Export Performance of the Croatian Wood Industry and Its Contribution to the Overall Croatian Economy

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Abstract

This article investigates the contribution of the Croatian wood industry to the overall Croatian economy. The contribution is analyzed in terms of production, employment, and value added, using the input–output method for analysis. The objective of this article is to calculate multipliers for the wood industry in Croatia and benchmark them to the economies of similar European new member states. The model uses the so-called open model calculation, from which households are excluded. It comprises direct and indirect effects only, without induced effects, which is one of the distinguishing features of the so-called closed model. Results are benchmarked to other national economy sectors and similar transition economies. The wood industry output multiplier is the highest in Croatia and Poland. Domestic producers use various domestic and imported inputs in the production process. Input–output multipliers are calculated for both domestic and foreign demand (exports). Exports are profoundly important for Croatia as a small, open economy. Results of this research are useful to a wide range of policymakers and academics.

Openness and trade are the most important factors enabling economic growth and job creation in a globalized economy. Increasing the competitiveness of the European Union (EU) and member states in global markets is considered to be of key importance to a trade policy, integral to the EU's 2020 strategy (European Commission 2010). Croatia is a small economy with limited domestic demand, so international trade could significantly add to growth of the economic activity and employment. In this article we estimate an important segment of national exports, namely wood industry products.

Based on the input–output table model, this paper estimates the overall contribution of the wood industry to the Croatian economy. In the production of wood products, producers use various nonwood-based materials in accordance with the technological process involved. In the production of furniture, the most important intermediate inputs are roundwood, sawn wood, and panels, but other domestic inputs are also needed: energy products, metal industry products, services of designers etc.

The influence of foreign demand through export multipliers is analyzed in more detail. Apart from positive impacts of specialization and integration, growth of exports pushes the expansion of the domestic market through the demand channel. Exports present direct additional demand for domestic producers, while increasing exports via rising domestic income contributes to the expansion of domestic demand. Exports induce an increase of production, employment, wages, and other income benefits. The value added relating to export demand generates the final demand of households and gross fixed capital formation to the extent of the proportion covered by domestic production. In economic literature, four main ways emerge as the channels through which exports push economic growth: (1) competition in international markets encourages the achievement of greater production efficiency (Krueger 1980); (2) exports promote specialization and economies of scale, leading to greater return benefits; (3) enterprises engaged in exports tend to introduce technical progress, which has spillover effects for the rest of the economy (Grossman and Helpman 1991); and (4) exports, by bringing in foreign currency, help to overcome external constraints on growth (Helpman and Krugman 1985).

Most authors find arguments in favor of causality flows from exports to economic growth. The most cited term in this field is the so-called export-led growth (ELG) hypothesis (Balassa 1978). The export expansion and openness to foreign markets is viewed as a key determinant of economic growth because of positive externalities it provides efficient resource allocation, greater capacity utilization, exploitation of economies of scale, and increased technological innovation stimulated by foreign market competition.

Recent literature is more oriented toward measuring net trade and quantifying the value added content of trade (Belke and Wang 2006, Daudin and Schweisguth 2011, Johnson and Noguera 2012).

The relationship between exports and growth from the demand perspective is present in the classical concept of a foreign trade multiplier and super-multiplier (Hicks 1950). In both concepts increments in exports allow the expansion of other components of the autonomous demand to the point in which the increase of imports equals the initial increment of exports.

Bojnec and Ferto (2014) analyzed the forestry industry trade of New Member States (NMS) and their impact on the enlarged EU and found Cyprus to be the best performing NMS economy in the wood industry sector, especially in the group of finished or at least semifinished wood products. Authors also found convergence in the forestry industry trade specialization of NMS economies and concluded that management in the wood sector should focus on better quality and greater trade competitiveness in the vertical wood industry supply chains from lower to higher value-added and marketed wood products.

Wood product supply chains based on logs (not on pulp) can be defined as large networks through which wood fiber is gradually transformed into consumer products (Fig. 1). In various supply chains, the production network starts in the forest, followed by the transformation during the production process, and on to distribution and retail networks for final products, with ultimate delivery to domestic or foreign consumers. The transformation process involves many generic processes which consume a set of inputs, combined in different ways in order to produce final products (D'Amours et al. 2008). The transformation process and
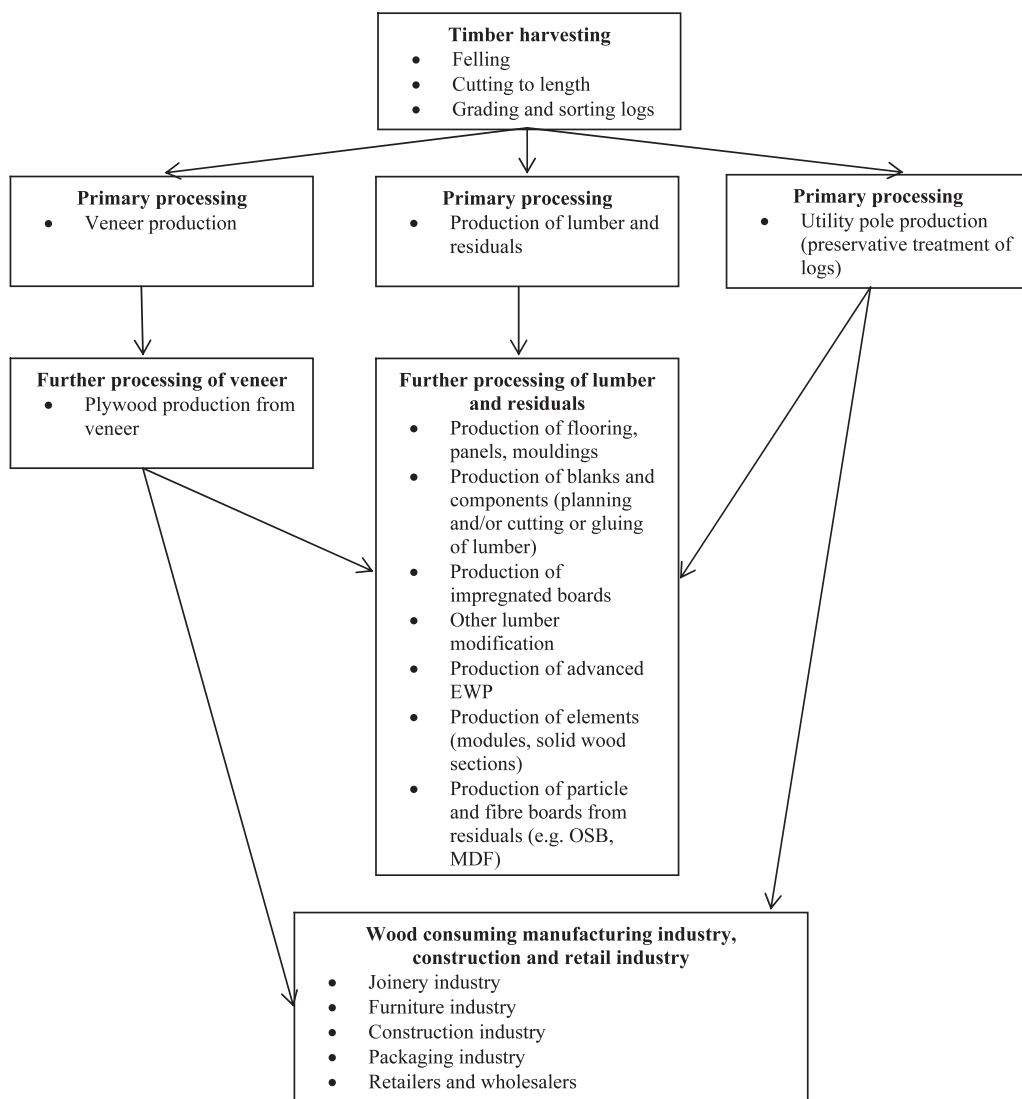

Figure 1.—Wood industry supply chain based on logs. Source: Stendahl (2009). EWP = engineered wood products; OSB = oriented strand board; MDF = medium-density fiberboard.

multiplying effects are best described in the framework of the input–output analysis.

Miller and Blair (2009) described the input–output analysis as a set of linear equations, each one describing the distribution of an industry's product throughout the economy. It basically represents the flow of money in an economy, among industries, but may also include households, governments, imports, and exports (Robinson 2009).

The use of the input–output analysis faces a certain number of assumptions underlying the input–output models, which are binding (McLennan 2006). Those assumptions relate to constant returns to scale, linear production function, supply constraints, fixed commodity input structure, homogeneous output, and the homogeneity of technology. As for multipliers, authors usually find high multipliers for the wood sector as far as total output and value added are concerned, but it is found to be a little bit less important for employment (Dixon et al. 2012, Burrows and Botha 2013).

After a short literature review, this article provides a description of the input–output methodology and the empirical results for the Croatian economy. It provides an analytical insight into one of the most important Croatian manufacturing industries, enabling policymakers to better understand the processes taking place after the EU accession. An additional motivation comes from the fact that the Croatian Bureau of Statistics (CBS) published the input–output table for 2004 in August 2013.

Methodology

The importance of exports of wood products for the Croatian economy is assessed through an input–output model which is able to quantify the direct and the indirect contribution of exports to the national economy. In the article we deploy a concept of input–output analysis with the open model, including direct and indirect effect, but excluding induced effect via household sector consumption. A limited data set on NMS and Croatia prohibits us from using a closed model with additional forward induced effects.

In the case of Croatia, the official input–output table recently published by the CBS (www.dzs.hr) covered data for 2004, while tables for other countries are for 2005 (http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/introduction). Many countries publish input–output tables with a considerable delay. The same applies to Croatia. But as technology changes are limited in the short run, presented results still can give some insight into the comparative importance of the wood industry.

The term wood industry, based on the classification presented in Kies et al. (2008), covers forestry, primary wood processing, and secondary wood manufacturing. Corresponding classification of products by activities (CPA) 2002 codes are presented in Table 1.

Input–output model

The input–output analysis is based on a static presentation of the structural relationship among economic sectors. It is mainly oriented to the estimation of the impact of final demand on domestic output, value added, and prices. Although some aspects of inter–sectoral relationship between economic units can be found in very old economic literature, Wassily Leontief is considered as the main developer of the input–output analysis (Ten Raa 2005). At

Table 1.—Classification of wood industry exports.[a]

CPA item	Description of item
	Forestry
0201	Wood in the rough; natural gums; natural cork; other forestry products
	Primary wood processing
2010	Wood sawn, planed, or impregnated
2020	Veneer sheets; plywood, laminate board; particleboard, fiberboard, and other panels and boards
	Secondary wood manufacturing
2030	Builders' joinery and carpentry, of wood
2040	Wooden containers
2051	Other products of wood
2052	Articles of cork, straw and plaiting materials
3611	Chairs and seats
3612	Other office and shop furniture
3613	Kitchen furniture
3614	Other furniture

[a] Source: Authors' systematization based on Kies et al. (2008) and CPA (classification of products by activities). CPA 2002 classification is used, instead of CPA 2008, because input–output data refer to the 2004 to 2005 period.

the moment, we are witnessing several international programs seeking to interconnect national input–output tables. For more on the process of input–output compilation and the conversion of the supply and use tables to symmetric input–output tables, see Soklis (2009) and United Nations (1999); for Croatia, see Lovrinčević and Mikulić (2011).

Input–output tables are used as a quantitative model suitable for the national and regional level economic analysis. In global markets that are characterized by international competition and more complex production processes, the input–output analysis, which enables the identification of supply chains on a domestic and international level, is even more important. Techniques and areas covered by the input–output analysis are described in Ten Raa (2005). Input–Output multipliers can also be used to assess the regional economic impacts of an activity (D'Hernoncout et al. 2011).

In the input–output framework, matrix A usually presents a technical coefficient matrix (ratios of inputs of each industry in the gross output), x is a vector of gross output, and y a vector of final demand. The following set of equations can be derived (Soklis 2009):

$$Ax + y = x \qquad (1)$$

$$x - Ax = y \qquad (2)$$

$$(I - A)x = y \qquad (3)$$

The solution of this linear equation system is

$$x = (I - A)^{-1} \times y \qquad (4)$$

where

A = matrix of input coefficients for intermediates (technology matrix),
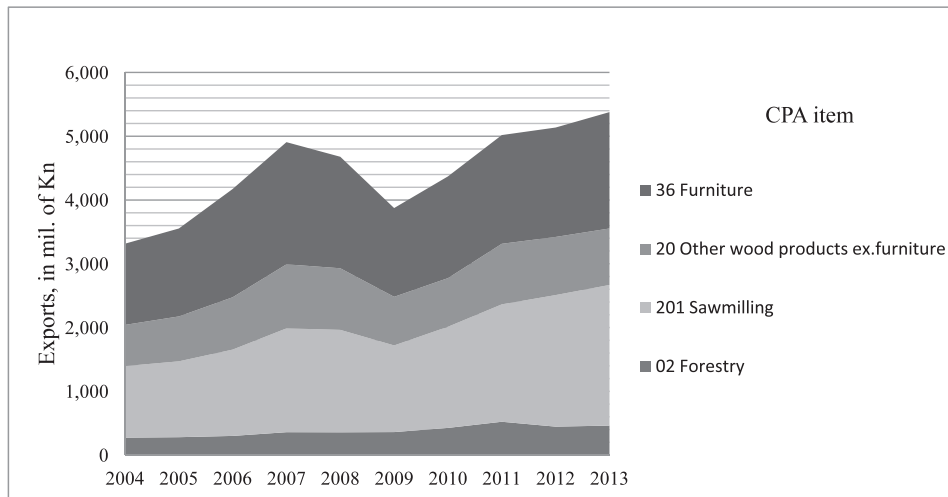
I = unit matrix,

Figure 2.—Trends in wood industry exports, 2004 through 2013. Source: Croatian Central Bureau of Statistics trade data, www.dzs. hr.

$(I - A)$ = Leontief matrix,

$(I - A)^{-1}$ = Leontief inverse,

y = vector of final demand, and

x = vector of output.

Matrix algebra is further used in multiplying a matrix of unit inputs (domestic and intermediate consumption, employment, and value added) with the total domestic gross output induced by foreign demand:

$$V = v \times (I - A)^{-1} \times y \qquad (5)$$

where V is the value of inputs (vector of value added, intermediate consumption, and employment) and v is a technical input coefficient (input component per unit of output: V/Y).

Vector Ax reflects the requirements for intermediates, while vector y represents the exogenous aggregate final demand. The matrix $(I - A)$ is usually called the Leontief matrix. On the diagonal of this matrix the net output is given for each sector with positive coefficients (revenues), while the rest of the matrix covers the input requirements with negative coefficients (costs). The Leontief inverse $(I - A)^{-1}$ reflects direct and indirect requirements for intermediates. In the estimation of multiplicative effects on the domestic economy it is crucial to identify the proportion of domestic intermediates which are used in the production process of an industry. The higher the share of domestic intermediate inputs, the more significant indirect effect is expected and vice versa.

The notion of multipliers rests upon the difference between the initial effect of an exogenous change in final demand (in our case, the change in foreign demand for manufacturing industry products) and the total effects of that change on the domestic economy. An output multiplier for exports of the manufacturing industry is defined as the total value of production of all domestic sectors that is necessary to satisfy the value of final demand for wood sector. It is worth noting that a multiplier is effective in both directions. A drop in foreign demand, besides a direct decrease of revenues of certain manufacturing industry, also has a negative impact on other domestic industries which are part of the supply chain.

Empirical Results

The importance of exports for the Croatian wood industry is assessed using the methodology discussed in the previous section. The importance of wood products exports for the domestic economy in Croatia is compared with a set of NMS based on the latest input–output tables available. The analysis provides an estimated direct and impact of manufacturing products exports in the 2004 through 2013 period.

Trends in wood industry exports

Wood industry exports consist of various products[1] described in Table 1 and based on a four-digit CPA 2002 classification of products by activities, with trends in the 2004 through 2013 period presented in Figure 2. Wood industry scope is similar to the definition used in Kies et al. (2008). The first two rows in Table 1 include rough forest products and basically processed wood products and, in general, do not present the final product, but inputs for further processing. Other items with a code beginning with 20 are the products which are more complex than the first group and, in general, the most complex production process relates to the production of furniture (items beginning with 36). Over the past 10 years, the exports of sawn, planed, or impregnated wood (item 2010) have recorded the most significant growth and currently have the largest share in total wood industry exports. The production of furniture showed favorable trends prior to the economic recession but recorded a significant drop in 2008 to 2009 after which a constant recovery can be noticed.

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[1] Wood industry in a broader sense also encompasses publishing products and pulp, which are excluded in this article. The cluster of printing and publishing industry linkage to the primary resource wood remains questionable (Kies et al. 2008). Besides, these products are not important in Croatian exports.

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The role of wood industry exports in Croatia's 2004 through 2013 economic growth

In the short run, changes in technology are limited and estimated multiplicative effects can be regarded as more reliable in comparison to longer periods, in which the technical coefficient can change significantly. However, in the absence of up-to-date input–output tables for the Croatian economy, the Leontief matrix from 2004 is used in the assessment of the total impact of exports on the domestic economy. Green field investments in the wood industry 2004 to 2013 were not large enough to completely alter the technological structure of the Croatian economy (Croatian National Bank, http://www.hnb.hr/statistika/strana-ulaganja/e-inozemna-izravna-ulaganja-u-rh-podjelatnostima.xls). Therefore, the presented results provide a good indication of the total contribution of manufacturing industry exports to GDP and employment in that period.

In columns 1 through 4 of Table 2, descriptive statistics are presented on the trends in the wood industry exports, gross value added (GVA), and exports in Croatia in the 2004 to 2013 period. Data are presented in constant 2004 prices, using the official national accounts figures published by the CBS (www.dzs.hr) on deflators for exports of wood products. Wood exports in terms of GVA recorded constant growth, reaching almost two percent of GVA in 2013. In columns 5 to 11, results on the total impact of wood industry on GVA and employment are presented using various indicators. Total gross value added and employment induced by exports are calculated by using input–output techniques described earlier. Column 9 presents the contribution of the wood industry to GVA growth, calculated as a change in the total value added induced by exports (column 4) divided by GVA in the previous period (column 3) and multiplied by 100. This indicator can be interpreted as the GVA growth rate which would be recorded if all demand components besides the exports of wood products were constant. In the period between 2004 and 2007, the exports of wood products contributed positively to GVA growth in the range between 0.06 to 0.28 percentage points, and explaining on average three percentage points of GVA trends (column 10). It is noticeable that a drop of wood industry exports started in 2008 while gross value added recorded growth based on other components of final demand. In 2013, more than 30 thousand employees were directly and indirectly engaged in the production of wood products for foreign markets and, contrary to total employment trends in Croatia, wood industry exports had a positive influence on employment.

Comparison of direct and indirect contribution of wood products exports to the Croatian and NMS economies

In the solution of the linear equation model described in the previous section, vector y presents the exports of wood products (disaggregated on product groups presented in Table 1). Vector y is multiplied by the Leontief inverse matrix and the result is a total output of domestic producers (vector x) needed to satisfy foreign demand for wood industry products:

$$x = (I - A)^{-1} \times y \tag{6}$$

Table 2.—Impact of changes in wood industry exports on Croatian gross value added (GVA) and employment.[a]

| | Constant prices in 204 (mil. of HRK) | | | | Values (in 000) | | | | Percentage points | | |
	Exports of wood products — 1	Exports of wood products, as % GVA — 2	Total GVA — 3	Total VA induced by export — 4	Employment — 5	Total employment induced by export — 6	Total impact of exports as share of GVA — 7	Total impact of exports in terms of employment — 8	Contribution of manuf. export to GVA growth — 9	GVA growth explained by changes in exports — 10	Employment growth explained by changes in exports — 11
2004	3,316	1.59	209,092	2,630	1,409	24.9	1.26	1.77			
2005	3,478	1.59	218,217	2,760	1,420	26.1	1.26	1.84	0.06	1.42	11.01
2006	4,278	1.87	228,862	3,381	1,468	32.2	1.48	2.19	0.28	5.84	12.63
2007	4,472	1.86	240,133	3,537	1,517	33.7	1.47	2.22	0.07	1.38	2.95
2008	4,123	1.68	245,923	3,270	1,555	31.0	1.33	1.99	−0.11	−4.60	−7.01
2009	3,401	1.48	230,396	2,699	1,499	25.6	1.17	1.71	−0.23	3.68	9.66
2010	3,906	1.74	224,505	3,105	1,432	29.4	1.38	2.05	0.18	−6.89	−5.65
2011	4,212	1.88	223,835	3,373	1,411	31.6	1.51	2.24	0.12	−40.03	−10.48
2012	4,133	1.90	217,924	3,310	1,395	30.9	1.52	2.22	−0.03	1.08	3.91
2013	4,213	1.95	216,327	3,382	1,344	31.5	1.56	2.34	0.03	−4.53	−1.10

[a] Source: Croatian Central Bureau of Statistics, various issues and authors' calculations.

Table 3.—Direct and indirect impact of wood industry exports on gross value added (GVA), intermediate consumption, and employment in 2005.[a]

	Croatia	Czech Republic	Slovakia	Slovenia	Poland	Romania	Hungary
Export of wood industry (mil. of national currency)[b]	3,316	75,449	1,307	1,230	23,019	6,124	915
Share of wood export in total national gross output in basic prices	0.64	0.88	1.00	1.50	0.76	1.05	0.35
Wood industry output multiplier	1.86	1.75	1.60	1.52	1.98	1.73	1.71
Impact on domestic intermediates (mil. of national currency)	1,616	31,915.6	486.8	411.8	12,251.1	2,709.8	397.6
Impact on imported intermediates	376.4	19,279.0	366.2	441.4	4,149.1	664.1	237.2
Share of imported intermediates in total intermediate consumption	18.9	37.7	42.9	51.7	25.3	19.7	37.4
Total impact on GVA (% of GVA)	1.26	1.71	1.74	2.60	1.80	1.88	0.70
Total impact on employment (000 em.)	24.9	108	52	28	NA	204	54
Total impact on employment (% em.)	1.81	2.17	2.48	3.08	NA	2.26	1.39

[a] Source: authors' calculations based on input–output tables downloaded from the Eurostat Web page: http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/workbooks. NA = not applicable.

[b] Note: Input–output data are conventionally published only in national currency. This does not influence calculation of multipliers, shares and other similar analytical indicators.

Technical coefficients for labor intensity (L/x) in different industries are additionally used for the estimation of direct and indirect employment induced by foreign demand for Croatian wood industry products. The share of wood industry exports in the total gross output has been the lowest in Hungary and Croatia, while the most significant share of wood exports is recorded in Slovenia. Table 3 presents the result of the input–output model, and it is interesting to see that the wood industry output multiplier is the highest in Croatia and Poland. One unit of wood industry exports induces an additional 0.84 unit of the Croatian domestic gross output and, as a consequence, the total output increased by 1.84 units. Variations in output multipliers can be primarily explained by variations in the orientation of wood producers to domestic or foreign intermediates. The share of imported intermediate consumption is the lowest in Croatia and Romania and the highest in Slovenia.

Table 4.—Percentage of gross value added (VA) and employment (EMP) induced by foreign demand for manufacturing products.[a]

CPA 2002:	Food products, beverages, and tobacco DA	Textile and leather products DB + DC	Wood, paper, and publishing DD + DE	Chemical products including petroleum products DF + DG + DH	Other non-metallic and metal products DI + DJ	Machinery and equipment DK + DL + DM	Manufacturing not elsewhere classified DN
Croatia							
VA	16.7	89.8	34.3	50.8	43.6	81.1	65.8
EMP	15.0	89.2	43.3	49.5	50.4	85.2	72.6
Czech Republic							
VA	27.9	96.7	63.0	81.5	80.4	89.4	82.0
EMP	27.9	98.2	62.5	83.1	80.7	90.1	82.1
Slovakia							
VA	28.0	91.4	61.2	79.6	78.0	83.6	64.1
EMP	28.0	91.4	60.9	84.4	72.7	82.9	64.1
Slovenia							
VA	24.9	85.6	65.6	90.8	73.6	93.5	83.6
EMP	24.6	84.0	67.0	91.4	71.0	93.0	83.4
Poland							
VA	19.2	67.3	39.4	46.2	52.7	62.8	59.1
EMP	NA	NA	NA	NA	NA	NA	NA
Romania							
VA	3.8	80.3	39.1	53.1	42.9	56.5	60.0
EMP	3.8	81.5	47.7	53.6	47.8	60.2	60.5
Hungary							
VA	29.1	84.7	38.6	71.4	58.7	91.7	57.7
EMP	29.4	84.4	45.3	74.4	62.1	91.0	59.1

[a] Source: Authors' calculations based on input–output tables downloaded from Eurostat Web page: http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/workbooks. NA = not applicable.

Foreign demand for wood industry induces, directly and indirectly, between approximately 0.7 percent of gross value added in Hungary and as much as 2.60 percent of GVA in Slovenia. In the Croatian case, the total contribution to GVA in 2004 was a relatively low 1.26 percent. A similar conclusion holds concerning the percentage of employed persons who are directly or indirectly engaged in the production of wood products oriented to foreign markets and the overall influence on total national employment.

Table 4 compares the importance of foreign demand for various economic sectors and dependence of domestic producers on exports. Machinery and equipment, and production of textile and leather products, are the sectors most affected by foreign demand in all counties. In most countries value added and employment in these sectors are almost entirely determined by foreign demand. Food products, beverages, and tobacco are still primarily delivered to domestic consumers. But the importance of foreign demand in other manufacturing sectors is heterogeneous, depending on natural resources and integration in global markets. In the Croatian case, the importance of foreign demand in the wood industry is relatively low in comparison to other NMS economies.

Conclusions

Openness and trade are identified as the most important factors of economic growth and job creation not only in economic literature but also in strategic documents at the national and supranational levels. Increasing the global competitiveness of the EU and member states is considered to be of crucial importance for the EU 2020 strategy (European Commission 2010).

The export-led growth (ELG) hypothesis, which holds that the expansion of exports is a key determinant of economic growth, is the most cited term in the field of international trade and growth. Export growth can be viewed as additional demand, contributing to the increase in real domestic output, an aspect which is the focus of this paper.

The wood industry output multiplier is the highest in Croatia and Poland. The overall influence of wood industry exports, including both direct and indirect impacts on the Croatian economy, is estimated using the input–output methodology. In 2004, wood industry exports directly and indirectly contributed 1.3 percentage points to the Croatian GVA and as much as 1.8 percentage points in terms of employment. Export growth of the wood industry positively contributed to GVA growth and employment in the period of economic growth 2004 to 2007. A significant drop in economic activity occurring in 2009 can be explained by the reduction in foreign demand via the export multiplier during global recession.

Considering the comparison to other NMS economies, historical perspectives, and natural resources, there is significant unused scope for further development of wood industry exports, which would provide a positive contribution to the much needed overall recovery of the Croatian economy.

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