966), country's trade advantage in a particular industry could be obtained by calculating the Trade Specialisation Index as a ratio of net trade to the total trade in the commodity category. This index is also referred to as the Net Trade Revealed Comparative Advantage Index (Prasad, 2004). The ratio is calculated as:

$$TSI_j^A = \frac{X_j^A - M_j^A}{X_j^A + M_j^A} \tag{1}$$

where:

$X_j^A$ - country A's export of product  $j$

$M_j^A$  - country A's import of product  $j$

This ratio ranges from -1 when there are no exports ( $X_j^A = 0$ ) to +1 when there are no imports ( $M_j^A = 0$ ). The values indicate comparative disadvantage when it is between -1 and 0 and comparative advantage when the value is between 0 and +1. However, if it is equal to 0, it indicates that exports and imports of a particular product are equal. More specifically, this index measures the degree of specialisation of a country in exporting a particular product (Prasad, 2004).

**Export/Import Ratio**

The ratio is calculated as:

$$EIR_j^A = \frac{X_j^A}{M_j^A} \cdot 100 \tag{2}$$

The higher the value of the ratio, the more a country has international trade competitiveness in a particular industry. By taking natural logarithm (Ln) to the ratio, the index is thus calculated as:

$$LnEIR_j^A = Ln \left( \frac{X_j^A}{M_j^A} \right) \cdot 100 \tag{3}$$

A positive value of this index indicates international trade competitiveness of a country for a particular product, and a negative value of the index implies that there is no international trade competitiveness.

**Standard Grubel-Lloyd Index**

Grubel and Lloyd (1975) carried out an empirical study on the importance of intra-industry trade and how to measure it. The index ( $GL$ ) is the ratio of the absolute value of differences in exports and imports to total trade of a particular industry or commodity group:

$$GL_j^A = 1 - \left( \frac{|X_j^A - M_j^A|}{X_j^A + M_j^A} \right) \cdot 100 \tag{4}$$

The Grubel-Lloyd index varies between zero (indicating pure inter-industry trade) and one (indicating pure intra-industry trade) or between 0 and 100 when expressed in percentage terms, respectively. Inter-industry trade is defined as trade between two countries where the goods are from different sectors, while intra-industry trade is when the traded goods are of the same sector.

**Revealed Comparative Advantage Index**

The revealed comparative advantage index (RCA) was proposed by Balassa (1965) to demonstrate whether a country has comparative advantage in producing a given product, comparing its share to the volume of domestic and international exports. According to Carvalho *et al.* (2009), an index greater than unity indicates that a country has comparative advantage in producing a product, while an index less than unity indicates that the country has revealed comparative disadvantage. The higher the index, the greater the comparative advantage of the country in international trade. The Balassa's RCA index is defined as:

$$RCA_j^A = \frac{X_j^A / X^A}{X_j^W / X^W} \tag{5}$$

where:

$X^A$  - total exports of country A

$X^W$  - total world exports (exports of a set of referenced countries)

Gonuguntla (2007) argues that although RCA reveals a country's resource based comparative advantage, it is quite likely that a country's comparative advantage is influenced by other variables such as changes in resource endowment, technology and demand. Another problem with the RCA index is that large differences in country sizes can cause problems when applying the RCA across countries and, therefore, Laursen (1998) adjusted the RCA index to make it symmetric (RSCA), such that the adjusted index values are between -1 and +1. This RSCA index is defined as:

$$RSCA_j^A = (RCA_j^A - 1) / (RCA_j^A + 1) \quad (6)$$

Positive values of RSCA show a competitive advantage, and negative values of RSCA show a competitive disadvantage in exporting product *j*.

#### Vollrath's Indexes of Revealed Competitive Advantage

Vollrath (1991) investigated alternative indexes under RCA theory. These are relative export advantage (RXA) index, relative import advantage (RMA) index, relative trade advantage (RTA) index, and revealed competitiveness (RC). Vollrath's indexes are presented below:

$$RXA_j^A = \frac{X_j^A / X_n^A}{X_j^R / X_n^R} \quad (7)$$

$$RMA_j^A = \frac{M_j^A / M_n^A}{M_j^R / M_n^R} \quad (8)$$

$$RC_j^A = \ln(RXA_j^A) - \ln(RMA_j^A) \quad (9)$$

where:

$X_n^A$  – exports of all products excluding product *j* by country *A*

$X_j^R$  – exports of product *j* by all countries in the world excluding country *A*

$X_n^R$  – exports of all products excluding product *j* by all countries in the world excluding country *A*

$M_n^A$  – imports of all products excluding product *j* by country *A*

$M_j^R$  – imports of product *j* by all countries in the world excluding country *A*

$M_n^R$  – imports of all products excluding product *j* by all countries in the world excluding country *A*

According to Song and Gazo (2013) if the  $RXA_j^A$  has a value greater than one, it reveals that country *A* has a competitive advantage in exports of commodity *j*. When the  $RXA_j^A$  has a value less than one, it reveals a competitive disadvantage. If the  $RMA_j^A$  has a value lower than one, it means that country *A* has a competitive advantage in imports of commodity *j*.  $RMA_j^A$  has a value higher than one when it has a competitive disadvantage.  $RC_j^A$  value greater than zero indicates a net competitive advantage, and  $RC_j^A$  lower than zero indicates a net competitive disadvantage of country *A*.

Wanat and Lis (2012) underlined that the indexes of revealed comparative advantage and intensity of economy share in intra-industry trade are interrelated. The competitiveness of products from a given market should not be determined only and exclusively by the credit balance of trade in relation to particular products. It is important to determine the intensity of simultaneous export and import within a given branch. If the value of exports and imports is similar, such a situation is referred to as so-called partner competitiveness.

### 3 RESULTS AND DISCUSSION

#### 3. REZULTATI I RASPRAVA

Overall Slovakia's performance of trade with respective wood products and product groups in 2003-2012 is shown in Table 2 and Table 3.

A positive value of the TSI indicates that Slovakia has a comparative advantage in the trade of coniferous and non-coniferous sawnwood as well as paper and paperboard products. On the other hand, comparative disadvantage is in trade with wood based panels and wood pulp. There is a clear trend in declining TSI values for both coniferous sawnwood (decline by 46.43 %) and non-coniferous sawnwood (decline by 68.67 %) during the observed period. The main reason for an

**Table 2** Slovakia's mechanical wood products trade performance in 2003-2012

**Tablica 2.** Rezultati slovačke trgovine mehaničkih drvnih proizvoda u razdoblju 2003. – 2012.

Year God.	Sawnwood (C) <i>Piljeno drvo četinjača</i>				Sawnwood (NC) <i>Piljeno drvo osim četinjača</i>				Wood-Based Panels <i>Ploče na bazi drva</i>			
	TSI	EIR	LnEIR	GL	TSI	EIR	LnEIR	GL	TSI	EIR	LnEIR	GL
2003	0.84	1135.97	243.01	16.18	0.83	1069.40	236.97	17.10	-0.11	80.12	-22.16	88.96
2004	0.79	872.06	216.57	20.57	0.80	879.69	217.44	20.41	0.00	99.47	-0.53	99.73
2005	0.81	931.71	223.19	19.39	0.73	645.63	186.51	26.82	0.00	99.93	-0.07	99.97
2006	0.73	631.39	184.28	27.35	0.74	679.36	191.60	25.66	-0.10	81.24	-20.77	89.65
2007	0.51	308.69	112.72	48.94	0.69	539.75	168.59	31.26	-0.10	81.22	-20.80	89.64
2008	0.66	481.78	157.23	34.38	0.71	598.17	178.87	28.65	0.04	107.28	7.02	96.49
2009	0.66	485.11	157.92	34.18	0.38	222.61	80.03	61.99	-0.19	68.70	-37.54	81.45
2010	0.33	197.04	67.82	67.33	0.64	453.01	151.07	36.17	-0.14	74.88	-28.93	85.64
2011	0.54	333.08	120.32	46.18	0.38	223.72	80.52	61.78	-0.22	64.44	-43.95	78.37
2012	0.45	264.86	97.40	54.82	0.26	171.38	53.87	73.70	-0.15	73.40	-30.93	84.66

TSI – Trade Specialisation Index / *indeks specijalizacije trgovine*; EIR – Export/Import Ratio

/ *omjer izvoza i uvoza*; LnEIR – Natural logarithm of Export/Import Ratio / *prirodni logaritam omjera izvoza i uvoza*; GL – Standard Grubel-Lloyd Index / *standardni Grubel-Lloydov indeks*

**Table 3** Slovakia's chemical wood products trade performance in 2003-2012

**Tablica 3.** Rezultati slovačke trgovine kemijskih drvnih proizvoda u razdoblju 2003. – 2012.

Year God.	Wood Pulp / Drvna pulpa				Paper and Paperboard / Papir i karton			
	TSI	EIR	LnEIR	GL	TSI	EIR	LnEIR	GL
2003	-0.06	89.02	-11.63	94.19	0.12	127.50	24.29	87.91
2004	-0.12	78.42	-24.31	87.91	0.22	154.91	43.77	78.46
2005	-0.13	77.66	-25.28	87.42	0.28	178.67	58.04	71.77
2006	-0.08	84.90	-16.36	91.84	0.30	185.11	61.58	70.15
2007	-0.13	77.09	-26.02	87.06	0.29	181.48	59.60	71.05
2008	-0.21	65.13	-42.88	78.88	0.20	149.52	40.23	80.15
2009	-0.18	68.92	-37.23	81.60	0.28	179.00	58.22	71.68
2010	-0.14	75.13	-28.59	85.80	0.32	192.24	65.36	68.44
2011	-0.20	66.43	-40.90	79.83	0.12	126.10	23.19	88.45
2012	-0.05	91.15	-9.26	95.37	0.13	129.57	25.91	87.12

TSI – Trade Specialisation Index / *indeks specijalizacije trgovine*; EIR – Export/Import Ratio / *omjer izvoza i uvoza*; LnEIR – Natural logarithm of Export/Import Ratio / *prirodni logaritam omjera izvoza i uvoza*; GL – Standard Grubel-Lloyd Index / *standardni Grubel-Lloydov indeks*

increase in competitiveness of coniferous sawnwood trade in 2005 was the severe windthrown in 2004 followed by growing production and export of sawnwood products. However, overall declining international trade competitiveness for both sawnwood products was also indicated by changes in LnEIR values, where in case of non-coniferous sawnwood the index dropped more significantly from 236.97 in 2003 to 53.87 in 2012. The analysis of GL indexes indicated gradual trend towards intra-industry trade specialisation for both sawnwood product groups. These changes were more significant for non-coniferous sawnwood rather than coniferous one where the GL index value increased from 17.1 to 73.7 in 10 years. However, compared to other product groups, sawnwood (mainly coniferous) can be still considered as the product considerably traded among industries.

TSI values for wood based panels oscillate around zero but in generally they indicate comparative disadvantage. This is clearly indicated by the development of LnEIR values when comparative advantage was revealed only in 2008 (7.02). The high values of GL index emphasise a balance between the imports and exports of wood based panels (99.73 in 2005), as well as strong intra-industry trade and specialisation in certain types and quality grades of wood based panels.

The intensive production of certain grades of papers causes a lack of wood pulp produced domestically and, therefore, this deficit needs to be supplemented by imports. Thus wood pulp imports dominated over exports during the observed period and TSI index implies no comparative advantage for wood pulp trade in Slovakia. A significant intra-industry trade is also characteristic for this commodity (GL in 2012 = 95.37). On the other hand, Slovakia shows comparative advantage in trading paper and paperboard products with high specialisation in certain paper grades and intra-industry trade.

Tables 4-7 illustrate the competitiveness of the V4 countries for individual products and product groups in the period 2003-2012. Results are mainly discussed on the basis of the analysis of two main indicators – RCA (RSCA) and RC. Table 4 provides an overview of competitiveness indicators for coniferous sawnwood in V4 countries. Results indicate revealed

comparative advantage for Slovakia and Czech Republic on one hand and disadvantage for Poland and Hungary on the other hand. RSCA values did not vary significantly and showed slightly increasing trend for the countries with comparative advantage and decreasing trend for the countries with comparative disadvantage. The Czech Republic was gradually gaining comparative advantage in coniferous sawnwood trade and reached the maximum in 2008 and 2009 (RSCA = 0.33), when many large and traditional exporters were losing their position due to the global economic crisis. Owing to low resource endowments, Hungary experienced high degree of revealed comparative disadvantage during the analysed period with the greatest RSCA value of -0.93 in 2012. Compared to other analysed countries, low exported volumes and a high import dependence of Hungary are also confirmed by the development of RC values (RC = -2.70 in 2012). Finally, Poland showed net competitive advantage till 2008, but owing to increasing imports it turned to disadvantage later on (RC = -0.37 in 2012).

Table 5 illustrates the development of competitiveness indicators for non-coniferous sawnwood in V4 countries. RCA index development indicates that Slovakia and Hungary have comparative advantage and Czech Republic and Poland (after 2007 onwards) comparative disadvantage in non-coniferous sawnwood trade. Slovakia is the country with the greatest comparative advantage within the V4 countries reaching the maximum in 2012 (RSCA = 0.51). The analysis also clearly shows that revealed comparative advantages reflect resource endowments of the respective countries (prevailing broadleaved forests). A clear trend towards increasing comparative advantage was also recorded for Hungary, when the RSCA value changed by 75 % during the analysed period.

Competitiveness indicators for wood based panel trade in V4 countries are shown in Table 6. Poland, as a typical wood based panel producer, is the country with the greatest revealed comparative advantage with the trend of values following the economic cycle when RSCA reached its maximum in 2003 (0.53), declined to 0.38 during the economic crisis in 2009 and started to increase with the recovery of economy (0.41 in

**Table 4** Competitiveness indicators for coniferous sawnwood for V4 countries in 2003-2012

**Tablica 4.** Indikatori kompetitivnosti piljenog drva četinjača za zemlje V4 u razdoblju 2003. – 2012.

Year God.	RCA				RSCA				RC			
	SK	PL	CZ	H	SK	PL	CZ	H	SK	PL	CZ	H
2003	1.65	0.75	1.87	0.09	0.24	-0.14	0.30	-0.84	2.44	1.38	1.76	-2.69
2004	1.01	0.57	1.76	0.08	0.00	-0.27	0.28	-0.85	2.19	1.00	1.81	-2.59
2005	1.67	0.43	1.73	0.08	0.25	-0.40	0.27	-0.85	2.27	0.31	1.47	-2.44
2006	1.75	0.45	1.75	0.09	0.27	-0.38	0.27	-0.84	1.88	0.36	1.66	-2.35
2007	1.55	0.50	1.80	0.04	0.22	-0.33	0.29	-0.92	1.09	0.03	1.67	-3.10
2008	1.88	0.42	1.99	0.07	0.30	-0.41	0.33	-0.87	1.55	-0.42	1.49	-2.49
2009	1.46	0.43	2.01	0.04	0.19	-0.39	0.33	-0.92	1.52	-0.32	1.49	-3.00
2010	1.81	0.46	1.88	0.05	0.29	-0.37	0.31	-0.91	0.65	-0.18	1.43	-2.61
2011	1.87	0.43	1.70	0.05	0.30	-0.39	0.26	-0.91	1.18	-0.51	1.21	-2.48
2012	1.38	0.43	1.74	0.03	0.16	-0.40	0.27	-0.93	0.91	-0.37	1.02	-2.70

RCA – Revealed Comparative Advantage Index / *indeks ustanovljene komparativne prednosti*; RSCA – Symmetric Revealed Comparative Advantage Index / *simetrični indeks ustanovljene komparativne prednosti*; RC – Revealed Competitiveness / *ustanovljena konkurentnost*

2012). Slovakia showed an increasing trend in revealed comparative advantage until 2008 (RSCA = 0.32), while with the start of the economic crisis these values started to decline and turned into comparative disadvantage in 2012 (RSCA = -0.01). However, when imports are considered, it can be mentioned that negative RC values of Slovakia in certain years (2009 onwards) meant no trade competitiveness (e.g. RC in 2011 = -0.51). The Czech Republic is also a country with com-

parative advantage in panel trade, while trade disadvantage was recorded in Hungary.

Table 7 shows values of competitiveness indicators for wood pulp trade in V4 countries. All analysed countries had comparative disadvantage in pulp wood trade when RSCA was ranging from -1.0 for Hungary to -0.01 for the Czech Republic in 2006. In general, comparative disadvantages and thus RSCA values were increasing in the periods of economic growth and vice

**Table 5** Competitiveness indicators for non-coniferous sawnwood for V4 countries in 2003-2012

**Tablica 5.** Indikatori kompetitivnosti piljenog drva osim četinjača za zemlje V4 u razdoblju 2003. – 2012.

Year God.	RCA				RSCA				RC			
	SK	PL	CZ	H	SK	PL	CZ	H	SK	PL	CZ	H
2003	2.59	1.49	0.32	1.40	0.44	0.20	-0.52	0.16	2.43	0.62	-0.71	1.48
2004	1.92	1.20	0.30	1.22	0.31	0.09	-0.54	0.10	2.25	0.35	-0.81	1.29
2005	2.21	1.09	0.27	0.99	0.38	0.04	-0.57	0.00	2.00	0.10	-1.02	1.07
2006	2.08	1.06	0.31	0.98	0.35	0.03	-0.52	-0.01	2.06	-0.02	-0.81	1.17
2007	1.87	0.92	0.23	1.11	0.30	-0.04	-0.63	0.05	1.81	-0.16	-1.17	1.27
2008	2.06	0.93	0.37	1.27	0.35	-0.03	-0.46	0.12	1.86	-0.19	-0.89	1.38
2009	1.91	0.72	0.92	1.28	0.31	-0.16	-0.04	0.12	0.88	-0.30	-0.42	1.42
2010	2.36	0.85	0.61	1.25	0.40	-0.08	-0.25	0.11	1.61	-0.05	-0.40	0.91
2011	1.24	0.79	0.58	1.59	0.11	-0.12	-0.27	0.23	0.90	-0.21	-0.10	0.76
2012	3.07	0.77	0.49	1.76	0.51	-0.13	-0.35	0.28	0.61	-0.17	-0.34	1.14

RCA – Revealed Comparative Advantage Index / *indeks ustanovljene komparativne prednosti*; RSCA – Symmetric Revealed Comparative Advantage Index / *simetrični indeks ustanovljene komparativne prednosti*; RC – Revealed Competitiveness / *ustanovljena konkurentnost*

**Table 6** Competitiveness indicators for wood based panels for V4 countries in 2003-2012

**Tablica 6.** Indikatori kompetitivnosti ploča na bazi drva za zemlje V4 u razdoblju 2003. – 2012.

Year God.	RCA				RSCA				RC			
	SK	PL	CZ	H	SK	PL	CZ	H	SK	PL	CZ	H
2003	1.42	3.29	1.18	0.83	0.17	0.53	0.08	-0.09	-0.19	0.76	0.11	-0.30
2004	1.40	2.93	1.12	0.67	0.17	0.49	0.06	-0.20	0.04	0.61	0.17	-0.16
2005	1.81	2.97	1.12	0.87	0.29	0.50	0.06	-0.07	0.05	0.55	0.15	-0.07
2006	1.55	2.88	1.30	0.84	0.22	0.49	0.13	-0.09	-0.18	0.43	0.26	-0.20
2007	1.47	2.34	1.31	0.83	0.19	0.40	0.14	-0.09	-0.36	0.23	0.16	-0.30
2008	1.96	2.52	1.37	1.12	0.32	0.43	0.16	0.06	0.03	0.28	0.08	-0.05
2009	1.15	2.23	1.51	0.96	0.07	0.38	0.20	-0.02	-0.46	0.26	0.46	-0.20
2010	1.40	2.37	1.33	0.99	0.17	0.41	0.14	-0.01	-0.36	0.26	0.35	0.03
2011	0.99	2.38	1.68	0.87	0.00	0.41	0.25	-0.07	-0.51	0.34	0.45	-0.13
2012	0.99	2.40	1.27	0.79	-0.01	0.41	0.12	-0.11	-0.39	0.50	0.20	-0.16

RCA – Revealed Comparative Advantage Index / *indeks ustanovljene komparativne prednosti*; RSCA – Symmetric Revealed Comparative Advantage Index / *simetrični indeks ustanovljene komparativne prednosti*; RC – Revealed Competitiveness / *ustanovljena konkurentnost*

**Table 7** Competitiveness indicators for wood pulp for V4 countries in 2003-2012

**Tablica 7.** Indikatori kompetitivnosti drvene pulpe za zemlje V4 u razdoblju 2003. – 2012.

Year God.	RCA				RSCA				RC			
	SK	PL	CZ	H	SK	PL	CZ	H	SK	PL	CZ	H
2003	0.84	0.12	1.10	0.00	-0.09	-0.79	0.05	-0.99	-0.05	-2.24	0.51	-5.44
2004	0.70	0.12	1.05	0.00	-0.17	-0.79	0.02	-1.00	-0.11	-2.21	0.69	-7.32
2005	0.73	0.11	1.05	0.00	-0.15	-0.80	0.02	-1.00	-0.09	-2.29	0.51	-
2006	0.57	0.07	0.97	0.00	-0.27	-0.86	-0.01	-1.00	-0.03	-2.68	0.52	-5.79
2007	0.65	0.04	0.84	0.00	-0.21	-0.92	-0.09	-1.00	-0.20	-3.06	0.48	-5.84
2008	0.61	0.04	0.80	0.00	-0.24	-0.92	-0.11	-1.00	-0.35	-3.17	0.52	-
2009	0.61	0.05	0.95	0.00	-0.24	-0.91	-0.03	-1.00	-0.35	-3.22	0.63	-
2010	0.81	0.07	0.91	0.00	-0.11	-0.88	-0.05	-1.00	-0.22	-2.88	0.67	-7.95
2011	0.68	0.07	0.70	0.02	-0.19	-0.87	-0.17	-0.97	-0.35	-2.79	0.66	-3.02
2012	0.79	0.03	0.76	0.02	-0.11	-0.94	-0.14	-0.96	-0.09	-3.64	0.66	-2.69

RCA – Revealed Comparative Advantage Index / indeks ustanovljene komparativne prednosti; RSCA – Symmetric Revealed Comparative Advantage Index / simetrični indeks ustanovljene komparativne prednosti; RC – Revealed Competitiveness / ustanovljena konkurentnost

**Table 8** Competitiveness indicators for paper and paperboard for V4 countries in 2003-2012

**Tablica 8.** Indikatori kompetitivnosti papira i kartona za zemlje V4 u razdoblju 2003. – 2012.

Year God.	RCA				RSCA				RC			
	SK	PL	CZ	H	SK	PL	CZ	H	SK	PL	CZ	H
2003	1.55	1.53	0.85	0.51	0.22	0.21	-0.08	-0.33	0.27	-0.17	-0.32	-0.67
2004	1.84	1.36	0.79	0.64	0.30	0.15	-0.12	-0.22	0.47	-0.32	-0.44	-0.54
2005	1.85	1.34	0.87	0.62	0.30	0.15	-0.07	-0.23	0.62	-0.34	-0.37	-0.48
2006	1.87	1.34	0.84	1.05	0.30	0.15	-0.09	0.02	0.65	-0.42	-0.39	-0.04
2007	1.97	1.35	0.82	0.75	0.33	0.15	-0.10	-0.14	0.61	-0.40	-0.37	-0.54
2008	1.53	1.26	0.84	0.59	0.21	0.11	-0.08	-0.26	0.42	-0.38	-0.44	-0.76
2009	1.74	1.33	0.78	0.75	0.27	0.14	-0.12	-0.14	0.57	-0.40	-0.54	-0.66
2010	2.64	1.58	0.79	0.82	0.45	0.23	-0.12	-0.10	0.67	-0.33	-0.48	-0.44
2011	1.28	1.75	0.85	0.90	0.12	0.27	-0.08	-0.05	0.22	-0.29	-0.36	-0.40
2012	1.33	1.88	0.83	0.95	0.14	0.30	-0.09	-0.03	0.23	-0.30	-0.35	-0.37

RCA – Revealed Comparative Advantage Index / indeks ustanovljene komparativne prednosti; RSCA – Symmetric Revealed Comparative Advantage Index / simetrični indeks ustanovljene komparativne prednosti; RC – Revealed Competitiveness / ustanovljena konkurentnost

versa decreasing in the period of economic crisis. When Vollrath’s index was used to analyse competitiveness, only the Czech Republic’s RC index reached positive values indicating net competitive advantage. This is in line with the development of foreign trade when wood pulp exports were growing while imports declined.

Table 8 presents values of competitiveness indicators for paper and paperboard trade in V4 countries. In general, Slovakia and Poland have comparative advantage in paper trade. The trend of RSCA values for Poland was following the economic development and thus was declining in the years of economic crisis. On the other hand, Slovakia’s comparative advantage increased in 2010 when RSCA was 0.45. Slovakia is also the only country holding its trade advantage, even if the imports of paper products take into consideration the fact that, when due to quick recovery of exports of office paper and declining imports in 2010, the value of RC was 0.67.

#### 4 CONCLUSION 4. ZAKLJUČAK

Competitiveness is the ability to face competition results in selling products that meet demand requirements ensuring profits. At the national level, it helps to develop export and maintain and expand the incomes of people over the longer term. Trade performance in-

dicators calculated for Slovakia show that the country has a comparative advantage in the trade of coniferous sawnwood, non-coniferous sawnwood and paper and paperboard products, while there is a comparative disadvantage in trade with wood based panels and wood pulp. The indicated comparative advantages for both sawnwood product groups were declining during the observed period followed by the increasing development of intra-industry trade specialisation. The highest degree of intra-industry specialisation is, however, in the trade of other higher added value wood products – wood based panels, wood pulp and paper and paperboard products due to specialised production in the country. Contrary to trade performance indicators, the calculated RCA indicator revealed a low comparative advantage also in wood based panel trade of Slovakia. In comparison with the group of V4 countries, the Slovak Republic is the country that has comparative advantage in most of the analysed products, while Hungary has revealed advantage only in non-coniferous sawnwood trade. In case of trade of certain products (non-coniferous sawnwood), the revealed comparative advantages pointed out the connection to countries’ resource endowments. On the other hand, the values of competitiveness indicators, as well as intensity of comparative advantages in the trade of certain wood products followed the economic development of countries.



