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Sujova, Andrea and Michal, Jakub and Kupčák, Václav and
Dudík, Roman

Technical University in Zvolen, Mendel University in Brno, Czech
University of Life Sciences in Prague

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The Impact of International Trade of Raw Wood to the Economic Growth of Forest-Based Sectors in the Czech and Slovak Republics

Andrea Sujová,^{a,*} Jakub Michal,^b Václav Kupčák,^c and Roman Dudík^c

International trade metrics can indicate the competitive advantage of the industry in international markets. However, the export of the raw materials utilized by the industry can influence company and industry performance negatively. This article assessed the effectiveness of the international trade with raw wood and its impact on the economic results of the industry. A system of indicators was formed to measure the international trade impact on the industry performance, and the following hypothesis was established: increasing the international trade with raw wood influences the economic growth of the industry negatively. The results confirmed the hypothesis, showing that the growth of export volume and also import of raw wood decreased industry performance during the monitored period. In the forestry sector, the more significant influence appeared in revenues, which influenced the profit most in the timber industry. Other findings demonstrated that the international wood trade in the Czech Republic and the Slovak Republic does not create a comparative advantage, but decreases competitiveness of the forestry sector.

Keywords: Economic growth; Foreign trade; Forestry sector; Raw wood

*Contact information: a: Department of Business Economics, Technical University in Zvolen, T. G. Masaryka 24, 960 53 Zvolen, Slovakia; b: Department of Forest and Wood Products Economics and Policy, Mendel University in Brno, Zemědělská 3, 613 00 Brno, Czechia; c: Department of Forest and Wood Products Economics, Czech University of Life Sciences Prague, Kamýčká 1176, 165 21 Praha 6, Czechia; *Corresponding author: sujova@tuzvo.sk*

INTRODUCTION

International trade is a part of every open economy and presents business activities in international markets. Because trade surplus in the international trade is one component of national gross domestic product (GDP), international trade can influence a country's GDP and industry and enterprise performance positively or negatively.

The commercial objective of the wood trade and industry is the net income and sufficient return to the invested capital. Processing generates value by adding further production factors. However, trade liberalisation and macroeconomic policy reforms have expanded the exports by developing countries, particularly in commodities, thereby increasing pressure on the environment (FAO 2003). The most important source of income in forestry is the sale of timber, which accounts for more than 78% of total sales in forestry. Timber production is a crucial economic activity in forest-based sectors. The structure and volumes of raw wood deliveries has been changing due to increasing demand for fuel wood (Parobek *et al.* 2014).

This paper measures the impact of international trade of raw wood on the competitiveness and performance of the forestry sector in the Czech Republic and the Slovak Republic. The production of wood-based products in Slovakia and the Czech Republic has a long tradition, and as a way of obtaining renewable resources, it is connected closely to many sectors of the national economy. One current challenge for these economies is the EU emphasis on development based on renewable resources. The national strategies for developing forest-based sectors in EU countries are based on the increasing valorisation of wood resources and

final processing of wood produced in the territory of a particular country, although in central European countries high exports of raw wood are a continued problem because they contribute to a trade surplus (Kupčák and Pek 2015; Sujová *et al.* 2015a). However, a wood flow analysis for forest-based products in Switzerland discovered the underutilization of local forests due to sizeable imports of wood (Binder *et al.* 2004).

The import of the raw wood in the Czech and the Slovak Republics is lower than export on a long-term basis. However, in the Czech Republic the volume of the raw wood import is equal to 50% of the export volume. The import and export of raw wood leave a high carbon footprint as a consequence of wood transportation. Additionally, the issue of controversial sources is becoming more significant due to the requirements of the European Union Timber Regulation or Chain of Custody of Forest Based Products (Dudík and Riedl 2015). For wood imports, it is more difficult to trace the origin of the raw material than in the case of timber harvesting in the site (country) of its processing.

Sustainable development of the forest-based sector depends on the effective utilization of raw wood materials. Thus, it is important to investigate the impacts of the international trade of raw wood material on the economic growth of forest-based sectors. There have been several studies on the assessment of competitiveness in forest-based industries (Carvalho *et al.* 2009; Han *et al.* 2009; Wanat and Lis 2012; Zhang *et al.* 2012; Hajdúchová and Hlaváčková 2014; Sujová *et al.* 2015b; Parobek *et al.* 2016).

Several indicators of international trade impacts have been designed to measure the economic growth at the macro level. The most commonly used measurement of international trade impact on the economic growth (measured by the growth of GDP) is quantification by so-called contribution to economic growth (Breda *et al.* 2007). This value expresses the contribution of net export to the growth of GDP as a weighted difference between export and import growth rate, where weights are portions of export and portions of import to GDP based on the previous time period (Hajnovičová 2008). Another measure of export impact on the economic growth is quantification of export impact using an input-output analysis based on the analysis of direct and indirect intensity of home production to import. The contribution of net export to the economic growth is calculated as total exports after deducting induced import to intermediate consumption (Coronado *et al.* 2014).

Multipliers of the final use are other indicators to assess the impact of international trade on economic growth. These factors quantify home production, imports in the particular year induced export, final consumption of households, final consumption of the government, creation of gross capital or the amount of produced added value, and employment at all stages of production (Lábaj *et al.* 2008). Based on the designed indicators, this paper assessed the impact of the international trade of raw wood material on the economic growth of the forest-based sector in the Czech Republic and the Slovak Republic for a period of 6 years. The factors that had a significant influence on the performance of the industry were identified based on earlier suggested indicators. This main aim is divided into partial objectives of the study: to assess the contribution of foreign trade with raw wood on economic results of the forest-based sector, to measure the impact of raw wood foreign trade to economic performance of the forestry industry and of the timber industry, and the comparison of the results in the Czech Republic and Slovakia.

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EXPERIMENTAL

The material necessary for obtaining relevant outputs was gathered by secondary research based on the review and analysis of the available scientific literature and by processing statistical data on international trade and economic indicators in the forest-based sector in the Czech Republic and Slovakia. The first part of the analysis assessed the international trade of raw wood material by quantifying (1) the ratio of raw wood export to timber export including complete wood processing industry, (2) the ratio of the raw wood import to its export, and (3)

the comparative advantages of timber export. The comparative advantages were identified by RCA indicator. The RCA indicator describes a comparative advantage or disadvantage of export and its competitiveness, and it is calculated as follows (Aiginger and Landesmann 2002),

$$RCA = \ln [(x_{ij} / m_{ij}) : (X_j / M_j)] \quad (1)$$

where x_{ij} is the export value of commodity group “i” within industry “i” in country “j”; m_{ij} is the import value of commodity group “i” within industry “i” in country “j”; X_j is the value of total exports from country “j”; and M_j is the value of total imports to country “j”.

The indicator RCA is interpreted as follows: $RCA < 0$ indicates comparative disadvantages in the industry or commodity group; $RCA > 0$ indicates comparative advantages in the country for export commodities for that industry or commodity group; and $RCA > 1$ identifies the commodity and industry as internationally competitive.

The next step was the design of indicators to measure international trade impact on industry performance by modifying macroeconomic indicators. Indicators that could be used for the industry were described by Sujová *et al.* (2015a). The first indicator was contribution of international trade (CFI) to the growth of economic indicators, which expresses contribution of net export to a year-to-year growth rate of the chosen economic indicator for the industry (Eq. 2),

$$CFI = \frac{\Delta X}{Y_{t-1}} = \left(\frac{EX_t}{EX_{t-1}} - 1 \right) \cdot \left(\frac{EX_{t-1}}{Y_{t-1}} \right) - \left(\frac{IM_t}{IM_{t-1}} - 1 \right) \cdot \left(\frac{IM_{t-1}}{Y_{t-1}} \right) \quad (2)$$

where ΔX is net export of sector commodities (gross export minus gross import); EX is export of sector commodities; IM is import of sector commodities; and Y is an economic indicator of the sector (revenues, value added, profit).

By means of the CFI indicator of the international trade impact on revenues, the added value and economic results of the industry was analysed. The values of indicator CFI are interpreted as follows: if $CFI > 0$ international trade contributes to industry performance; if $CFI < 0$ international trade influences the economic industry performance negatively.

Other indicators were multipliers of import, export, and net export modified for chosen economic indicators for the industry, including revenues, added value, and economic result. The multiplier was enumerated so that a new generated value of the economic indicator is divided by a generated value of export and net export. The relation for the industry multipliers is calculated as follows,

$$M_X = \frac{\sum_{i=1}^n \Delta Y_j}{\sum_{i=1}^n \Delta X_j} \quad (3)$$

where Y_j is an economic indicator of the industry j and the commodity i , and X_j is an indicator of international trade (import, export, net export) for the industry j and the commodity i . If $|M_X| < 1$, international trade does not have a multiplying effect on the economic performance of the commodity group in the industry. If $M_X < 0$, international trade has an opposite effect on the economic performance of the commodity group in the industry.

The last indicator was the transformation effect of an economy (*TEE*), which observes dependence between raw materials import (M_i) and export f of the industry production (X_j). It is calculated in Eqs. 4 and 5.

$$TEE = X_j - M_i \quad (4)$$

$$TEE = \frac{M_i}{X_j} \cdot 100 \quad (5)$$

A comparison to the development of international trade indicators in the observed years representing the index of change of an international trade component was necessary for the analysis and correct interpretation of the obtained results,

$$X_i = \frac{X_t}{X_{t-1}} - 1 \quad (6)$$

where X refers to a component of the international trade (*e.g.*, the value of export, import, and net export).

The calculation of the individual indicators was applied for the forestry and timber industries in the Czech and Slovak Republics. The characteristic feature of the forest-based sector is processing of raw wood and production of the wood products at the various stage of final processing. The product of the forestry industry is raw wood. The timber industry represents primary mechanical processing of wood within the classification of enterprise operations of EU NACE 16 (Sujová *et al.* 2015b). The data were collected from databases of the Czech Statistical Office and the Statistical Office of the Slovak Republic (2016) and Eurostat (EC 2016) with annual data on international trade of the countries. The commodity structure in the classification of the Statistical classification of products by operations (CPA 2008) in millions of Euro (FOB/FOB) for the period of 2008 to 2014 was examined also. Another group of data included economic indicators of the forest-based and timber industries, such as value of production, revenues of particular operations, added value, economic result before taxation, where the database was created by the Statistical office and Green reports (<http://slovak.statistics.sk>; <http://www.czso.cz>).

RESULTS AND DISCUSSION

The impact of the international trade of raw wood material was considered relative to the economic growth in the forestry and timber industries. Tables 1 and 2 present the analysis for the Slovak Republic and the Czech Republic, respectively, for the period of 2009 to 2014.

The data in Table 1 show that international trade balance was active, with growth until 2011 due to the export of wood. Wood import decreased until 2011 but grew remarkably afterward. The wood import to wood export ratio revealed that from 2012, a third of exported wood was imported back to Slovakia. The proportion of raw wood export to export in wood processing industry grew gradually to 8.5%. The proportion of wood export to the export in timber industry, which processes raw wood directly, encountered a sharp increase of 34% in 2010, indicating that one third of the commodity export was created by raw wood. However, the export performance of this industry went down markedly in 2010 from 100% to 50%, but subsequently, it grew up to 83% in 2013. The positive values of the RCA index suggest that wood trade had a comparative advantage at the national level, yet in the course of the analysed period, the advantage gradually decreased. This result was related to the decreasing net exports and the growth of wood imports.

Table 1. Indicators of Foreign Trade in Wood and its Impact on Economic Growth of FBS in SR

| Indicator | Year | | | | | |
|----------------------------------|--------|--------|--------|--------|--------|--------|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| Foreign trade in raw wood | | | | | | |
| Net export (NEX) | 125.17 | 142.32 | 143.82 | 121.37 | 113.18 | 129.52 |
| IM/EX (%) | 17.21 | 16.28 | 15.77 | 34.75 | 42.41 | 23.92 |
| Change indices | | | | | | |
| IM | -0.15 | 0.06 | -0.03 | 1.40 | 0.29 | -0.51 |
| EX | 0.15 | 0.12 | 0.00 | 0.09 | 0.06 | -0.13 |
| NEX | 0.24 | 0.14 | 0.01 | -0.16 | -0.07 | 0.14 |
| Share in export WPI (%) | 7.61 | 8.83 | 8.73 | 9.01 | 9.15 | 8.25 |

| | | | | | | |
|---|--------|--------|--------|--------|--------|--------|
| Share in export of TI (%) | 25.70 | 34.98 | 33.53 | 34.22 | 37.46 | 32.31 |
| Share of exports in sales TI (%) | 119.39 | 50.02 | 63.64 | 80.99 | 83.32 | |
| RCA | 1.74 | 1.80 | 1.83 | 1.00 | 0.79 | 1.35 |
| CFI to Forestry | | | | | | |
| CFI to sales | 0.06 | 0.06 | 0.00 | -0.052 | -0.02 | 0.04 |
| CFI to value added | 0.09 | 0.09 | 0.01 | -0.10 | -0.03 | 0.07 |
| CFI to profit | 0.00 | 0.01 | 0.00 | -0.46 | 0.00 | 0.52 |
| Multiplier of NEX to sales | -3.96 | 3.90 | 0.00 | 1.85 | 0.87 | 2.78 |
| Multiplier of NEX to value added | -2.73 | -0.32 | 0.00 | -0.79 | -0.07 | 1.57 |
| Multiplier of NEX to profit | -0.74 | 0.27 | 0.00 | 0.37 | 1.05 | 1.23 |
| CFI to TI (NACE 16) | | | | | | |
| CFI to sales | 0.03 | -0.17 | 0.03 | -0.05 | -0.03 | 0.05 |
| CFI to value added | 0.17 | -0.78 | 0.10 | -0.16 | -0.13 | 0.23 |
| CFI to profit | 1.21 | -6.22 | 0.15 | -0.27 | -0.24 | 0.39 |
| Multiplier of NEX to sales | -8.72 | -6.69 | -6.06 | 3.13 | -2.71 | |
| Multiplier of NEX to value added | -0.91 | -2.63 | -1.85 | 1.87 | 0.76 | |
| Transformation Effect of Economy | | | | | | |
| TEE1 (mil. €) | 562.26 | 458.35 | 482.36 | 478.95 | 441.32 | 486.25 |
| TEE 2 (%) | 4.42 | 5.69 | 5.29 | 11.89 | 15.89 | 7.73 |
| TEE index | 0.88 | 0.97 | 1.02 | 1.04 | 1.03 | 0.98 |

The CFI indicator values showed that the decrease of net exports coupled with the growth of imports in 2011 and 2012 caused a substantial decrease in revenues and a decrease in added value. The strongest effect on added value growth and revenues was caused by an increase of net exports due to decreased wood imports in 2009, 2010, and 2014. The decrease in wood exports had a positive effect on revenue growth. The international trade impact was demonstrated most at the changes of added value. The multiplying effect was observed for sales where the values of net export multiplier were higher than 1. The same impacts of net wood export on the economic growth were observed in timber industry, while the impact was higher. The wood trade influenced the economic results in this industry most, such that an increase in wood export influenced the economic results exceptionally negatively. The wood import influenced the economy transformation effect in forest-based sectors. However, the gradual growth of the ratio of raw material import to all commodities export by 11% in the examined time period did not generate positive changes because the transformation effect gradually declined.

Table 2. Indicators of Foreign Trade in Wood and its Impact on Economic Growth of FBS in CR

| Indicator | Year | | | | | |
|----------------------------------|--------|--------|--------|--------|--------|--------|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| Foreign trade in raw wood | | | | | | |
| Net export (NEX) | 143.39 | 167.79 | 172.10 | 175.94 | 221.79 | 201.41 |
| IM/EX (%) | 38.79 | 44.35 | 46.19 | 49.51 | 45.51 | 48.79 |
| Change indices | | | | | | |
| IM | 0.72 | 0.47 | 0.10 | 0.17 | 0.07 | 0.04 |
| EX | 0.19 | 0.29 | 0.06 | 0.09 | 0.17 | -0.03 |
| NEX | 0.00 | 0.17 | 0.03 | 0.02 | 0.26 | -0.09 |
| Share in export WPI (%) | 9.23 | 10.33 | 10.26 | 11.16 | 16.31 | 11.67 |

| | | | | | | |
|---|--------|---------|---------|---------|---------|---------|
| Share in export of TI (%) | 23.56 | 26.56 | 27.71 | 28.65 | 34.11 | 30.09 |
| Share of exports in sales TI (%) | 39.1 | 43.3 | 44.0 | 46.7 | 52.1 | |
| RCA | 0.87 | 0.76 | 0.70 | 0.60 | 0.67 | 0.59 |
| CFI to Forestry | | | | | | |
| CFI to sales | -0.00 | 0.04 | 0.01 | 0.00 | 0.05 | -0.03 |
| CFI to value added | -0.00 | 0.04 | 0.01 | 0.00 | 0.04 | -0.02 |
| CFI to profit | -0.01 | 0.00 | -0.00 | 0.01 | 0.00 | -0.08 |
| Multiplier of NEX to sales | 0.0 | 8.6 | 16.0 | 8.0 | -2.0 | -3.2 |
| Multiplier of NEX to value added | 0.0 | 6.7 | 46.4 | 17.9 | -1.2 | -1.6 |
| Multiplier of NEX to profit | 0.0 | 5.7 | 20.4 | 8.1 | -0.9 | -6.6 |
| CFI to TI (NACE 16) | | | | | | |
| CFI to sales | -0.02 | 0.04 | 0.01 | 0.01 | 0.02 | 0.01 |
| CFI to value added | -0.08 | 0.12 | 0.04 | 0.03 | 0.09 | 0.02 |
| CFI to profit | -0.31 | 0.82 | 0.18 | 0.12 | 0.40 | 0.11 |
| Multiplier of NEX to sales | 5.1 | 1.4 | 0.9 | 0.1 | -4.0 | |
| Multiplier of NEX to value added | 1.2 | 0.3 | -0.7 | -0.2 | -0.8 | 4.5 |
| Transformation Effect of Economy | | | | | | |
| TEE1 (mil. €) | 903.49 | 1001.64 | 1006.36 | 1043.86 | 1008.06 | 1115.13 |
| TEE 2 (%) | 9.1 | 11.8 | 12.8 | 14.2 | 15.5 | 14.7 |
| TEE index | 0.87 | 1.14 | 1.07 | 0.99 | 0.78 | 1.38 |

The analysis of the international trade with wood in the Czech Republic given in Table 2 shows that the net exports were positive during the reference period, and its amount grew gradually. On average, 45% of exported wood was imported back to the Czech Republic, while imports tended to grow. The proportion of the raw wood export to the export of wood processing industry gradually grew from 9.3% in 2009 to 16.3% in 2013, which was 8% higher than in Slovakia. The ratio of wood export to the production export in the timber industry, which first processes raw wood, gradually increased from 23.6% to 34% in 2013, which means that one third of exported commodities in the Czech Republic were raw wood. However, the export performance of this industry was much lower than in Slovakia, growing gradually from 40% to 52%. The RCA index values demonstrated a comparative advantage of wood trade at the national level, but it was much lower than Slovakia. Moreover, during the reference period this advantage gradually decreased and approached zero, which indicated its loss. This result was related to the high export during a simultaneous increase of wood import.

CFI indicators in the forestry industry showed that decrease net exports in 2014 caused a decrease in revenues, added value, and profit. A sharp increase in wood import caused the same effects. An increase of the value of net export due to higher growth of wood export in 2010 and 2013 had the strongest effect on the growth of added value and revenues. The impact of international trade with wood was demonstrated most in changes of added value and revenues and least in profit. Calculating the multipliers, the effect of net export with the opposite tendency was found in the last 2 years, demonstrating that increased exports led to multiple decreases in economic indicators.

The impacts of net export of wood on economic growth in timber industry were similar to the Slovak Republic. A rapid increase of wood imports at an unchanged value of net export in 2009 caused an economic decline, especially in profit. The decline of the net export value as a result of wood export decline in 2014 had opposite effects compared to the forestry sector; it started economic growth. The strongest effect on the economic growth was caused by

a substantial growth of wood exports. Wood trade influenced most economic results of this industry, but an increase wood exports had a noticeable positive effect. It is also confirmed by high values of the multiplier. The gradual growth of raw material imports to all commodities export from 9% to 15.5% in the studied time period generated positive development.

The results led to a more detailed analysis of relationships and consequences of the impact of international trade with wood on the economic growth in forest-based sectors. The indicators of international trade on the economic growth of wood producers in the forestry industry implied the following chain of effects. The growth of net exports caused growth in added value, revenues, and profit. In Slovakia, this effect was because of decreased wood imports, and in the Czech Republic, it was because of increased exports. The relationship can be written as follows,

$$FI: \uparrow NEX \leftrightarrow \uparrow EX \text{ in } CR, \downarrow IM \text{ in } SR = \uparrow M_x \cdot S + \uparrow M_x \cdot VA + \uparrow P$$

where *FI* is forestry industry, *NEX* is net export, *EX* is export, *IM* is import, *S* is sale, *VA* is value added, *P* is profit, *CR* is the Czech Republic, *SR* is the Slovak Republic.

In the timber industry (TI), the following effects apply. The decline of exports and imports leads to growth of revenues, added value, and profit in the Slovak Republic, but in the Czech Republic, the growth of raw wood imports or exports influences the profit growth. The relationship can be written as follows:

$$TI: \downarrow EX \text{ or } \downarrow IM = \uparrow S + \uparrow VA + \uparrow M_x \cdot P \text{ but in } CR \uparrow EX \text{ or } \uparrow IM = \uparrow P$$

International trade with raw wood in the Czech Republic and Slovak Republic had a marked influence on the revenues growth and added value in the forestry sector and on profit growth in the timber industry. An ambition of developed countries is to achieve the best possible valorisation of home resources instead of doing business with them. The high export of raw wood is, therefore, not desirable. In the forestry sector, increasing the net export of raw wood influenced the economic growth positively. This result suggests that it is still more advantageous to export raw wood than to sell it to domestic processors for further processing, which contradicts the long-term intentions and strategies of the states. Furthermore, the growth in net exports of wood influenced the performance and economic growth of wood processors negatively.

Previous studies of authors dealing with analysis of forest-based sector mentioned in the introduction were focused on analyses of trends in foreign trade with raw wood, on competitiveness or on performance of the sector. The results of previous studies pointed to high export and imports of raw wood and their negative increasing trends as a barrier for valorization of home wood sources. As for performance of the forest-based sector, the results showed its low level. However, in no study the connection and consequences between foreign trade of raw wood and performance of the forest-based sector is presented.

Quantification of impacts of international trade to economic growth through several indicators was provided only at a macroeconomic level by authors Breda *et al.* (2007), Coronado *et al.* (2014, Hajnovičová (2008) or Lábaj *et al.* (2008). Only one previous study of Sujová *et al.* (2015a) was dealing with measuring the impact of foreign trade at a sector level with application in the wood processing industry. However, the cited study doesn't present the influence of foreign trade in raw wood on the performance of the analysed sector.

CONCLUSIONS

1. This study brings new knowledge in the area of analyses of forest-based sector done in previous research. It can be considered to be a connection between analyses of foreign trade and performance of the sector, which showed direct assessment of the impact of foreign

trade in raw wood to economic growth of the forest-based sector using a set of indicators created by authors.

2. The strategic aim for the forest-based sector in EU is to increase the final processing of domestic raw wood. In the Slovak and Czech Republics, domestic raw wood export has increased in recent years. The situation appears worse in the Czech Republic because wood exports are constantly growing, and even as much as a half of the exported wood is imported again. In Slovakia, the growth of wood export is more moderate, and the imported wood necessary for domestic processing equals up to one-third of the exported wood.
3. The economic growth of the forestry and timber industries in the Czech Republic is unfortunately still dependent upon raw wood exports. The growth of wood exports has positive impacts on the growth of revenues, added value, and profit. Nonetheless, the growth in raw wood imports also has a positive effect on the Czech economy.
4. In Slovakia, a desirable effect corresponding with the EU strategy has appeared. Decreasing the volume of foreign trade with wood, *i.e.*, a decrease in imports and exports of raw wood, has a positive effect on the economic growth of forest-based sectors. This result was confirmed by the finding that raw wood import does not enhance the economy.
5. Although the international trade of raw wood in the Slovak Republic and the Czech Republic creates active trade balance, its comparative advantages are disappearing. High and increasing wood exports are still a barrier for performance growth in the forest-based sector.
6. The unfavourable effect of international trade of raw wood on the economic growth of forest-based industries should motivate the governments of the Slovak Republic and the Czech Republic to approve adequate and effective measures to limit the export of raw wood. The first recommendation is to create a common conception for the forestry sector and wood processing industry in order to secure the sufficient deliveries of raw wood for domestic wood processors at a long-term basis. The second group of tools should be focused on preference of domestic processing of raw wood through direct limitation of export and supporting tools for domestic wood producers.

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