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Competitiveness of the Forest Sector in the EU Candidate Countries — Cluster Analysis

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Contents

Abstract

This study, initiated within the framework of IIASA's Young Scientists Summer Program 2001, investigates some key issues related to the enlargement and, in particular, the competitiveness of forest-based industries in the candidate countries. The main contribution of this study is its holistic approach to discern various forms of industrial competitiveness in selected candidate countries. Moreover, the objective is to investigate how the observed patterns of competitiveness have evolved during the transition process so far, giving some implications of the modes of restructuring and integration of the European forest sector as a whole.

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Competitiveness of the Forest Sector in the EU Candidate Countries — Cluster Analysis

Esa Viitamo and Orest Bilas

1 Introduction

The accession of Austria, Finland, and Sweden with the European Union (EU) in 1995 brought about considerable changes in the EU's forest sector. The forested land increased by over 90%, the direct employment of forest-based industries increased to 4.2 million, and the extended production and export changed the EU's balance from deficit to surplus in forest products trade. This resulted in a growing awareness of the importance of the forest sector for Europe as a whole. Initiatives for a common forestry strategy were taken to secure the competitiveness of the European forest-based industries in global markets.

The ongoing process of Eastern enlargement will pose new and more extensive challenges to the European forest sector. Compared to earlier accessions, the most critical issues are related to industrial restructuring and the modernization of production facilities in the candidate countries. The big question is: How will this be carried out to meet the EU's standards on common competitive conditions, environmental protection, and its strive for regional equality? With structural changes and specialization of production, the enlargement entails great potential for the growth and increased competitiveness of the European forest sector.

This study, initiated within the framework of IIASA's Young Scientists Summer Program 2001, investigates some key issues related to the enlargement and, in particular, the competitiveness of forest-based industries in the candidate countries. The main contribution of this study is its holistic approach to discern various forms of industrial competitiveness in selected candidate countries. Moreover, the objective is to investigate how the observed patterns of competitiveness have evolved during the transition process so far, giving some implications of the modes of restructuring and integration of the European forest sector as a whole.

The four countries investigated were selected by using two criteria: first, their progress in economic transition and development. In this respect, Poland and the Czech Republic belong to the most advanced candidate countries, whereas Bulgaria and Romania have shown a weaker and even stagnating development. Second, the neighboring countries, Poland and the Czech Republic, have closer borders to the EU whereas the other two countries are the most remote. Hence, the purpose is to find out if this spatial factor influences the patterns and development of competitiveness.

By definition, the forest sector consists of the following vertically linked activities: forestry, wood supply to industry, and forest-based industrial production and trade.

Various definitions exist for forest-based industrial production but, in general, it refers to the value chain of processing wood to different final products in the woodworking and pulp and paper industries. Usually the furniture and publishing and printing industries are also included although they are relatively weakly related to the basic industries. In this study, the furniture and printing and publishing industries are only dealt with in the descriptive sections but excluded in the competitiveness analysis.

This report is organized as follows: Section 2 surveys the position of the forest sector in the candidate countries and raises some general issues related to the transition process and EU enlargement. Section 3 presents the methodological approach, the accompanied clustering technique and its application to the research problem accordingly. In Sections 4 to 7, which look into the profiles of the forest sector in the selected countries, the emphasis is on the patterns of competitiveness. Section 8 further investigates the relative sectoral performance of the candidate countries. Conclusions and policy implications are presented in Section 9.

2 Forest-based Industries in the CEECs, Transition and Enlargement

2.1 Forest Sector in the CEECs[1]

Forest-based industries rely on natural resources from forests, the size and coverage of which differ considerably from country to country. With respect to total forested area, the countries with the most abundant resources are Poland, Romania, Bulgaria, Latvia, and the Czech Republic. Of the CEECs, the most forested country is Slovenia where the forested areas cover 53% of the total area, whereas Hungary with 19% is at the other end of the spectrum.

With the production volume of EUR 22 billion and direct employment of 1 million, forest-based industries —the including furniture and printing and publishing industries — have a central position in the industrial structure of the CEEC region. By value of production, the paper and printing sector accounts for 48% of forest-based industries, followed by the wood and wood products sector with 28%, and the furniture industry with 24%, respectively. The employment shares are more equally distributed and are about one-third in each sector (Hanzl and Urban, 2001).

Forest-based industries are of major importance to Latvia and Estonia, where they account for one-quarter of the total value of the manufacturing sector. This corresponds to the figures in the Nordic countries, with major shares in the European sawmilling and pulp and paper industries. In the Baltic countries, however, the high figures mainly result from extensive forest and wood products sectors. A second group of countries, consisting of Slovenia, Poland, Lithuania, and Slovakia, have shares varying between 11% and 15%. The paper and printing sector is particularly important for Slovenia,

[1] The 10 Central and Eastern European Countries (CEECs) — known as CEEC 10 — include Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia.

Estonia, and Latvia and the furniture industry has a central position in Estonia and Slovenia (Hanzl and Urban, 2001).

The figures for the second group of CEECs are, on average, higher than for the current Eastern EU countries. The highest share of forest-based industries, 12%, is found in Austria while Italy and Germany rank second with 9% each. This is also the figure for the Czech Republic. The rest of the CEECs, Romania, Hungary, and Bulgaria, are at the bottom with 8%, 6% and 6%, respectively.

Figure 1: The candidate countries and the EU.

2.2 Transition and Integration with the EU

After the demise of communism and the Council of Mutual Economic Assistance (CMEA) (see Holzmann *et al*., 1995), which maintained an artificial industrial structure and specialization among the CEECs, the composition of the manufacturing sector and foreign trade has altered substantially in most of the candidate countries. On the whole, the CEECs and the Soviet Union shifted from an arrangement of mutual trade to bilateral trade agreements with the EU countries at the beginning of the 1990s. The abandonment of planned economies was a painful operation for all countries, which can be demonstrated by the production figures; between 1985 and 1993 the production of sawnwood fell by 40% and the production of panels and pulp and paper by around 30%. Domestic consumption shrunk even more, as displayed in Table 1.[2]

[2] The figures describe the development of a sample of countries consisting of Poland, the Czech Republic, Hungary, Romania, and Bulgaria (Thoroe, 2001).

Table 1: The slump of forest-based industries in Eastern Europe. Source: Thoroe (2001).

	Change in Production 1985–1993	Change in Consumption 1985–1993
Sawnwood	-42%	-50%
Panels	-30%	-37%
Pulp	-30%	-40%
Paper	-32%	-29%

The readiness of countries to face the change differed significantly. The countries and regions with close relations to the West and strong West European affiliations suffered less than other countries and were able to restructure their economies more rapidly. Independent of the pace of economic reforms, the transition process of CEECs is manifested in the growing trade with the EU. Towards the end of the 1990s, the absolute growth of trade with the EU has been faster in the more advanced candidate countries but, at the same time, the less advanced candidates have become relatively more dependent on the EU[3] (Hazley, 2000). This holds true for the manufacturing sector in general.

Associated with the increased EU orientation, the export of forest-based products by CEECs has grown faster than the EU's export, indicating more intensified specialization and adaptation to the European market system. As suggested in Figure 2, the share of the CEECs combined export[4] has increased strikingly in the wood and wood products sector reaching almost 20% by 2000. The corresponding share of pulp and paper shows a slower and more stable development.

By 1998, the total export of forest-based products[5] from the CEEC 10 to the EU amounted to 6 billion ECUs, of which Poland held one-third. The second biggest exporter was the Czech Republic with 970 million ECUs followed by Slovenia, Romania, Latvia, and Hungary exporting between 450 and 570 million ECUs (Hanzl and Urban, 2001). Thanks to the extended woodworking and furniture industries, total trade resulted in a surplus of 1.6 billion ECUs that year.

In spite of the growing trade and a positive trade surplus between the CEECs and the EU, the share of total trade for forest-based products[6] has remained relatively stable throughout the 1990s. The share in the CEECs' import has varied around 5%, while the corresponding figure for export has been around 12%[7]. Looking at the individual countries, large differences can be distinguished. In the Baltic countries, the total export share increased from 9% to 25% between 1992 and 1997, whilst almost the same but adverse trend has been demonstrated by Romania. In Poland, the share has also grown steadily being 15% in 1997 (Hazley, 2000).

[3] The EU's share of their total trade has increased faster than in the more advanced countries.
[4] The sum of EU and CEEC exports.
[5] Including furniture production and printing and publishing.
[6] Excluding printing and publishing.
[7] The shares are calculated as percentages of nominal values of total trade 1992–1997.

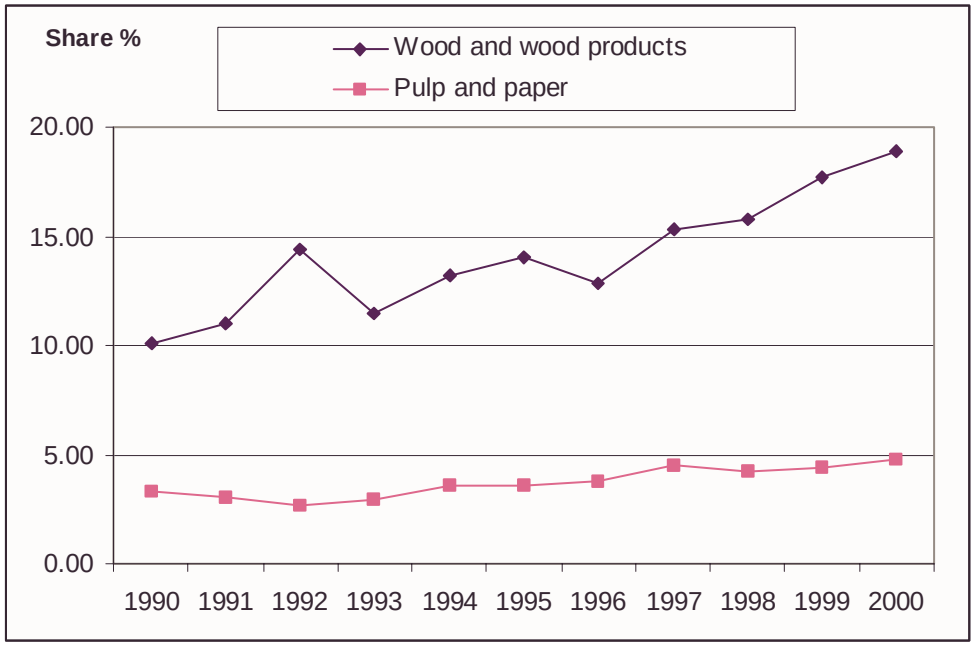


Figure 2: The CEECs' share of combined export, in volumes (FAO, 2000)

While there are distinctive country specific differences, the CEECs are generally specialized in industries characterized by high labor intensity and relatively low capital costs. With low wage levels and difficulties in capital formation, the structure of trade reflects their comparative advantage. As conveyed in Figure 3, this comparable advantage is concentrated in the woodworking and furniture industries, whereas the paper and printing industries show a clear comparative disadvantage.

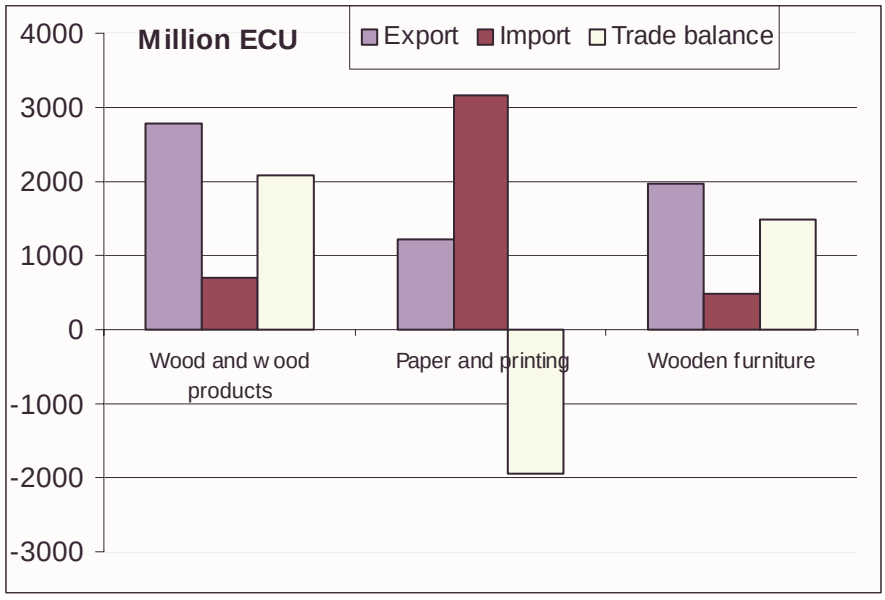


Figure 3: Forest-based products trade between the EU and CEEC 10, 1998.

Looking at their export structure, it is noteworthy that lumber and panels, which are typically products with low value-added, are not the most important exported products as a whole. Instead, more processed products related to the furniture industry are the major source of export income, especially in EU trade. Hence, in the majority of the countries, economic clusters built around the furniture industry have been central in creating competitiveness of forest-based industries.

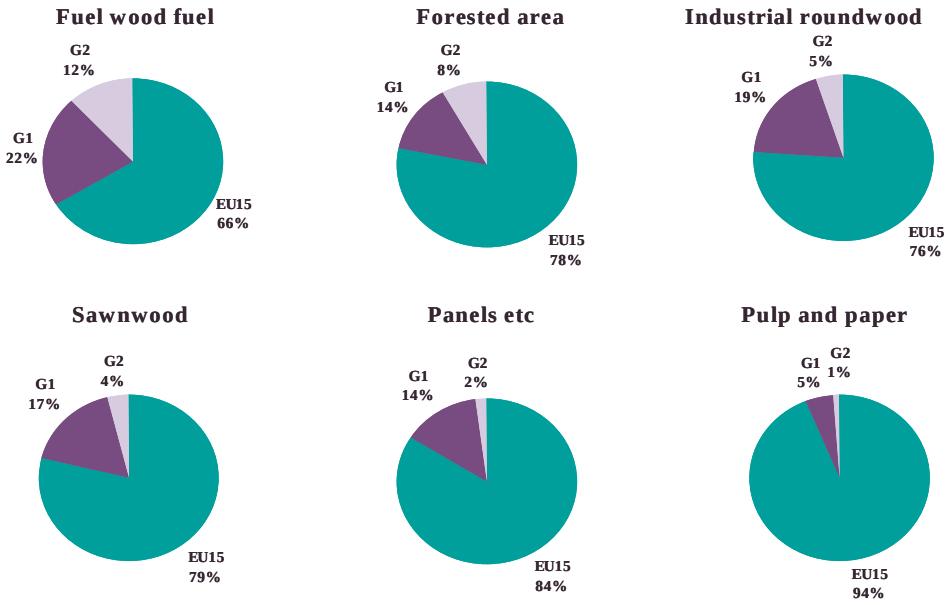
With the consolidation of trade relations and industrial restructuring, forest-based industries are prepared for deeper integration with the EU. However, the opportunities vary across countries and there is a widening gap between the advanced and less advanced CEECs. For the latter, serious obstacles for catching-up are low labor productivity, outdated production facilities, and limited access to finance needed for restructuring. In this respect, foreign direct investment (FDI) and FDI policies accordingly play a decisive role.

The main argument for encouraging FDIs is that the import of tangible and intangible capital in an industry facilitate its development and also bring positive spillovers to other industrial sectors. In this process, foreign owned companies become part of the international network, mostly within European multinational companies, thereby intensifying integration (Hunya, 2000; Dunning, 1999). Although, empirical evidence on long-term impacts has yet to come, some studies have shown that FDIs in the forest sector in Eastern Europe has increased and contributed to the increase in productivity (Barrel and Holland, 2000).

In the most advanced CEECs, FDI inflows and the export market shares within the EU have grown faster in more technologically advanced sectors indicating an improvement of their industry structures and an increase in overall competitiveness. However, it is important to note that through multiple input-output linkages, investments in other sectors also have cumulative impacts on the forest sector. It is evident that with growing FDI endowments, accompanied by increasing competitive pressure to improve factor productivity, unemployment raises in the short term. On the other hand, it is expected that specialization and the gradual improvement in the standard of living will enhance the production and trade of forest-based products within the enlarged EU.

The dichotomy between more and less advanced countries is also reflected in the structure of the forest sector in the hypothetical EU 25 shown in Figure 4. If the total population — with the same distribution as the forested area — is taken as a point of reference, the less developed candidates are over-presented in the production of fuel wood while in the forest industry sectors it is the other way round. The specialization of CEECs in the low value-added wood products industries is also highlighted.

In summary, through trade and FDIs CEECs are, on average, highly integrated to the EU's market system already. The major changes brought about by full membership are their accession to EU funds and the adaptation to a common legislation defining the rules of the game within the EU markets and the relationship towards non-members. The key issue for future competitiveness of European FDIs are the mechanisms of how forest sector policy is designed and implemented.



Note: G1 refers to the advanced countries: the Czech Republic, Poland, the Baltic countries, and Slovenia; G2 refers to the less advanced countries: Slovakia, Bulgaria and Romania, respectively.

Figure 4: Distribution of the forest sector in a hypothetical EU 25, 1998. Source: Thoroe (2001).

3 The Cluster Approach

3.1 Measuring Industrial Performance

As the amount of piecemeal information on human behavior is constantly growing, the ability to perceive the development of multidimensional social phenomena has become increasingly more difficult. Consequently, the need to see behind the figures and to avoid human errors in interpreting the data has boosted the development and application of computer-based tools. Cluster algorithms and neural networks in particular, originally designed to understand the complex functioning of human brains, have become a standard tool in solving technical, economical, and societal problems.

In general, a clustering algorithm is a device to reduce the data making distinctions between the objectives and reveal the dependencies among the variables characterizing the object. In doing so, it solves a simple double maximization problem conveyed, e.g., by Sharma (1996): *"Cluster analysis is a technique used for combining observations into groups or clusters such that:*

- *Each group or cluster is homogenous or compact with respect to certain characteristic. That is, observations in each group are similar to each other, and*

- *Each group should be different from other groups with respect to the same characteristics. That is, observations of one group should be different from the observations of other groups"* Sharma (1996:185).

While cluster algorithms have become a standard device for designing business strategies, the algorithms are less applied in research on economic activities and performance of industries. In this respect, the attractiveness of the statistical clustering techniques lies within the property of producing taxonomies across different types of economic performances, which contrasts with the traditional cut-off classifications of industries into good- and bad-performing industries.[8]

This has also been the main deficiency of competitiveness research based on the cluster approach used in industrial economics. In that framework, clusters consist of economic units — firms and industries — that are interdependent and produce positive spillovers to each other (Porter, 1990; Bergman and Feser, 1999). While the similarity of the actors in an economic cluster is not explicitly provided, they are interlinked by common knowledge, technology or input flows. In this respect, statistical and economic clusters are closely related.[9]

Economic cluster analysis in particular is applied in research on industrial competitiveness, which became a topical issue in the 1990s. According to the findings, based on the Porterian approach, strong interdependencies and intensive competition within a cluster is the main source of international competitiveness of industries. The main argument is that the *competitiveness of one industry will enhance the competitiveness of related industries, and vice versa.* This argument has been shown to be valid both for countries and larger economic entities (Viitamo, 2001).

The most well known application of statistical clustering is the study by Peneder (1995) who, inspired by Porter's work, investigated the competitiveness of Austrian industries. Based on specific performance indicators in international trade, his clustering procedure yielded a classification of the Austrian industrial sector into clusters showing different patterns of competitiveness.

It is noteworthy to mention that in Peneder's findings, forest industries and their equipment suppliers were located in those clusters that, on average, received high scores for all competitiveness indicators. As he infers, this is partially the result of well functioning Porterian clusters in the Austrian forest sector. However, Peneder did not go further to prove the argument, the verification of which would necessitate further clustering analyses with explanatory indicators. Methodologically, this is done in his later work where he tests the dependencies between different indicators of competitiveness in the OECD region Peneder (2001).

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[8] It should be kept in mind that if carried out only once, without further statistical analysis, the clustering is not capable of explaining observed phenomena. It is also true that the results are very sensitive to the selection of indicators and the amount of clusters.

[9] Note that statistical clustering is just a technique to organize data for further analysis. In applied industrial economics the cluster approach refers to a broad and specific way of looking at the functioning of industries. Hence, it has more qualitative contents.

3.2 Self-Organizing Maps (SOM)

In applied research a number of different cluster algorithms exist, the choice of which depends on the problem to be solved. For the most general level, the distinction is been made between hierarchical and non-hierarchical (partitional) methods, which differ by the clustering mechanism and by the rules determining the number of clusters. In hierarchical clustering, the number of clusters can be decided during the clustering process, while in the non-hierarchical technique the amount of clusters must be decided in advance.[10]

The common drawback of the aforementioned clustering methods is that they prefer certain cluster structures depending on the rules of the game, and the final cluster structures are influenced by the distributional properties of the data. In addition, it is often difficult to interpret the outcome especially because the techniques lack a visualizing device to display how the clusters look and how they are interrelated.

These problems can be mitigated by the application of neural network algorithms designed to model competitive learning processes. As defined by Kaski (1997:19): "*…competitive learning is an adaptive process in which the neurons in a neural network gradually become sensitive to different input categories, sets of samples in a specific domain of the input space. The specialization is enforced by competition among the neurons: when an input arrives, the neuron that is best able to represent it wins the competition and is allowed to learn it even better, as will be described below*".

One of the most well known applications of the competitive-learning networks is the Self-Organizing Map (SOM) method, which is also used in this study. SOM, developed in the early 1980s by Kohonen (1995) has become a popular tool for a range of different data mining purposes, such as statistical clustering and visualization of high dimensional data sets in general.[11] Its self-organizing property implies that clustering is unsupervised, in contrast to the methods described above, while mapping refers to projecting the multidimensional data on a lower dimensional (two dimensional in this case) display or a map. The projection is executed non-linearly.

As a detailed description of SOM is given in Kohonen (1995) only the very essence of the method is presented here. The visualizing device — map — consists of a regular grid of processing units, "neurons", which represent the vector input x — describing the arrays of the chosen indicators — with the reference vectors m_i also called a code book vector or a model. With the learning process the models will adapt to capture the distinguishing properties of clusters. Fitting of the model vectors is usually carried out by a sequential regression process, where t = 1,2,... is the step index. For each x(t), the winner index c (best match) is identified by the condition:

[10] For a more detailed description of the methods see, e.g., Sharma (1996).

[11] SOM has been successfully applied in various engineering applications, financial data analysis, and telecommunications tasks. Related to this study, an interesting engineering application is that of Simula *et al*. (1999), which investigates the cluster characteristics of several thousands of paper machines worldwide.

$$\forall i, \left\| x(t) - m_c(t) \right\| \leq \left\| x(t) - m_i(t) \right\|, \quad (1)$$

where $\| \ \|$ is Euclidean distance. The winning unit and its neighbors adapt to represent the input x even better by modifying their reference vectors towards the current input. The amount the units learn will be governed by a neighborhood kernel h, which is a decreasing function of the distance of the units from the winning unit on the map lattice (Kaski, 1997). If the locations of units i and j on the map grid are denoted by the two-dimensional vectors r_i and r_j, respectively, then:

$$h_{ij}(t) = h\left(\left\| r_i - r_j \right\|; t \right). \quad (2)$$

Kernel h is also called the neighbor function, which is usually specified as a learning rate factor ($0 < a(t) < 1$). Finally, the adaptive learning process for model vectors or a subset of them that belong to units centered around $c = c(\mathbf{x})$ are updated as:

$$m_i(t+1) = m(t) + h_{ci}(t)\left[x(t) - m_i(t) \right]. \quad (3)$$

For the convergence, it is required that $h_{ci} \to 0$ when $t \to 0$ and with increasing $\left\| r_c - r_i \right\|, h_{ci} \to 0$. In the resulting map, units or clusters are located according to their similarity to each other, i.e., clusters with a similar model vector are close to each other and dissimilar ones far from each other. It should be noted that the number of models and, hence, clusters is a decision variable and the choice depends on the amount of data available and the degree of desired homogeneity within clusters. Interpretable pattern exploration often assumes repetition of the clustering process by varying the size of the model grid.

3.3 Application to the Research Problem

Figure 5 depicts a SOM with a grid allowing the formation of 3 x 3 clusters. That is, the maximum number of clusters is 9, but x vectors are not always assigned to all neurons leaving empty units. The software application used here orders clusters also by one of the chosen indicators illustrated by gray scaling, which in Figure 5 means that cluster A3 scores the highest by that indicator and the black clusters show the lowest values. *In our analysis the value of export is illustrated by gray scaling*. The size of the squares indicates the number of x vectors or observations the cluster includes.

The SOM algorithm is applied here to analyze the pattern of competitiveness of forest-based industries in the selected candidate countries mentioned above. In order to highlight the dynamics of the patterns during the transition process, a comparison between two periods in the 1990s is made. This is done by calculating arithmetic means for each standardized indicator for the periods 1993–1995 and 1998–2000, respectively. Using averages instead of figures of specific years mitigates the problems caused by

high yearly variations in the values of the indicators.[12] Furthermore, it also partly eliminates the problem of non-systematic errors in the data and better reveals whether any real changes have taken place.

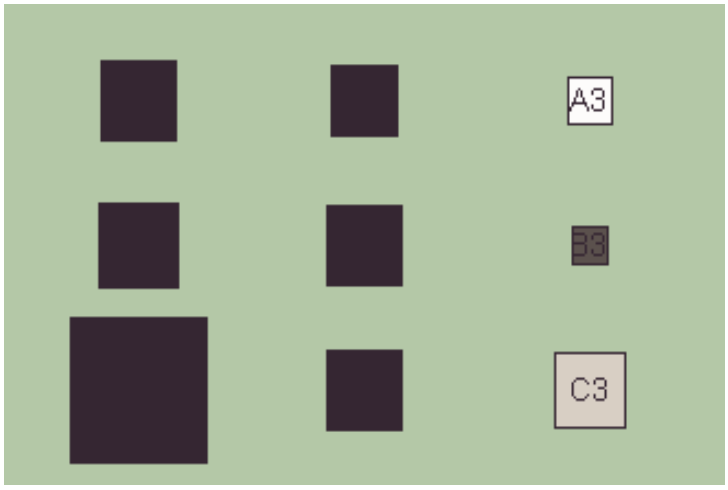

Figure 5: An example of a SOM.

The analysis was carried out first for the four countries separately (Sections 4 to 7) to explore the country specific profiles, and second by pooling the countries (Section 8) to explore the competitiveness of the countries in relation to each other. After several experiments, a 2 x 3 grid size was applied for the country analysis. This best met the demand of having enough sizable clusters to show the unifying characters of the industries while, at the same time, allowing for interpretable distinctions between clusters. Based on these principles, a 3 x 3 grid was chosen for the analysis across countries.

Preceding the choice of indicators, competitiveness must be defined. From various definitions, we applied that of Trabolt (1995), which was originally intended to measure the performance of countries. However, Trabolt's components of competitiveness are also applicable for industry sector analysis. Accordingly, competitiveness manifests itself in three determinants, which are:

1. the ability of an industry to produce export income in a profitable way, *the ability to sell*,
2. the ability of an industry to restructure as the working environment changes, *the ability to adjust*, and
3. the ability of an industry to attract FDIs, *the ability to attract.*

The outcome of these input indicators is reflected in the *ability to earn*, i.e., the financial performance of the business activity. In this study, competitiveness is measured two-dimensionally by using the combination of the first two input indicators and the

[12] This turned out to be a problem for some products and countries. However, the averages did not remove all the anomalies completely, e.g., negative consumption figures.

performance indicator in a modified form. Both absolute performance (left column in Table 2) and relative performance (right column in Table 2) are investigated.

Table 2: The indicators of competitiveness.

Expval xi =	**Exp/prod xi** =
Value of total export of product group i.	The share of export in relation to domestic production in volumes.
Measures the absolute ability to earn in international markets.	Measures the degree of outward orientation.
Impval xi =	**Imp/cons xi** =
Value of total import of product group i.	The share of import in relation to domestic consumption in volumes.[a]
Measures the absolute value of dependency on import.	Measures the degree of import penetration.

[a] Apparent consumption = production + import – export.

The absolute indicators were chosen to display the net ability to earn on international markets — the difference between export and import or balance of trade — while relative indicators display the degree of comparative advantage and specialization. A positive difference between *exp/prod* and *imp/cons* indicates comparative advantage for a product group, while their equality is a sign of specialization within a product group. If both *exp/prod* and *imp/cons* are close to zero, competitiveness is inward oriented. Restructuring or adjustment is reflected in the change of specialization across and within product groups.

The main argument, which is pointed out through the following Sections, is that one should be careful in classifying economic performances to more and less competitive. For example, while it is true that high trade surplus associated with comparative advantage may reflect competitiveness and high import penetration low competitiveness, other aspects of competitiveness should also be taken into account., This especially concerns the quality and the value-added contents of traded products, which are also considered here. Moreover, inward oriented performance, assuming unconstrained import, reflects the competitiveness of the domestic industries on the domestic markets. Hence, it is not only the ranking but also the type of competitiveness that matters.

The construction of indicators is based on the FAOSTAT database (FAO, 2000), which contains long updated time series on forest products trade and production worldwide. To meet the requirement of consistency of product classification in the different years, forest-based products were decomposed into 21 categories.[13] The broader main categories are roundwood, fuel wood, recycled paper, sawnwood, panels, and pulp and paper.

[13] For Bulgaria and Romania, the number of product groups is less because some products were not consumed or produced.

In the sections, cluster tables for each country and two periods are constructed. As noted above, the closer the clusters are to each other the more similar they are and vice versa. Because the number of observations and chosen grid size is relatively small, neurons had occasional difficulties to place clusters logically by their similarity. Dissimilarity, on the other hand, is more clearly pointed out, which is demonstrated by the patterns of the opposite corners. In the cluster charts, solid arrows indicate the highest similarity while the dashed arrows indicate the highest dissimilarity between the clusters. Hence, the main distinction between the clusters is made along two diagonals or dimensions. The gray scale indicates the differences in absolute value of export, and white shows the highest value.

Each product group was also assigned a quality score, which is the ratio between import unit value and export unit value. Values higher than unity indicate that in international trade the country is specialized in low quality products. Another interpretation is that more domestic forest resources are needed to produce the same income that is paid for the import.

4 Country Profile — The Czech Republic

4.1 Forests and Forestry

Forests cover one-third of the total land area in the Czech Republic. Coniferous species make up more than 80% of the growing stock volume, the main species being Norway spruce, European larch, and Scots pine. Beech is the most common broadleaved species; others include oak, poplar, birch, maple, and willow. The growing stock volume per hectare is among the highest in Europe and net annual increment per hectare is above the European average.

However, there are certain negative influences on forest health, particularly in spruce stands, by insects, diseases, and industrial pollution, which cause the collapse of some forests. The proportion of broadleaved species more resistant to pollution is gradually increasing. All forest area is classed as semi-natural and claimed to be under a forest management plan. Of the surveyed countries, the share of state ownership of forests is the lowest, 71%, and is expected to continue to fall through ongoing restitution and privatization. As noted below, however, restitution is associated with serious side defects.

Table 2: Forestry statistics — Czech Republic, 2000. Sources: FAO (2001), UNECE (1997), United Nations (2000).

Total land area; 1000 ha	7728
Total forest area; 1000 ha	2632
Exploitable forest area, 1000 ha	2581
Change of the forested area, 1990-2000 1000 ha	1
Net annual increment 1000 m^3	20440
Net annual fellings 1000 m^3	14540

4.2 Industry

The wood and wood products sector has a long tradition in the Czech Republic. Associated with the transformation into a market economy and the split of Czechoslovakia into two countries in 1993, production fell more than 40% between 1989–1993 and since then the Czech woodworking sector has shown, on average, a relatively stagnate development.

In contrast to sawnwood and panel production, which together constitute 40% of the sector, more processed products show a more dynamic development in exports.[14] Foreign direct investments originating mainly from Austria and Germany have expited modernization and competitiveness of the targeted companies.

Privatization of the woodworking sector was by and large completed at the end of the 1990s. Measured by unit labor costs, the Czech woodworking industry still enjoys an advantage to Western Europe but, through the ongoing integration, the advantage has been decreasing rapidly in the 1990s. The rise in wages is accompanied by a decrease in labor productivity thereby weakening the overall labor-based competitiveness (Hanzl and Urban, 2001).[15]

In contrast to the woodworking industry and the manufacturing sector in general, the paper and printing industry did not collapse at the beginning of the 1990s. From 1991, the sector attained a steady growth path mainly due to the success of the publishing and printing industry. Since 1994, the pulp and paper industry has shown a gradual upward trend in production and exports but the development has varied across product groups.

Table 4: Forest-based industries in the Czech Republic in 1998. Source: Hanzl and Urban (2001).

Industry	**Production (million EUR)**	**Share of the total value of manufacturing**	**Employment (thousand persons)**
Wood and wood products	948	2.4	35
Pulp and paper; publishing and printing	1835	4.6	43
Furniture	623	1.7	27.5
Total	**3406**	**8.7**	**105.5**

The Czech Republic has a long tradition in pulp- and papermaking but — as in all other former East European communistic countries — the state, having full control of printing and publishing, hindered development of the industry. As a consequence, production technology became outdated and most of the current mills are too small to meet western

[14] The figures in the industry descriptions for all countries are taken from Hanzl and Urban (2001). The production volumes are measured by the value of production in national currencies with constant prices. Hence, the deep declines for most countries at the beginning of the 1990s also resulted, to a large extent, from devaluation of the domestic currency, which partially hides the development of real industrial activity. This is also the case in the transition period.

[15] The Hanzl and Urban (2001) study calculates labor productivity as a ratio between output in constant 1996 prices converted with ECU-based purchasing power parities and the number of employees. Unit labor costs are defined as nominal wages in ECU divided by productivity.

efficiency standards. Because of the high capital intensity of the industry modernization by domestic investments has been extremely difficult.[16] Nowadays, almost all companies are privatized and most of the leading ones have foreign participation.

The main products of the industry are sulphite pulp and packaging and wrapping papers. For the higher quality graphic papers, the import dependence is high. In spite of the fact that the Czech pulp and paper belongs to the top exporters in the Central and East European (CEE) region, it still lacks restructuring, a clear ownership structure, and sufficient foreign capital for the needed technical modernization. The incentives for foreign investors have been the favorable location of the country and cheap work force. While nominal wages are rising, so is labor productivity thanks to foreign capital inflow.

4.3 The Pattern of Competitiveness

Already at the very outset of economic transition, Czech forest-based industries were relatively well integrated into the European market system and specialized by its foreign trade. The composition of industries was diversified and the pattern of competitiveness showed clear product specificity for some clusters. Outside the clustering patterns, a distinctive feature of Czech trade is an extensive export of roundwood, suggesting that there are severe structural problems in the forest sector. The majority of roundwood export is directed to Austrian forest industries.

As the diagonals in Figure 6 show, the main distinctions in the first period (1993–1995) are made by the *openness* or specialization within product groups (southwest-northeast) and the *ability to earn* (northwest-southeast). The inward oriented cluster C6, while having low level of trade, exhibits a slight outward orientation and a comparative advantage. Products included are typically intermediate inputs and products assuming local consumption as well as end products with high value-added contents (paper and paperboard NES[17]). At the other end of the spectrum, cluster C3 — the most open and specialized cluster — exhibits, on average, also a high comparative advantage.[18] Thus cluster consists of plywood and veneer sheets, which are strongly interrelated, and products of the pulp and paper industry.

The other diagonal shows that cluster C1, consisting of sawnwood and its raw materials, yields the highest export income and trade surplus, whereas the pulp cluster C5 is highly import dominated and exhibits the highest comparative disadvantage. Cluster C1 can also be characterized as inward oriented, which is attributable to the low level of *imp/cons* and relatively low *exp/prod* linking it to cluster C6. Hence, there is an interesting relationship between high and low scoring patterns, namely that the highest ability to earn is strongly linked to inward orientation and high openness and specialization is close to high import penetration. Pulp production, showing both patterns, is in general a very specialized industry within and across product groups.

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[16] This holds true for all CEECs.
[17] NES = not elsewhere specified.
[18] As seen below, very high specialization figures may indicate that products are simply traded, i.e., imported products are exported. Another explanation is that imported products are processed and exported with higher value-added contents.

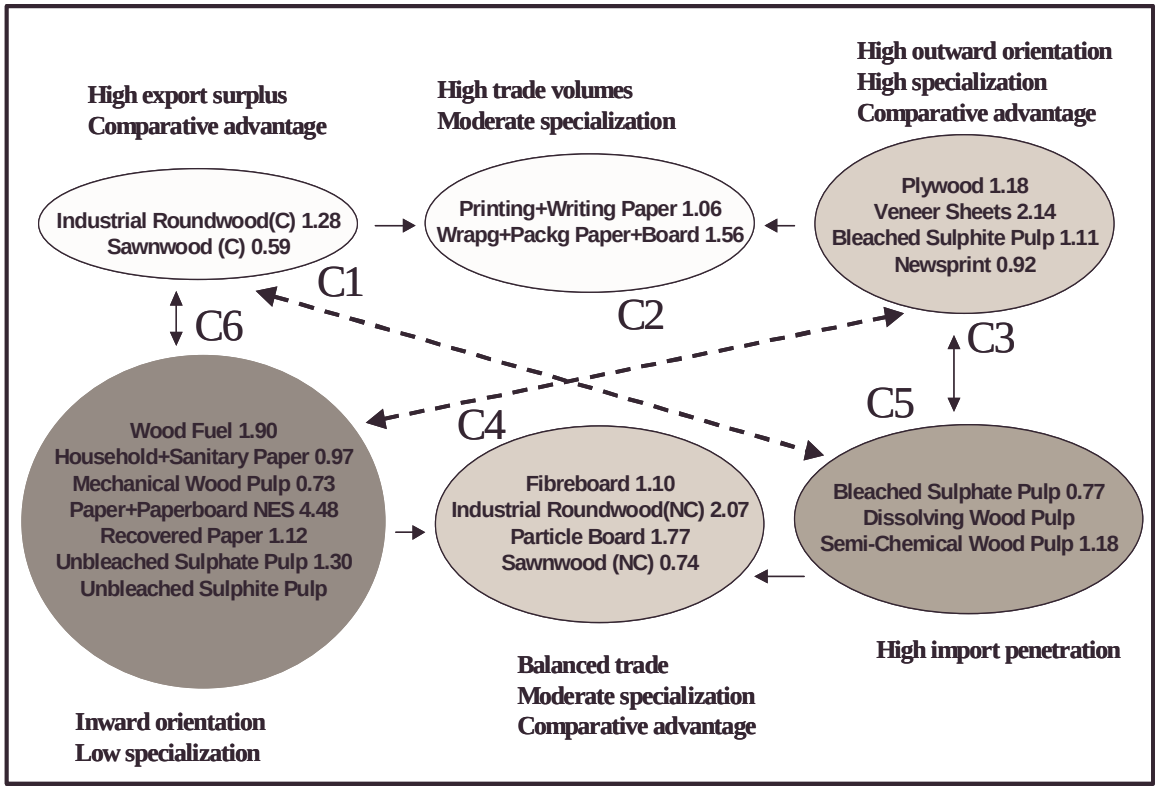


Figure 6: Competitiveness of Czech forest-based industries, 1993–1995.

The C2, the paper cluster, and cluster C4 are intermediary clusters, which are mutually interlinked too. The paper cluster produces high export income linking it to C1 but because of the low or negative trade balance it is also similar to cluster C3. C4, consisting of strongly interrelated woodworking products, is positioned between the two *worst* performing clusters but it is characterized by a slight trade surplus and specialization. In general it exhibits an average competitive performance across all the Czech clusters. Hence, in Figure 6 the area above the diagonals exhibits the most competitive performance, namely clusters C1, C2 and C3.

Looking at the quality scores of the clusters' sizable degrees of outward orientation, it is noticeable that coniferous and non-coniferous sawnwood are the only products exhibiting distinctive quality competitiveness. On the other hand, coniferous roundwood, which scores second in export value, shows quality disadvantage and further illustrates the structural problems of the Czech forest sector. While the export of roundwood evidently yields considerable income to the forest owners, the industry has to import raw material, which is generally more expensive.

The general trend in the 1990s has been a smooth increase in production volumes and the strengthening of specialization within and across product groups. This suggests that restructuring and further integration with the European market system has taken place. Furthermore, with the exception of clusters C3 and C4, the pattern of competitiveness has by and large remained the same (see Figure 7).

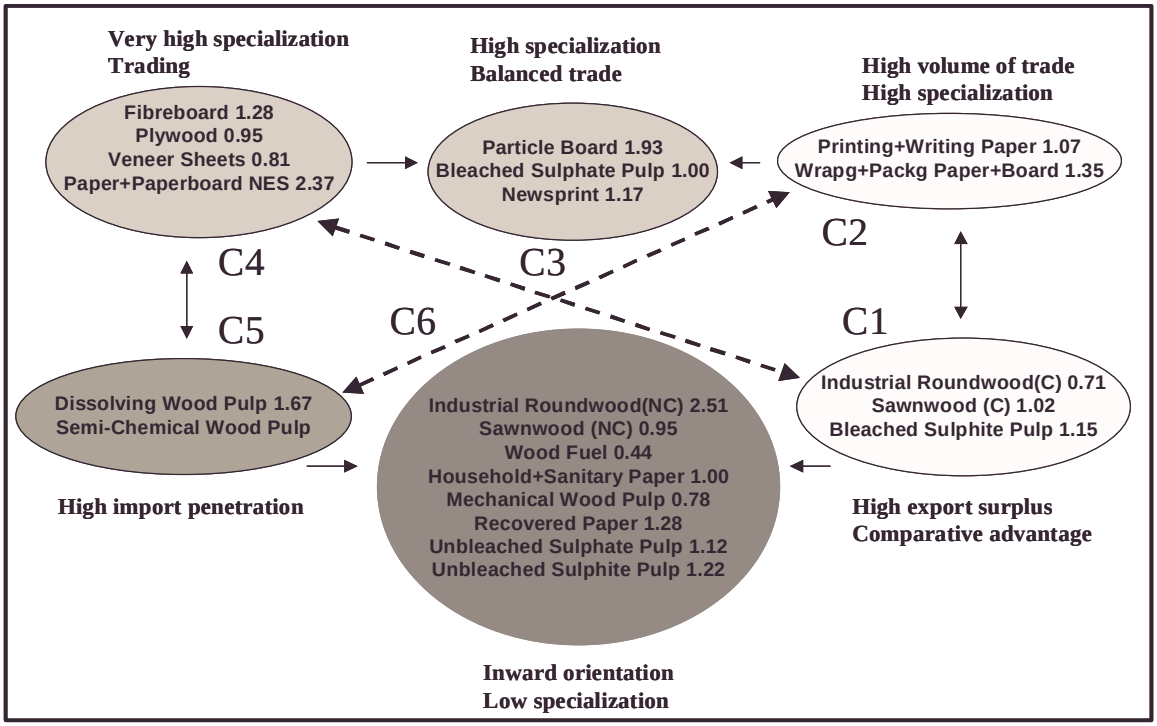


Figure 7: Competitiveness of Czech forest-based industries, 1998–2000.

Due to the intensified specialization, however, the principles of dissimilarity shown by the diagonals have changed and become somewhat more obscure. In the northwest-southeast direction, the decisive indicator is the *relative import penetration, imp/cons*, which is highest for C4 and lowest for C1. For the former, both *imp/cons* and *exp/prod* are, on average, higher than the one indicating extensive trading and/or processing of imported products to be exported.[19] Cluster C1, on the other hand, which now also includes bleached sulphite pulp, still produces the highest trade surplus and shows the highest comparative advantage. However, while the export of coniferous sawnwood has increased in the 1990s so has the export of its raw material indicating the persistence of the Czech syndrome.

By its export value C1 is close to paper cluster C2, which contrast most with the shrunk pulp cluster C5. For these clusters, the distinguishing feature is the *value of export and total trade*. For the pulp cluster C5, which is almost totally import-dominated, exports and imports are lowest whereas for C2 the figures are, on average, highest.

With its increased specialization and openness, cluster C6 stands as a link between the clusters with the highest and lowest comparative advantage. The other intermediary cluster, C3, is linked to C2 by a similar level of specialization and to C4 by a balanced specialization[20] and similar levels of trade. As shown in Figure 7, the most competitive area has changed to that below the southwest-northeast diagonal and above the northwest-southeast diagonal including clusters C1 and C2.

[19] Both explanations are plausible for panels, while paper is more typically traded.
[20] The equality of *imp/cons* and *exp/cons*.

As to the quality indicators, there has been a slight decrease in the average value (from 1.40 to 1.22) indicating an improvement in overall quality competitiveness. However, for the most important traded products, there has been significant increase in coniferous sawnwood and decrease in coniferous roundwood. This has mainly resulted from the changes in import prices.

4.4 Conclusions and Policy Implications

The overall stability of the competitiveness profile suggests that the Czech Republic was already highly integrated with the European market system at the beginning of the 1990s. On the other hand, the stability suggests that the forest sector has not been actively developed, which is demonstrated by the decreasing labor productivity in the woodworking sector. The most distinguished change during the transition process has been the increase and specialization of trade within and across product groups, which has changed the dimensions of competitiveness, for which the most remote clusters differ.

The analysis of the Czech forest industries suggests that the value-added content is positively correlated with intra-industry specialization. The persistent structural problem is that the cluster still providing the largest trade surplus consists of pure raw materials and intermediate inputs. This indicates a waste of domestic resources and deficient forestry strategy. Competitiveness of these product groups is also very vulnerable to changes in international market fluctuations. Hence, based on the above analysis, the main policy implications for the Czech forest sector are:

- Formulation of a clear national forest sector strategy, which links sustainable forest management to the creation of a competitive strategy for forest-based industries → *a more dynamic cluster structure.*
- Launching industrial development programs to increase domestic processing of forest resources. This should be associated with tax reform and new restitution principles of the forests → *transfer of roundwood into the inward oriented cluster.*
- Revising FDI policy (new incentive schemes) and launching industrial development programs to facilitate restructuring and specialization → *broadened frontier of competitive clusters and increased value-added contents of the cluster with the highest comparative advantage.*

5 Country Profile — Poland

5.1 Forests and Forestry

Forests account for less than one-third of the land area and have been gradually increasing in recent decades. More than 90% of the forest is available for industrial utilization. The same proportion of the forests is classed as semi-natural and the remainder is divided between forest undisturbed by man and plantations. Considerable forest areas are protected in some way and Poland has the largest, 144,000 ha, area of

undisturbed forests in the CEE region. However, together with France, Germany, and Austria, Poland had the largest removals towards the end of 1990s.

Of the growing stock volume, 80% is made up of coniferous species of which Scots pine is by far the most important and oak is the major broadleaved species. Despite widely occurring damages due to insect attacks, air pollution and other causes, that reduce the average rate of growth, the total growing stock has gradually increased. The net increment has remained above fellings, which is mainly due to the dominance of younger stands. In Poland, 81% of the forests are still owned by the state but the share is gradually decreasing as a result of restitution and privatization. All of Poland's forests are claimed to be under a forest management plan.

Table 5: Forestry statistics — Poland, 2000. Sources: FAO (2001), UNECE (1997), United Nations (2000).

Total land area; 1000 ha	30442
Total forest area; 1000 ha	9047
Exploitable forest area, 1000 ha	8474
Change of the forested area, 1990-2000 1000 ha	18
Net annual increment 1000 m^3	44006
Net annual fellings 1000 m^3	25741

5.2 Industry

Compared to the Czech Republic, Poland managed the transition of the forest sector to a market economy much better; production fell only 20% in 1990 but thereafter growth has been impressive and faster than in total manufacturing. The main stimulus for this dynamic development in the woodworking industry came from a significant customer, the furniture industry, which was already largely privately owned at the beginning of the transition process. Boosted by extensive foreign direct investments, mainly from Germany, it experienced a fast recovery and growth in production and export.[21] Being the main customer to the panel industry, the success of the furniture industry leveraged the growth of the fiberboard and particleboard industries. In 1998, the share of panels and sawnwood of the woodworking sector were 31% and 25%, respectively.

At the end of the 1990s, privatization of the industry was largely completed, with a private share of 90%. The panel industry has absorbed the majority of foreign direct investments contributing to rapid restructuring and growth, whereas the sawmilling industry is still suffering from obsolete technology and lack of capital. As to the unit labor costs, Poland has a clear competitive advantage to the Czech Republic as wages have risen more slowly and productivity has increased rapidly (Hanzl and Urban, 2001).

[21] The development can be illustrated by the trade index. From a value of 100 in 1989 the index grew to 800 in 1998 for the furniture industry.

Table 6: Forest-based industries in Poland, 1998. Source: Hanzl and Urban (2001).

Industry	Production (million EUR)	Share of the total value of manufacturing	Employment (thousand persons)
Wood and wood products	2975	3.5	121.5
Pulp and paper; publishing and printing	5139	6.0	122.2
Furniture	3134	2.7	145.4
Total	**11248**	**12.2**	**389.1**

The pulp and paper industry also experienced a rapid recovery since the adoption of a market economy and the growth rate of production has exceeded that of total manufacturing towards the end of the 1990s. As with other countries, the industry is fragmented with small production units on average but the restructuring and investment growth rate has been impressive: between 1996 and 1999 the rate varied from 41% to 64%. While there are some domestic owned companies among the largest, the investments have been mainly carried out by foreign companies. By the end of the 1990s, the whole industry was virtually privatized: around 80% of the equity capital was owned by foreign companies.

The product range of the Polish pulp and paper industry covers all of the main categories and the main products are different pulp grades, printing and writing papers, and packaging papers. Part of the restructuring has been the closing down of unprofitable specialty paper lines and the specialization to more scale-intensive paper grades, which better meet growing domestic demand. The main incentive for foreign companies to invest is not only the market size but also competitive export opportunities.

While the quality of paper is still lagging behind, compared to the EU countries, the gap is decreasing. The Polish pulp and paper industry is already deeply integrated with the EU but it still enjoys a remarkable labor cost advantage. Despite rising wages, Poland is still 35% lower than in Austria. At the same time, productivity has increased keeping labor unit costs low and stable.

5.3 The Pattern of Competitiveness

Of the investigated candidate countries, Poland constitutes the biggest market for forest-based products, which has enabled the development of a versatile industrial structure early in the beginning of the transition process. The locational attractiveness of Poland is demonstrated by the fact that it has received the majority of foreign direct investments in Eastern Europe.

By and large, the pattern of cluster formation has been similar to that of the Czech Republic, especially with respect to the first period (1993–1995). As demonstrated in Figure 8, the northwest-southeast diagonal makes the distinction by the degree of *openness and specialization* within product groups. As with the Czech Republic, a large inward oriented cluster exists, C6, where domestic companies dominate domestic

markets and export a very small fraction of production. These products are typically intermediate inputs (pulps) and sanitary papers. The production of the latter is economical to locate close to the markets. In contrast, cluster C3, consisting of almost identical products as the equivalent cluster in the Czech Republic, shows the highest specialization and openness.

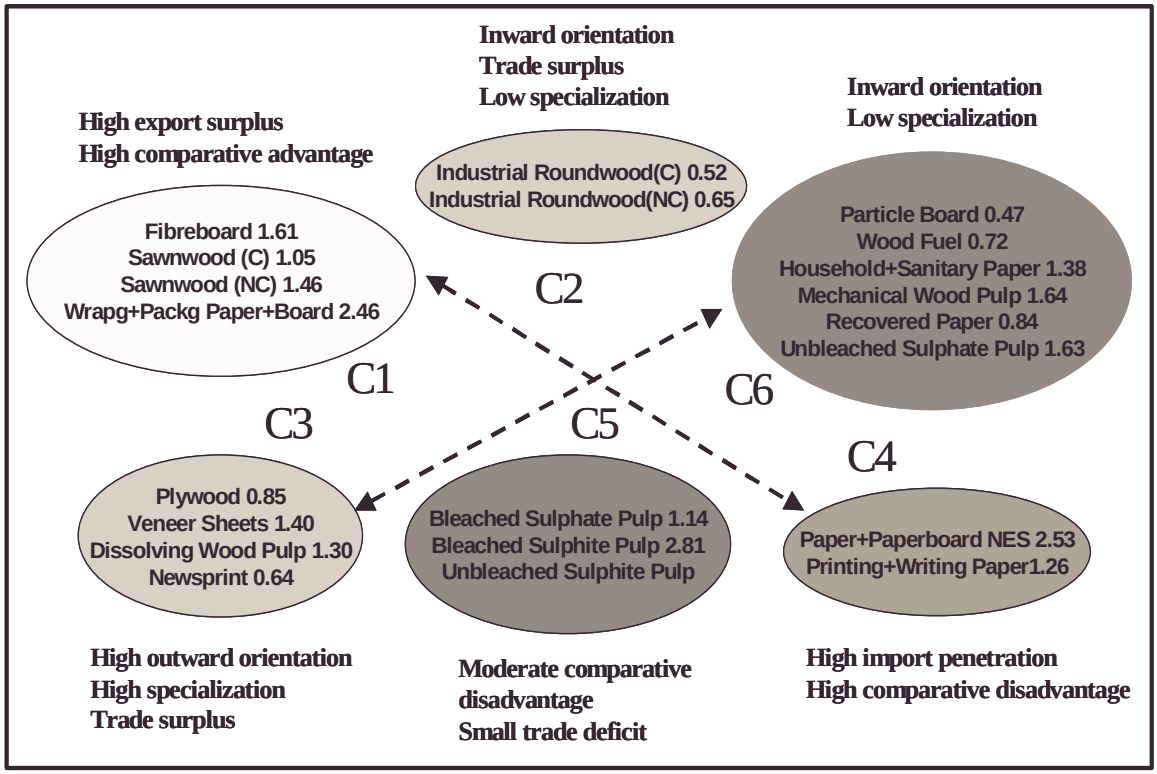


Figure 8: Competitiveness of forest-based industries in Poland, 1993–1995.

As with the Czech Republic, the other diagonal makes the distinction by *comparative advantage* and trade surplus, which is lowest for the paper cluster C4 and highest for cluster C1. If trade surplus is kept as a yardstick, the Polish C1 is more versatile and consists of products with higher value-added contents compared to the Czech C1. In Poland, it also shows a higher comparative advantage. Another difference is the high comparative disadvantage in the Polish paper cluster C4.

Another inward oriented cluster is C2, which consists of roundwood, showing the second largest trade surplus, and forms a link between C1 and C6. For Poland, roundwood is a far less important source of export income than in the Czech Republic indicating a more developed forest sector in this respect. The pulp cluster C5, which is less import dominated than that in the Czech Republic, forms a link between low performance in the trade surplus and high performance in specialization and openness. As seen in Figure 8, the diagonals suggest that the most competitive area is located below the northwest-southeast diagonal and above the northeast-southwest diagonal, clusters C1 and C3.

A further comparison between Poland and the Czech Republic reveals that the cluster formation in both countries has, to a certain extent, been based on the proximity of the product groups in general. In contrast to the Czech forest-based industries, none of the most important processed and traded products in Poland enjoys quality competitiveness. For plywood, newsprint, and roundwood the unit price ratio indicates quality advantage but, especially for some paper grades, import prices are even 2.5 times higher than export prices.

Compared with the Czech Republic, the Polish cluster structure experienced a more drastic change towards the end of the 1990s and development of competitiveness has been more dynamic (see Figure 9). Production, consumption, and trade volumes have grown simultaneously, which can be illustrated by roundwood production. In the first period (1993–1995), total production was about 17,000,000 m^3 while for the second period (1998–2000) the corresponding figure was almost 23,000,000 m^3. As noted above, this is strongly attributed to the success story of the Polish furniture industry. Hence, in the Polish woodworking industry the Porterian cluster mechanism is clearly functioning.

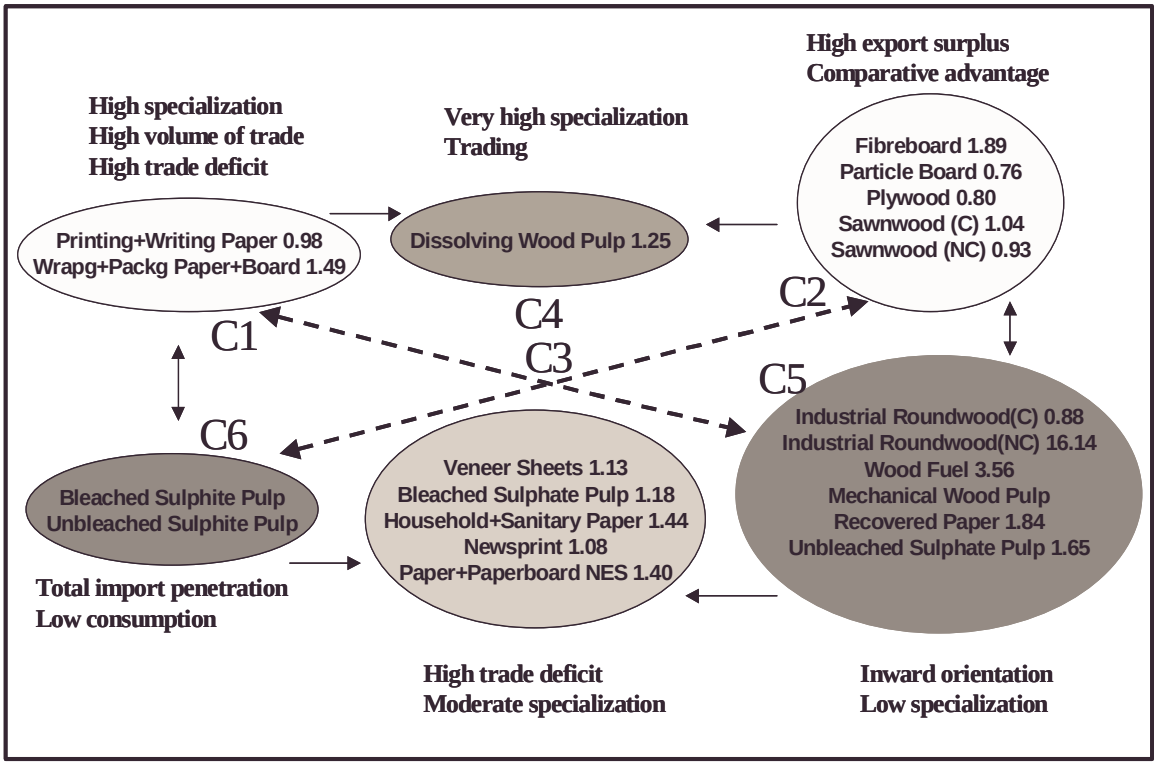


Figure 9: Competitiveness of forest-based industries in Poland: 1998–2000.

In the 1990s, there has also been a clear concentration of clusters into a more distinguished taxonomy coupled with strengthened clustering along related product groups. Compared with the Czech Republic, the determinants of similarity have changed less, which can be explained by the absence of big trading clusters[22] and the fact that the inward oriented cluster C5 has become more balanced and even more inward oriented. In the northeast-southwest direction the *value of import and total trade* has become the most distinctive feature.

At the same time, cluster C5 has become concentrated purely on raw materials indicating a clear strategic change, that is, domestic resources are exploited more by domestic industries to produce higher value-added products, which generate higher income. This is further demonstrated by the move of roundwood into this cluster. The opposite of the inward oriented raw material cluster is the paper cluster C1, whose composition has changed by one product. While showing the largest trade deficit, the paper cluster has become the top exporter and highly specialized.

For the reasons mentioned above, the growth of production has also been strong in the panel industry. The former C1 (Figure 8), which has become the sawnwood and panel cluster C2 (Figure 9), creates the largest trade surplus and shows the highest comparative advantage as well as a higher and more balanced specialization than in the first period. In particular, the production and export of fiberboard and particleboard has grown rapidly. At the other end of spectrum, the pulp cluster C6 has shrunk and become totally import dominated.

In general, the production and trade of pulp has experienced strong specialization within and across the product groups, which is further demonstrated by the very high trade specialization of cluster C4. This indicates that dissolving pulp is also traded. C4 bridges the clusters with the highest ability to earn. With the exception of paper and paperboard NES, the notion of increased specialization in paper grades holds true for the other paper dominated cluster C3, which links the clusters with a negligible value of exports.

Associated with deep restructuring, there has been a general increase in the quality competitiveness of the most important product categories. This especially holds true for paper products and panels, which have experienced the biggest increase. Hence, with the exception of fiberboard still showing low quality performance, the growth of exports has concentrated on products groups with high or improved quality ratios.

5.4 Conclusions and Policy Implications

In the first period (1993–1995), Poland and the Czech Republic had a relatively similar structure of competitiveness across forest-based industries, although in Poland a more versatile product mix created the trade surplus. In the second period (1998–2000), Poland showed more profound restructuring; increased value-added contents, quality

[22] *Exp/prod* and *imp/cons* are higher than unity.

ratios, and export values of its forest-based industries. This has been associated with a more effective utilization of domestic resources.[23]

In Poland and, to a lesser extent, in the Czech Republic, clusters in the second period can also be defined as sub-clusters in an economic sense, since their products have strong vertical and horizontal linkages. Hence, the pattern of competitiveness by the chosen indicators is clearly related to the proximity of the markets and technologies of the product groups. In general, the Polish country profile seems to suggest that because of the favorable development during the transition process, there is no need to revise forest sector policies. Related to the strong growth, however, the analysis yields the following recommendations:

- Improving the institutional and policy framework to meet the needs of the dynamic industrial development. With the creation of a sound forest sector policy this improved framework will also facilitate monitoring and controlling industrial growth → *sustained competitiveness of the cluster structure.*
- Launching industrial development programs and revising FDI policies to boost the growth and diversification of the chemical forest industry → *transfer of paper grades to the cluster with the highest comparative advantage*.

6 Country Profile — Bulgaria

6.1 Forests and Forestry

Compared with the more advanced candidate countries, the forests of Bulgaria and Romania have been suffering more from human disturbances and negligence. Nevertheless, growth of the forested area has been faster in the less advanced countries as well, resulting from economic problems and afforestation.

Table 7: Forestry statistics — Bulgaria, 2000. Sources: FAO (2001), UNECE (1997), United Nations (2000).

Total land area; 1000 ha	11055
Total forest area; 1000 ha	3690
Exploitable forest area, 1000 ha	3222
Change of the forested area, 1990–2000 1000 ha	20
Net annual increment 1000 m^3	2318
Net annual fellings 1000 m^3	4798

In Bulgaria, forests and other wooded land accounts for over one-third of the total land area. Afforestation, while increasing forest resources, is intended chiefly for soil protection and to correct forest degradation in earlier years, rather than for wood production. Plantations account for more than a quarter of the forested area and most of

[23] The growth of the industry has resulted in an increased import of roundwood.

the remainder of the forests are classified as semi-natural forests. All the forests of Bulgaria are officially claimed to be under a forest management plan.

The broadleaved species account for about 60% of the growing stock, the main species being beech and oak. The main coniferous species are Scots and Austrian pine and Norway spruce. Forests were state-owned until the restitution process began in 1999 and since then ownership by municipalities and private individuals has gradually increased.

6.2 Industry

The Bulgarian wood and wood products sector experienced a stagnant development and a slight decline of production already towards the end of the 1990s. However, it was less pronounced than in total manufacturing. Of the total production from forest-based industries, the wood and wood products sector accounts for 20% of which sawnwood and panels are the most important products. Together they form 86% of the exports to the EU within the woodworking sector in 1998 (Hanzl and Urban, 2001). In spite of progressive privatization,[24] the inflow of foreign investments has been modest thus hindering the modernization of production facilities.

A few foreign owned enterprises meet European technological standards, whereas the other companies are technologically outdated and suffer from severe capacity underutilization. This is related to various structural problems demonstrated by wood shortage and the high prices of energy. On the other hand, of all the CEECs, Bulgaria has had the lowest and most stable unit value costs, which also reflects a lower degree of economic integration with the EU[25] (Hanzl and Urban, 2001).

Table 8: Forest-based industries in Bulgaria 1998. Source: Hanzl and Urban (2001).

Industry	**Production (million EUR)**	**Share of the total value of manufacturing**	**Employment (thousand persons)**
Wood and wood products	78	1.2	14.8
Pulp and paper; publishing and printing	251	3.9	24
Furniture	58	0.8	15.6
Total	**387**	**5.9**	**54.5**

Compared to the woodworking sector, the Bulgarian pulp paper industry has shown a deeper decline, which has also been deeper than in total manufacturing. This is mainly the consequence of domestic structural problems as the pulp and paper industry has been highly inward oriented. The pulp and paper enterprises, amounting to twenty companies, are privatized but many of them still have minority state holding. Half of

[24] 90% of employees are in the private sector.
[25] Labor unit costs were 20% of the Austrian level in 1998.

them have foreign stakeholders, mainly from countries close to Bulgaria like Greece and Turkey, but also from more distant European countries.

Those companies with foreign stakes have access to modern technology and most of them are able to compete on the international markets. In contrast, the domestic owned companies have typically outdated production facilities and low capacity utilization rates. Because of the weak competition in domestic markets, however, they have been able to remain on the market. The main products of the industry are chemical pulp, special technical papers, wrapping and packaging papers, and sanitary papers.

The problem hindering restructuring is not only the shortage of investment capital but, more importantly, there are also severe institutional defects. These are manifested in the high prices of energy and the increasing price of industrial roundwood. However, as with the woodworking industry, the wage level and unit labor costs are the lowest of the all the CEECs,[26] thus being Bulgaria's most important competitive advantage.

6.3 The Pattern of Competitiveness

As noted above, the Bulgarian economy has been less open and less integrated with the European market system than the economies of countries dealt with earlier. This is also reflected in the clustering pattern of the forest-based industries. Moreover, the dominance of the domestic industry, especially in the sectors with low consumption levels, suggests that production facilities are outdated and scale-inefficient. This holds true especially for cluster C4 in the first period (1993–1995). As mentioned above, the presence of these kinds of inefficiencies have been possible mainly due to the closed economy.

It is illuminating that in the first period (Figure 10) there were two dominating clusters, covering 67% of the products, which are inward oriented. They also have, however, some distinctive properties. Cluster C3, consisting more of raw materials and intermediate products, shows a relative high trade surplus and a slight comparative advantage, whereas for cluster C4 trade is more balanced and more inward oriented. Regarding cluster C3, one interesting observation is that the export volumes of roundwood are very low indicating a healthy industrial[27] structure in this respect.

Due to the domination of an inward orientated pattern, the Bulgarian cluster chart is missing a specialized cluster. Nevertheless, the diagonals reveal a distinguishing clustering pattern. The most outward oriented cluster C1, producing the largest income surplus, contrasts with the most inward oriented cluster C4. The distinguishing property is *exp/prod*, which follows from the absence of specialized clusters found in the more advanced countries.

The southwest-northeast diagonal makes the distinction by the degree of import penetration *imp/cons* and *the value import*. The paper cluster, C5, characterized by a total import penetration, demonstrates a high specialization across product groups and

[26] Unit labor costs are still 10% of the Austrian level.
[27] Compared, e.g., with the Czech Republic.

the structural problems of the Bulgarian forest sector. On the other hand, this becomes understandable taking into account the low consumption levels of paper products and the increased economies of scale in production. The opposite of C5 is cluster C3, which exhibits a slight comparative advantage and trade surplus. Plywood forms a one-product cluster link to C1 and C3 by its intermediate comparative advantage and by the domination of the domestic industry. In Figure 10, the area below the diagonals displays the most competitive clusters: C1, C2, and C3.

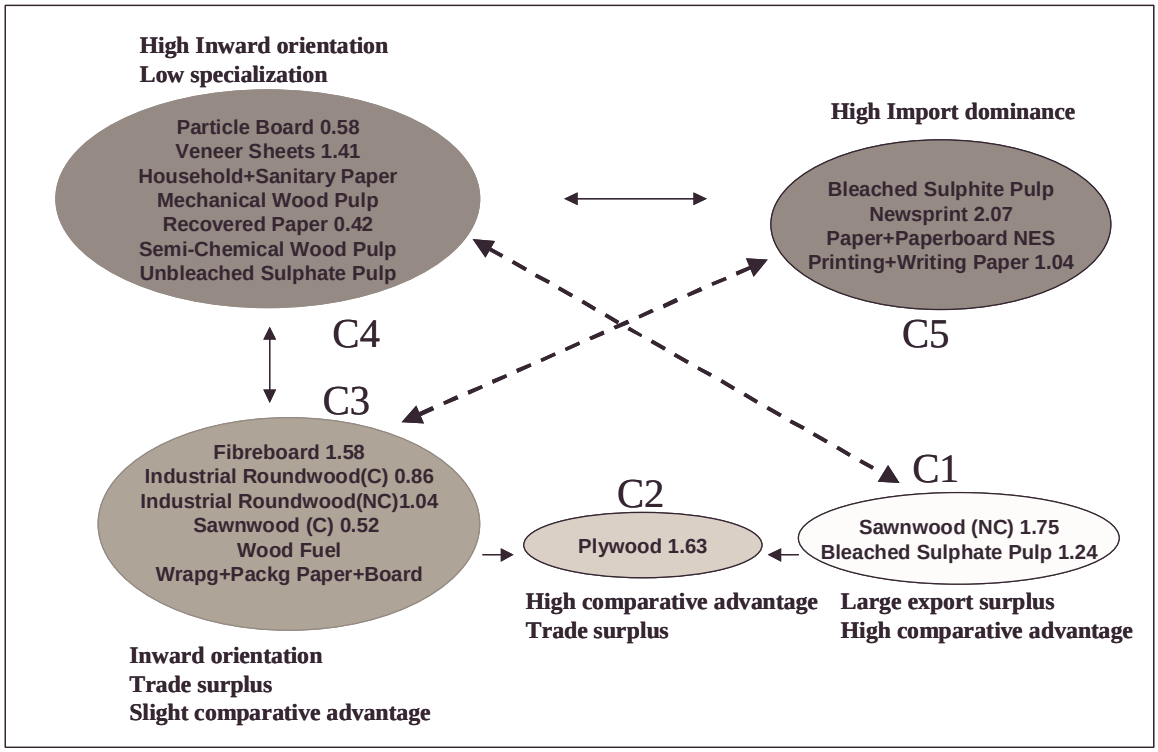


Figure 10: Competitiveness of forest-based industries in Bulgaria, 1993–1995.

With the exception of coniferous roundwood and sawnwood, which enjoy quality competitiveness, Bulgaria has specialized in low valued products in its trade. In this respect, Bulgaria is similar to the Czech Republic. The overall pattern of competitiveness in the first period (1993–1995) resembles that of the more advanced candidates but in a weaker form due to the closed economy.

As with Poland, Bulgaria has experienced a noticeable change in its industrial structure towards the end of the 1990s. This is associated with an increase in total production,[28] resulting mainly from a remarkable growth in veneer sheet production mainly sold to the domestic markets for further processing. The manufacture of many other products, pulp and paper in particular, has simultaneously declined leading to an increased specialization into the woodworking sector.

[28] Roundwood production increased by 33%.

In general, the forest sector has become more open, i.e., both import penetration and export orientation were increased indicating specialization and restructuring. With respect to exports, this can be partly explained by shrinking domestic demand for some products thereby forcing companies to sell abroad. Furthermore, the export of roundwood has increased sharply indicating some structural problems of the economy and forest-based industries. In the second period (1998–2000) an anomaly exists affecting the pattern of the clustering. Namely, for non-coniferous sawnwood the share of export of production is 193% while the share of import in consumption is -8%, which is probably due to the yearly variations in roundwood stocks.[29]

At the end of the 1990s, there is only one inward oriented cluster C5 (Figure 11) consisting of raw materials and low value-added products. Following the pattern of the first period, the opposite is C1 exhibiting the highest comparative advantage, which is the difference between *exp/prod* and *imp/cons*. As a result of the anomaly mentioned above and the absence of a clearly specialized cluster, the southwest-northeast diagonal makes the distinction by the average differences between the indicators. The biggest difference can be found in import penetration, *imp/cons*, which is almost complete for the paper cluster C6. This cluster shows a rising specialization across product groups. The lowest figure is found in a new cluster C4, which consists both of products with high and low value-added contents.

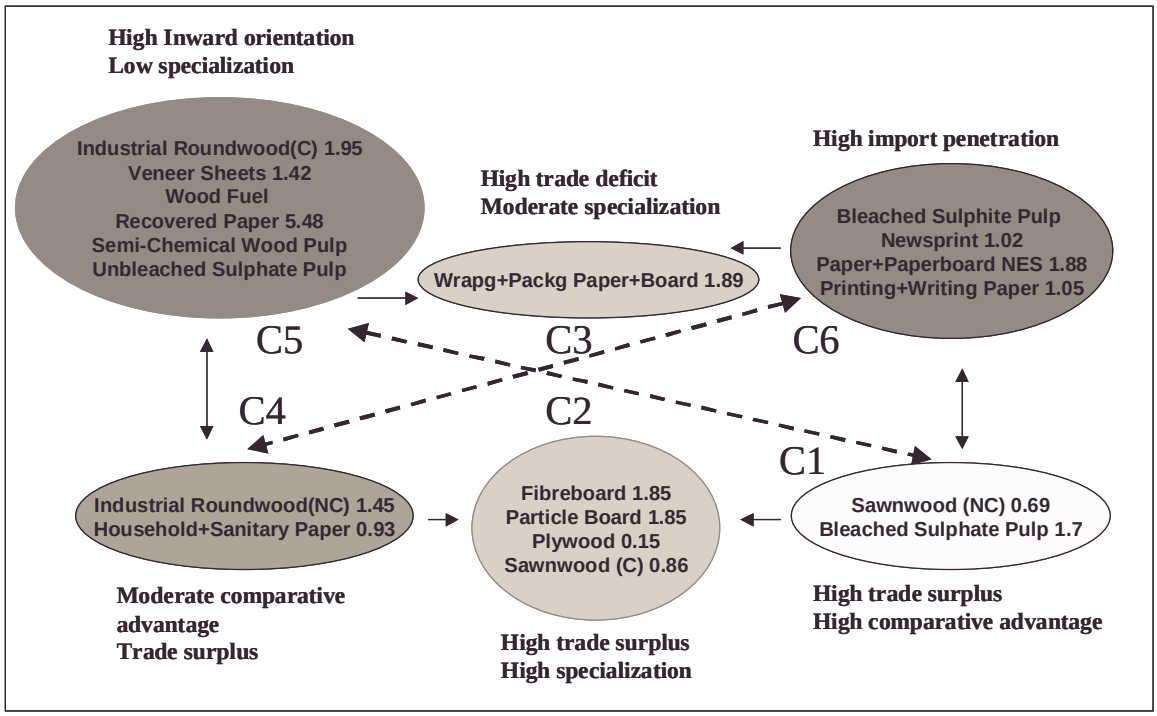


Figure 11: Competitiveness of forest-based industries in Bulgaria; 1998–2000.

[29] We made an exercise by changing the values, 8 for *imp/cons* and 93 for *exp/prod* and the outcome was a pattern similar to the advanced candidates.

The pattern of intermediary clusters reflects the trend towards a more open and specialized industry structure. Whilst showing the second highest imports value, wrapping and packaging papers in C3 have also become an important export product, resulting in a moderate and balanced specialization. A corresponding change has also taken place in the more advanced candidates, although to a larger extent. Panels and coniferous sawnwood have created a new cluster with the highest specialization and a high comparative advantage. This is also similar to development in the advanced countries, especially Poland.

It is noticeable that, for sawnwood and plywood, the increase in production and exports has been associated with maintenance or significant growth of quality competitiveness, suggesting that there have been efforts to develop and differentiate the products. On the other hand, for other panels and paper products restructuring has led to specialization in exports in relatively low quality grades.

6.4 Conclusions and Policy Implications

In spite of the low levels of production and trade, Bulgaria has been able to broaden and differentiate its competitive frontier in forest-based industries. Restructuring is characterized by the development also found in the Czech Republic and Poland. It is probable that the massive growth in the domestic demand for veneer sheets at the end of 1990s has provided a stimulus for the outward oriented growth in the vertically linked product groups (panels and pulp) and horizontally linked products (sawnwood) through the economies of scale and scope in roundwood production. An accompanied negative trend is, however, an increase in the export of coniferous and non-coniferous roundwood. Hence, for Bulgaria the analysis avails the following policy recommendations:

- Advancing institutional reform needed for changing into a workable market economy. This reform should also contribute to macroeconomic stability that is needed for the growth of domestic demand for forest products → *transfer of roundwood to the inward oriented cluster, an increased specialization and value-added of competitive clusters.*
- Revising forest sector strategy and forestry management to better meet the needs of forest-based industries → *increased production and outward orientation across clusters.*
- Revising FDI policies to boost the inflow of foreign capital → *broadened frontier of competitive clusters, increased specialization.*

7 Country Profile — Romania

7.1 Forests and Forestry

In Romania, forests and other wooded land accounts for less than one-third of the land area, with most of these areas located in the Carpathian mountainous region and the pre-Carpathian hills. Some 90% of all forested area is available for industrial utilization and

an even higher proportion is semi-natural forest, with only small areas of forests undisturbed by man and in the form of plantations. Around 60% of the volume of growing stock is comprised of broadleaved species, the main species being beech and oak. Norway spruce is the principle coniferous species. The age class structure of the forests is oriented towards middle-aged stands.

Table 9: Forestry statistics — Romania, 2000. Sources: FAO (2001), UNECE (1997), United Nations (2000).

Total land area; 1000 ha	23034
Total forest area; 1000 ha	6448
Exploitable forest area, 1000 ha	5739
Change of the forested area, 1990–2000 1000 ha	15
Net annual increment 1000 m^3	34600
Net annual fellings 1000 m^3	13100

The net increment, which is above the European average, has exceeded fellings by a considerable margin for some decades, leading to increased growing stock. Ownership of the forests was formerly entirely by the state, but the process of privatization and restitution is leading to an increase in private ownership. In addition, all forests in Romania are claimed to be under a forest management plan.

7.2 Industry

Similar to development in the Czech Republic, the production of wood and wood products along with total manufacturing declined by about 40% at the beginning of 1990s. Since then, the decline has leveled-off, but the development has stagnated and is below total manufacturing. It was not until 2000 that production showed some signs of recovery with a rise of 12.9%. Within the industry the most important products are carpentry and joinery having 32% share of the export to the EU, followed by sawnwood with 30% and other wood manufactures with 21%, respectively. Wood based panels rank fourth with 12% (Hanzl and Urban, 2001).

By the end of the 1990s, practically all companies in the industry were privatized, but because of the existence of big state owned conglomerates the significance of the private sector on the domestic markets is still remarkably low. As in Bulgaria, the Romanian woodworking industry lacks resources for investments in modern technologies. Because of the deep institutional problems and low attractiveness for FDIs accordingly, restructuring and modernization of the conglomerates will be difficult. The remoteness of the country to the EU is reflected in wage levels and the unit labor cost — similar to Bulgaria — which, however, would still give a potential competitive advantage.

Table 10: Forest-based industries —Romania, 1998. Source: Hanzl and Urban (2001).

Industry	Production (million EUR)	Share of the total value of manufacturing	Employment (thousand persons)
Wood and wood products	231	2.2	79
Pulp and paper; publishing and printing	258	2.6	49.3
Furniture	310	3.1	119.6
Total	**800**	**7.9**	**247.9**

The pulp and paper industry, while following the dramatic decline of total manufacturing up to 1994, showed some signs of recovery thereafter. Production increased slightly but experienced a new downturn in 1997. The privatization of the industry, consisting almost of 400 companies, was carried out during a very short period in 1999 and 2000. Of the private capital, 50% is in domestic hands and foreign investors possess the other 50%. Although having a dispersed industry structure, domestic markets are dominated by large integrated companies, which are difficult to restructure.

With its long tradition, the Romanian pulp and paper industry is relatively diversified covering all the main categories. This is partly the consequence of a national self-sufficiency strategy inherited from the communist era and is now the most critical issue in restructuring. While foreign direct investments have contributed to some technological development and a gradual increase in exports, internal competition is still weak. Domestic companies are operating paper machines that were built between 1965–1980 (Hanzl and Urban, 2001).

As in Bulgaria, there are many institutional obstacles for restructuring; a high level of corruption and contract violations. Although Romania is rich in forests, wood availability is currently a serious problem. Energy is also relatively expensive. Labor productivity has not shown any clear upward tendency during the transition process, and wages and labor unit costs have also stayed at a very low level.

7.3 The Pattern of Competitiveness

As in Bulgaria, the closed economy was the dominating character of Romania at the beginning of the transition process. Comparing the absolute values of *imp/cons* and *exp/prod* across the four countries, 78% of Romanian forest based industries can be classified as inward oriented and non-specialized (Figure 12). Consequently, these properties are strongest for cluster C4, which presents the inward oriented cluster in Romania.[30] This cluster consists of intermediate products and low value-added products, of which the quality index can be calculated for only less than half of the product groups. As in Bulgaria, a low level of specialization affects clustering, in that the opposite of C4 is the cluster with the highest average outward orientation *exp/prod*. The

[30] Both *imp/cons* and *exp/prod* deviate very little from zero for all product groups.

paper grades in this cluster exhibit a slight specialization reflecting a broader production mix compared with Bulgaria.

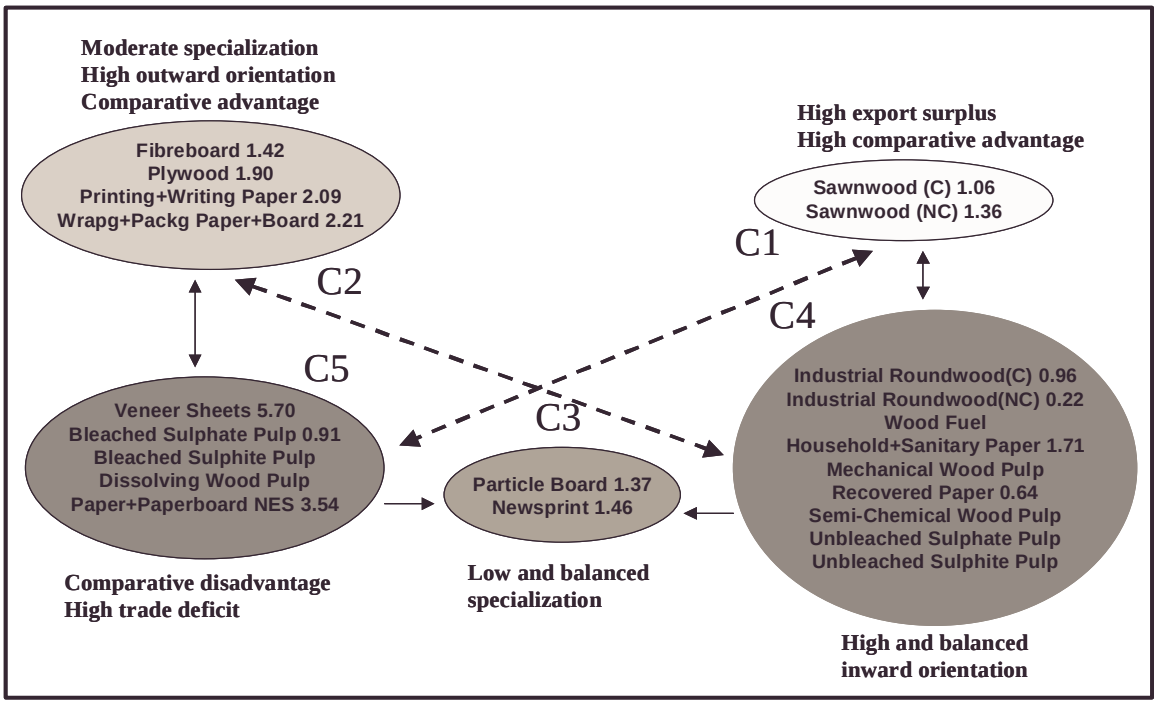


Figure 12: Competitiveness of forest-based industries in Romania, 1993–1995.

In the northwest-southeast direction, the distinguishing feature is the *ability to earn*, which is highest for the sawnwood cluster C1 and lowest for cluster C5 consisting mainly of pulp and paper products. Cluster C1 also produces the largest trade surplus and shows the highest comparative advantage. As in Bulgaria, there is one missing intermediary cluster[31] illuminating the similarity between the countries. Cluster C3 links the inward oriented and high deficit clusters and is characterized by a slight and balanced specialization and balanced trade. As conveyed in Figure 12, clusters C1 and C2 are located above the diagonals and are the most competitive clusters in the first period (1993–1995).

The analysis of price ratios reveals that none of the clusters operating on the international markets enjoys quality competitiveness. Hence, even with the spearhead product — sawnwood — competitive performance is built on standard products in relation to import competition.

Restructuring and increased openness during the 1990s is also labeling the Romanian forest sector, although this is clearly influenced by the decreased domestic demand for some products, particularly in the woodworking sector. While the production of industrial roundwood and sawnwood in particular, has shown an upward trend, there has been a general decline in the other product groups indicating increased specialization across product groups. Reflecting the problems in the domestic markets, the export of

[31] A specialized cluster.

roundwood, equivalent to the increase in its production, has grown rapidly. While still belonging to an inward oriented cluster, roundwood has become the fourth important export commodity.

As a result, the taxonomy of competitiveness has become more obscure, which is demonstrated by the formation of new small clusters (Figure 13). The inward oriented cluster C6 is extended by bleached pulp grades that, together with the increased export of roundwood, mainly contribute to the increase in specialization. Opposite to cluster C6 is the paper cluster C2 amended by particleboard and showing the highest but unbalanced specialization. In Figure 13, the distinguishing determinant in the northwest–southeast direction is the *degree of specialization*. For the paper and paperboard NES, the values of *imp/cons* and *exp/cons* exceed unities indicating that there is trading or a leveling off of the stocks.

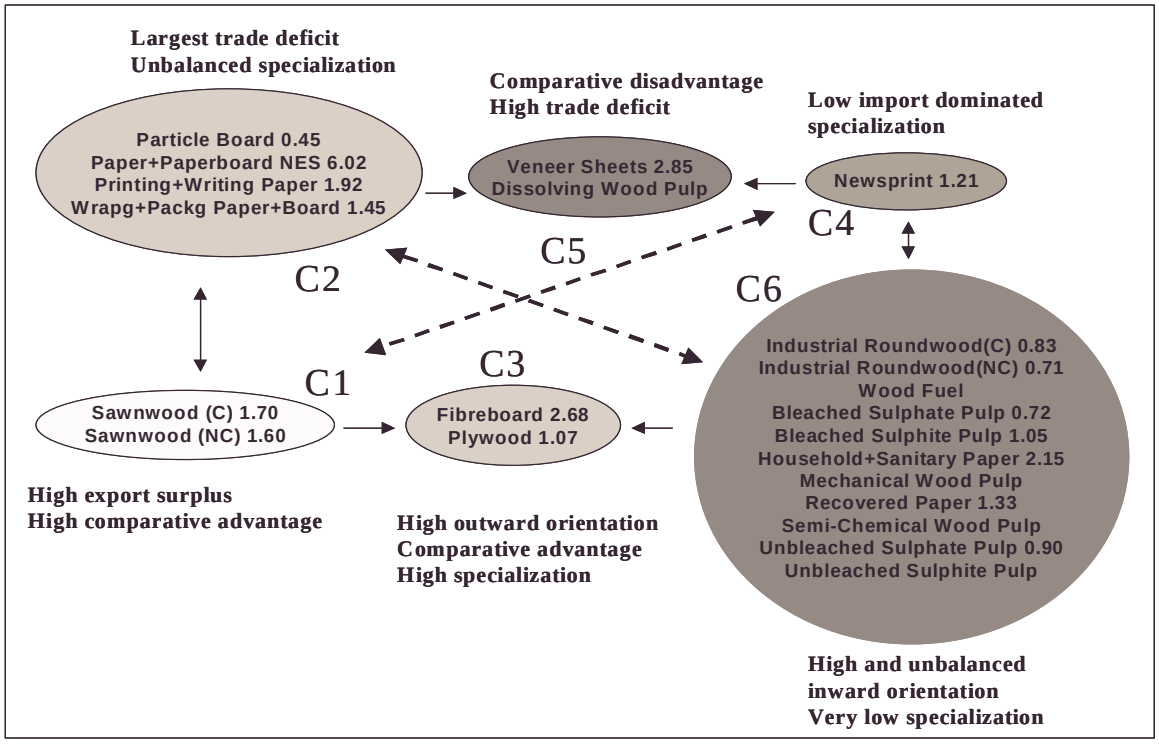


Figure 13: Competitiveness of forest-based industries in Romania, 1998–2000.

The vigorous rise in export and outward orientation of sawnwood has strengthened the degree of comparative advantage of cluster C1, which is boosted by the decrease in domestic demand. It would be logical to expect that the contrasting cluster would be C5, which has the largest trade deficit, but this is not the case. Instead, that clustering position is taken by the newsprint cluster C4, which seems to exhibit no extreme property. However, a closer look reveals that these clusters differ most if all four indicators are compared. The clearest distinction can be seen in *exp/pro* and *value of export*, which are low for newsprint and high for cluster C1.

With the exception of particleboard, which has experienced deep restructuring,[32] the quality ratios have not shown any significant improvement. For sawnwood, the trend is in the opposite direction resulting mainly from the fall of export unit values. For paper and paperboard NES, the production of which has shrunk from 48,000 tons to 9,000 tons, the deterioration of the ratio was largest. As noted above, however, a large share of the export is evidently imported paper.

7.4 Conclusions and Policy Recommendations

To summarize, the development of Romanian forest-based industries has shown a mixed performance. A gradual restructuring in the form of increasing openness and specialization suggests that the forest sector is gradually integrating with the European market system but the development is largely boosted by the internal economic problems of the country. This is reflected by the absence of a systematic pattern of clustering at the end of the 1990s, a general increase in import domination, and the dramatic increase of roundwood export. With respect to the policy deliverables, the Romanian agenda is similar to that of Bulgaria. In Romania, the needed changes are much more profound however:

- Advancing institutional reform needed for changing into a workable market economy. This reform should also contribute to macroeconomic stability that is needed for the growth of domestic demand for forest products → *increased inward orientation of roundwood and other intermediate products, an increased openness of the cluster structure and value-added of competitive clusters.*
- Revising forest sector strategy and forestry management to better meet the needs of forest-based industries → *increased production and outward orientation across clusters*.
- Revising FDI policies to boost the inflow of foreign capital→*broadened frontier of competitive clusters, increased specialization and integration with the EU*.

8 Competitiveness Across Countries

The country profiles of competitiveness investigated in the previous sections conveyed the patterns of clustering, where the point of reference was the performance of the other domestic clusters. The comparison of country profiles showed that the main division can be made between advanced and less advanced countries but, as pointed out, the countries also share some similarities across this division. In particular, this holds true for the change in profiles in the 1990s.

Country profiles, however, do not reveal the real competitive position in an international context. For example, specialization in trade found in country analysis may turn out to be inward orientation when clustering is made across countries. In this section, this is

[32] The domestic demand has been relatively stable but import has substituted for half of the domestic production.

done by pooling the country data and allowing clustering on a 3 x 3 grid. It should be mentioned that because of the symmetry of the grid, the properties of the diagonals in making the major distinction becomes less pronounced. However, while the horizontal and vertical distances between the corners are also large the diagonal still reveals the opposite competitive performances.

From a technical point of view, the advantage of increasing the amount of observations and allowing more clusters the similarity and dissimilarity becomes more visible. Furthermore, with a symmetrical grid one cluster is expected to be in the middle reflecting an average performance. The change of the average cluster will provide some implications of the overall development in the 1990s. Finally, pooling the countries provides further information on the proximity of the countries and possible product specific patterns.

8.1 The First Period 1993–1995

It is no surprise that the determinants distinguishing between the patterns of competitiveness are equivalent to those in the country analyses. In general, the clustering principles in pooling the countries seem to be a mixture of the country profiles. It is also clear that the closeness between Bulgarian and Romanian industries is labeling the overall pattern, especially in the first period (1993–1995).

In the northeast-southwest direction, the distinguishing property is the degree of *comparative advantage*, the difference between *exp/prod* and *imp/cons* (see Table 11). This is highest for A1, which is characterized by a moderate level of trade and trade surplus. With respect to the country composition, this cluster is the most evenly distributed and is dominated by products of woodworking industries.[33] It is noticeable that all but Bulgarian fiberboard is located in this cluster, indicating product specificity.

Table 11: The average performance of clusters and shares of the countries by product groups, 1993–1995.[34]

Dominating products/ Indicators	**A1 Panels**	**A2 Mixed**	**A3 Sawnwood**	**B1 Inputs Panels**	**B2 Pulp Paper**	**B3 Paper**	**C1 Inputs**	**C2 Pulp**	**C3 Pulp and Paper**
Av import USD	4933	9959	25144	3953	22569	142447	1012	9027	7139
Av export USD	21051	29755	95522	8614	13070	31274	808	1705	110
Av Imp/cons Q	8	46	7	5	35	51	2	27	94
Av Exp/cons Q	40	67	28	10	27	23	1	3	2
Poland	20%	20%	43%	25%	60%	67%	10%	60%	0
Czech Republic	25%	80%	43%	30%	20%	33%	10%	20%	33%
Bulgaria	25%	0	0	20%	0	0	40%	0	67%
Romania	30%	0	14%	25%	20%	0	40%	20%	0

[33] 7 out of 12 product groups are panels.
[34] Clusters are named if a certain product group is clearly dominant.

The opposite performance is exhibited by C3, dominated by the Czech Republic and Bulgaria, with products of the pulp and paper industry. In absolute terms, the difference between *exp/prod* and *imp/cons* is much higher than for A1 being close to total import dominance. While the countries share a similar pattern, the difference is that the Czech market is penetrated by certain pulp grades whereas Bulgaria is dependent on the paper import of several grades.

In the northeast-southwest direction, the major distinction is made between the lowest and the highest *value of export*, but the clusters A3 and C1 also have other specific properties. Associated with the high export value of A3 is the highest trade surplus, high comparative advantage, and moderate specialization of some products, particularly the papers in Poland and the Czech Republic. In other respects, the pattern of A3 seems to be typical for sawnwood — four out of seven product groups are sawnwood — and, as seen in Figure 12, the advanced candidates dominate this cluster.

At the opposite corner, cluster C1 represents the biggest and most inward oriented cluster with average *exp/prod* and *imp/prod* of 1 and 2, respectively. From product composition, this cluster is dominated by raw materials and intermediary inputs, fuel wood, and sanitary papers, which assume local consumption. The northeast-southwest diagonal shows the greatest difference between advanced and less advanced candidates; namely cluster A3 consists of products mainly from Poland and the Czech Republic while cluster C1 is dominated by Bulgaria and Romania. The more closed nature of the latter pair of countries is further demonstrated by B1, which is similar to C1 but shows higher specialization. The products of the Czech Republic and Poland are typically those found in C1 but Romanian and Bulgarian products have clearly higher value-added contents.

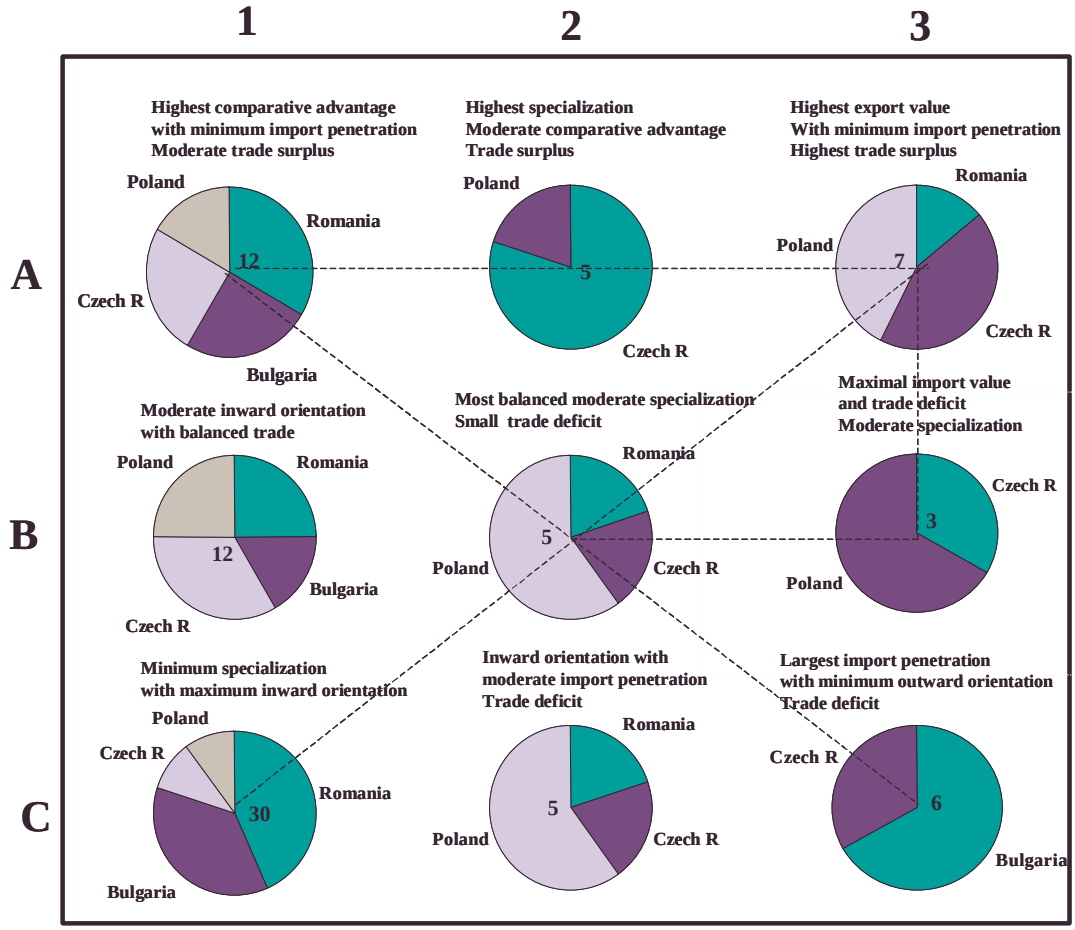
The average pattern of competitiveness is a moderate trade and even specialization, as illustrated by B2, of which Poland has the major share, and consists mainly of pulp and paper grades. Polish dominance can also be seen in two other clusters. The pattern of C2, which is similar but stronger for C3, is typical for imported inputs to the Polish paper industry. Cluster B3, on the other hand, has the highest value of import and shows a comparative disadvantage but also a moderate specialization of printing and writing papers and paper and paperboard NES.

Figure 14 revels that clustering patterns have both country and product group specific characters. In Column 1, which basically measures the degree of outward orientation with minimum specialization, all countries are present, but the majority of Romanian and Bulgarian products are located here. Column 3, on the other hand, measures the export-import ratio in values, indicating also variations in specialization within and across product groups. This column is also more occupied by the advanced candidates. Furthermore, taking into account the domination of Poland and the Czech Republic in clusters A2 and B2, it can be concluded that their competitiveness is more specialized compared to the other pair of countries.

In Figure 14, the upper triangle bordered by B1 and B3[35] is the area with the highest competitiveness. In looking at the shares of different countries, it is evident that Poland

[35] These clusters can be interpreted as intermediary cases between well- and non-performing clusters.

and the Czech Republic together rank on the top and have the most versatile patterns, while Romania is still relatively close to them. Bulgaria, instead, is present only in the cluster common to all countries, the panel cluster. In addition to panels, it is noticeable that product groups, to a high extent, also organize the other clusters. For example, the other best performing cluster A3 is mainly occupied by sawnwood and roundwood. In general, the pulp and paper industry is characterized by specialization, import dependence, and trade deficit.



Note: The number in a cluster is the number of product groups in a cluster.

Figure 14: Competitiveness across countries, 1993–1995.

8.2 The Second Period 1998–2000

The overall change in the 1990s has been a more even distribution of countries and product groups along the nine clusters implying a partial *convergence of countries and an increase in trade specialization*. This is demonstrated by the formation of only one and somewhat reduced inward oriented cluster, the presence of all countries in six clusters[36] and the change in the average performing cluster B2. B2 has become more

[36] There were only three such clusters in the first period.

specialized with higher *exp/prod* and *imp/cons* and focused on panels and pulp and paper grades.

As indicated by the diagonals, in the northwest-southeast direction the distinctive variable is still *comparative advantage*, the difference between *exp/prod* and *imp/cons*, which is highest for cluster C3 and lowest for cluster A1 (Figure 15). Corresponding to C3 of the first period (1993–1995), cluster A1 consists mainly of different pulp grades showing almost complete import dominance. Compared with cluster C3 of the first period, A1 has grown both by products and countries indicating that specialization across pulp grades has some industry specific characters.[37]

Table 12: The average performance of the clusters and shares of the countries by product groups, 1998–2000.

Dominating products/ Indicators	**A1 Pulp**	**A2 Mixed**	**A3 Paper**	**B1 Mixed**	**B2 Panels Pulp**	**B3 Mixed**	**C1 Inputs**	**C2 Mixed**	**C3 Sawnwood, Panels**
Av import USD	11015	26301	310940	38941	35763	660	1826	4722	30328
Av export USD	573	15277	163915	11811	30781	53429	2507	9823	125162
Av Imp/cons Q	95	108	56	32	44	5	3	11	10
Av Exp/cons Q	7	106	47	17	61	145	3	31	39
Poland	22	14	67	30	11	0	22	22	50
Czech Republic	22	58	33	20	45	50	15	22	25
Bulgaria	34	14	0	10	22	50	26	45	0
Romania	0	14	0	40	22	0	37	11	25

Associated with the highest comparative advantage, cluster C3 also yields the greatest trade surplus on average and the second highest value of exports. Hence, by its nature, cluster C3 is equivalent to cluster A3 in the first period. However, because of the impressive growth of Polish fiberboard and particleboard industries, C3 has grown by Polish panels. At the same time, wrapping and packaging papers of Poland and the Czech Republic and Czech roundwood have dropped off, which has resulted in the specialization of cluster C3 in sawnwood and panels.

The northeast-southeast diagonal divides the competitive performance according to the *value of total trade* — import and export — measuring the degree of absolute specialization of industries and integration with international markets.[38] In this respect, the inward oriented C1 scores lowest, although it has become somewhat more open. At the same time, its product mix has become more concentrated on raw materials, roundwood, and pulp and fuel wood.[39] In the opposite corner, we find the paper cluster A3 producing the highest export income but also the largest deficit. However, its specialization has increased and become more balanced. This holds true especially for wrapping and packaging papers of Poland and the Czech Republic.

[37] This is of course no surprise because the application of modern technology favors larger production units.

[38] Notice that these were also the distinctive determinants for the Czech Republic and Poland in the second period.

[39] To illustrate, in the first period cluster C1 consisted of six paper product groups while in the second period there is only one left.

The fourth cluster in the competitive triangle (B2, A3, B3, C3), B3, consists of two product groups showing the highest comparative advantage, yet uneven performance in other respects. The Czech sulphite pulp, which is almost totally exported, produces a trade surplus comparable with C3, while Bulgarian non-coniferous sawnwood has an *exp/prod* value of 193[40] but much smaller trade surplus.

In Figure 15, the clusters linking low and high performance are now clusters A2 and C2. The common feature of the clusters in row A is high import penetration, which is more than 100% for A2. Characterized by an *exp/prod* rate exceeding 100% on average, this cluster can be termed as a trading (or processing) cluster showing a slight trade deficit. Row C, on the other hand, is characterized by low import penetration with varying degrees of comparative advantage. In this respect, cluster C2 exhibits an average performance with a slight trade surplus. Cluster B1, linking the low performing clusters by a low outward orientation, is moderately specialized yet showing a slight trade deficit.

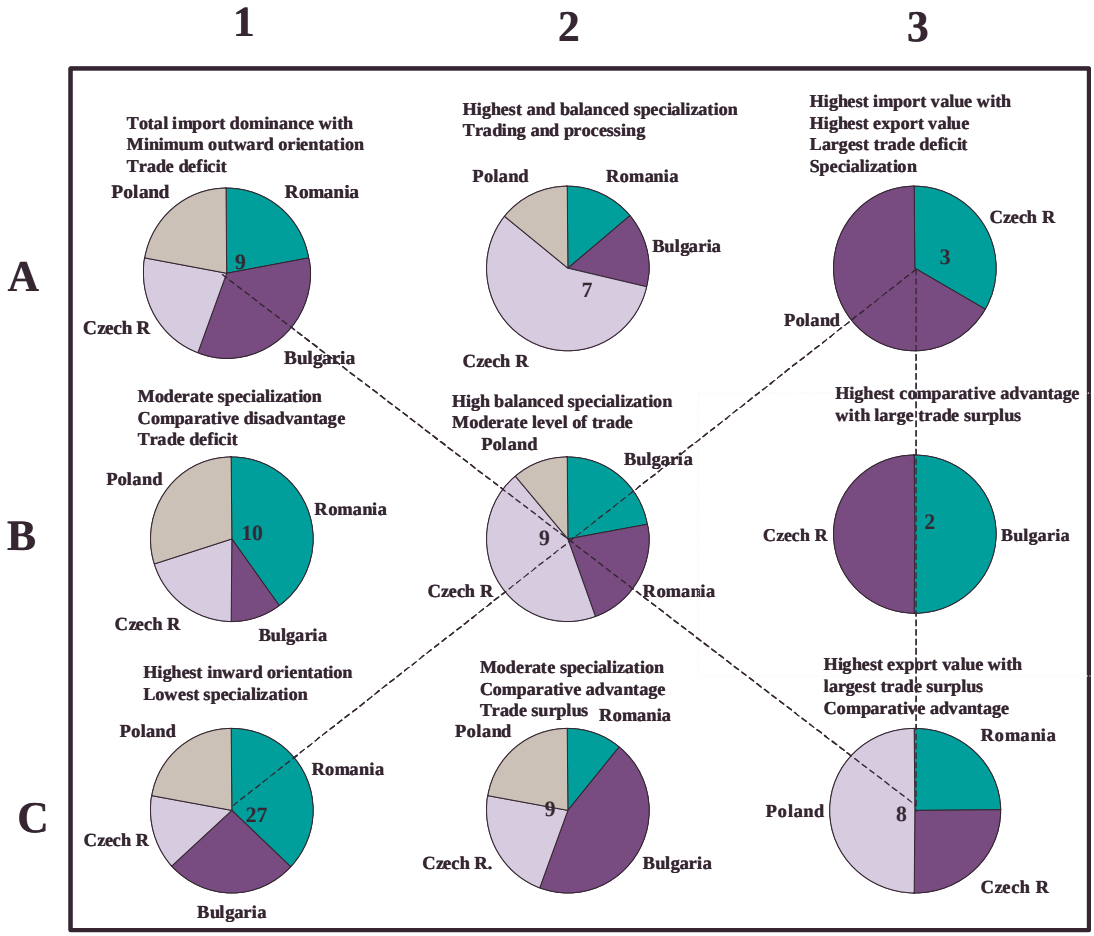


Figure 15: Competitiveness across countries, 1998–2000.

[40] The possible explanation for the anomaly was given in Section 6.3.

Although the product specificity of clustering has become less pronounced in the second period it is interesting to see that the diagonals, as in the first period, still indicate a clear specificity for some products and countries. In this respect, cluster A3 in the first period is the most significant, because it stands as a common base for the development of the most competitive but opposite clusters A3 and C3 in the second period. The woodworking industries occupy the cluster scoring highest in comparative advantage and trade surplus, while paper products score highest in the ability to produce export income and absolute specialization.

Looking at the relative positions of countries, it is clear that Poland has strengthened its position in the top, which is attributable to the favorable domestic development and the strong economic clustering around the panel and furniture industries. By excluding wrapping and packaging papers, Romania shows a similar type of competitiveness ranking as the Czech Republic, albeit for opposite reasons. In the latter, the growth in trade and production is mainly driven by domestic economic development, whereas Romania has been forced to increase its openness due to shrinking domestic markets. Bulgaria, on the other hand, while still scoring lowest and suffering from similar problems as Romania, has been more successful in restructuring and specialization.

9 Summary and Policy Implications

After 10 years of transition the majority of the candidate countries — of CEEC 10 — are already highly integrated with the European market system. According to a recent assessment of the Commission (Thoroe, 2001), all candidates meet the criteria of political transition and all, except Bulgaria and Romania, have changed to workable market economies.[41] For all candidates, the biggest obstacle and future challenge is the institutional and legislative reform, which is a precondition for a stable and speedy transition.

In this study, the transition process is investigated from the competitiveness point of view of the forest sector. Until the collapse of communist regimes, candidate countries possessed a relatively vital and well functioning forest sector. As a consequence of the coarse closure of planned economies, forest-based industries along with the other industrial sectors experienced a drastic decline. However, the ability to absorb the shock has differed significantly from country to country. Poland and the Czech Republic, having the most market oriented economies before the collapse, recovered faster whereas Bulgaria and Romania, with looser ties to Western economies, suffered more and have not yet been able to reach the pre-transition levels of industrial activities.

Hence, the degree of the countries' readiness to face the change has been a decisive determinant for economic development during the transition period so far. The advanced countries, with promising growth prospects, have attracted foreign capital to boost restructuring and technological development. This has further widened the gap between the two groups of transition countries. Nevertheless, the general trend for the CEE region is gradual specialization in the woodworking sector, in which they enjoy the highest comparative advantage. If national forest resources are compared against

[41] This holds less true for Slovakia.

production volumes, the degree of forest utilization in the more advanced candidate countries is, on average, the same as in the EU[42] or even slightly higher. In contrast, for the three less advanced countries huge potential exists in raising the production volumes in a sustainable way.[43]

In this study, a novel approach to the competitiveness of industries and its interpretation was applied. The statistical clustering methodology and its dynamic applications remedies the traditional ways of analyzing competitiveness as measured unidimensionally or by using various indicators separately. The immediate implication of our approach is that competitiveness, being a complicated phenomenon itself, should be defined not only by ordinal scaling but also by nominal classification. This introduces different and interesting aspects of competitive performance in the analysis. In particular, in order to predict correct policy conclusions it is important to discern the industry and country specific patterns and how they evolve over time.

The indicators of competitiveness used in this study measure absolute performance in trade, the degree of outward orientation of domestic industries, and import penetration of domestic markets. Although the number of observations in different countries was small, the Self-Organizing Maps were able to produce interpretable taxonomies of competitiveness.[44] In general, the main dimensions of competitiveness resulted in being the absolute ability to earn and the degree of specialization and inward orientation. The first measure reveals industries in which the country has specialized to exploit comparative advantage. The degree of outward orientation and import penetration, on the other hand, measures specialization within product groups.

In many cases, the distinction made by primary indicators is associated with secondary characteristics, i.e., typical combination of indicators, which is depicted in Table 13. Furthermore, it is noteworthy that in Poland and to a lesser extent in the Czech Republic clusters can also be interpreted as economic sub-clusters, since their product mix has strong vertical and horizontal linkages. Hence, the pattern of competitiveness measured by the chosen indicators is related to the proximity of the product groups themselves. This was further verified by clustering across countries and demonstrated by the diagonals. *Consequently, the study gave empirical support to the argument that statistical and economic clusters often coincide* (see Section 3.1).

Of the investigated countries, *Poland*, with the most abundant resources and versatile industrial base, is showing the highest stability in competitiveness pattern during the 1990s. This is the case in spite of the fact that production and export, boosted by extensive foreign investments, grew rapidly during the transition period. Taking all indicators into account, Poland is exhibiting, on average, the highest competitive performance, which is further demonstrated by the analysis across countries.

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[42] See Figure 4 in Section 2.2.

[43] This is demonstrated by comparing their share of European forests with the corresponding share in the production of industrial roundwood, which is 14% for the advanced candidate countries and 5% for the less advanced countries.

[44] In following the applications, the number of units will be increased by a more detailed product classification and by an increased number of countries.

Although Poland shows an impressive performance, the critical policy issue is how the growth of the forest sector will be managed, i.e., does the institutional environment provide sufficient conditions for the continuation of such development? According to recent economic debates the probable answer is not positive. There are signs of growing political confrontation, hampering needed decisionmaking on institutional reforms. At the same time, there are growing pressures to modernize production facilities especially in the woodworking sector.

Table 13: Determinants of the competitiveness and the most competitive products.

Country	**First Period 1993–1995**[a]		**Second Period 1998–2000**[a]	
Czech Republic	*Specialization within product group*: Plywood Veneer Sheets Bleached Sulphite Pulp Newsprint	*Comparative advantage, Ability to earn*: Industrial Roundwood (C) Sawnwood (C)	*1 Value of export, 2 Value of total trade:* Printing+Writing Paper Wrapping+Packaging Paper+Board	*1 Import penetration, 2 Comparative advantage, Ability to earn*: Industrial Roundwood (C) Sawnwood (C) Bleached Sulphite Pulp
Poland	*Specialization within product group*: Plywood Veneer Sheets Dissolving Wood Pulp Newsprint	*Comparative advantage, ability to earn*: Fiberboard Sawnwood (C) Sawnwood (NC) Wrapping+Packaging Paper+Board	*1. Value of import;, 2. Value of total trade:* Printing+Writing Paper Wrapping+Packaging Paper+Board	*Comparative advantage, Ability to earn*: Fiberboard Particle Board Plywood Sawnwood (C) Sawnwood (NC)
Bulgaria	*1 Outward orientation, 2 Comparative advantage, Trade surplus*: Sawnwood (NC) Bleeached Sulphate Pulp	*Import penetration, Value of import*: Fiberboard Industrial Roundwood (C) Industrial Roundwood (NC) Sawnwood (C) Wood Fuel Wrapping+Packaging Paper+Board	*1 Outward orientation; 2 Comparative advantage, Trade surplus:* Sawnwood (NC) Bleached Sulphate Pulp	*1 Average difference between indicators, 2 Import penetration:* Industrial Roundwood (NC) Household+Sanitary Paper
Romania	*1 Outward orientation, 2 Comparative advantage*: Fiberboard Plywood Printing+Writing Paper Wrapping+Packaging Paper+Board	*Ability to earn, Comparative advantage*: Sawnwood (C) Sawnwood (NC)	*Specialization within product group*: Particleboard Paper+Paperboard NES Printing+Writing Paper Wrapping+Packaging Paper+Board	*1 Average difference between indicators, 2 Ability to earn, Comparative advantage:* Sawnwood (C) Sawnwood (NC)

[a] 1 refers to the primary indicator and 2 to the secondary property.

The *Czech Republic* shows a similar competitiveness pattern as Poland, which is attributable to common factors such as proximity to each other and the Western Europe, long traditions and knowledge in wood processing, high ranking in the transition process, etc. Although the Czech forest sector is showing the second highest competitive performance as a whole, its restructuring and growth lags far behind development in Poland. There are plausible explanations for this. The forest sector was already relatively well integrated with European markets at the beginning of the transition process but has been less successful in its FDI policy, privatization and institutional reforms. In spite of having a relatively good starting point, the Czech Republic has lacked incentives to make further improvements.

While showing increased specialization across forest industries, the persistent problem in the Czech Republic is that the cluster showing the highest comparative advantage and trade surplus is concentrated to few products with low value-added contents. Moreover, the unexceptional high level of roundwood export reflects a deficient forest sector strategy and, hence, loss of unexploited opportunities. Roundwood exports, which are a consequence of unclear property rights with respect to the forests and short-term profit seeking, are also detrimental to roundwood markets in Austria.[45] Consequently, the main policy agenda for the Czech Republic is to launch development programs to create a more versatile industrial structure and increase the value-added contents of the exported products. This necessitates institutional reforms in the national forestry strategy to replace roundwood export by domestic processing.

As pointed out above, the common feature for all of the investigated countries is restructuring in the form of increased specialization across and within product groups. This indicates the adaptation and integration with the European market system. Moreover, as indicated in Figures 14 and 15, there is a clear convergence of competitiveness patterns among the investigated countries during the transition process. The driving forces behind development, however, are different for the less and more advanced countries.

For Poland and the Czech Republic, economic growth has contributed to increased consumption of forest-based products, which in turn has encouraged industries to make further investments and increase export. Export is facilitated further by the competitiveness of customer industries.[46] In contrast, for the less developed countries of Bulgaria and Romania, the increase of openness and specialization has mainly been driven by the persistent problems of domestic economies and institutions. With stagnating or shrinking consumption, import is substituting for domestic production and simultaneously industries are forced to find new markets abroad. The economic deadlock of customer industries is aggravating the situation.

The differences between the countries can be demonstrated by comparing the development of domestic consumption per capita to export volumes by product groups (see Appendix). In Poland and the Czech Republic, the positive average growth in consumption per capita is associated with positive and, in most cases, higher average growth in export volumes. In a way, this indicates the presence of the Porterian cluster effect, that is, established and stable demand conditions also facilitate an increase in competitiveness in international markets. Stability, measured by the standard deviation, is essential for the creation of long-term competitiveness. As seen, the stability of consumption and export is much higher for the advanced countries. The negative effect of shrinking domestic demand can be seen in the Bulgarian and the Romanian sawmilling industry, the Romanian paper industry and, to a certain extent, in the Bulgarian panel industry.

Bulgaria and *Romania* have the biggest growth potential and exhibit a similar pattern of competitiveness, although the similarity is less pronounced than in the case of the more advanced countries. Because of its more extensive paper industry, Romania had some

[45] Roundwood export is lowering the price of roundwood in Austria, which decreases domestic supply.
[46] Especially the furniture industry.

similarities with Poland and the Czech Republic in the first transition period. The less advanced countries are characterized by a high degree of inward orientated industries, which has hindered a distinctive cluster formation, especially in the first period. Nevertheless, for the reasons mentioned above, they have experienced restructuring. In this respect, the change in Bulgaria is more radical and successful illuminated by the broadening of its competitive frontier. Although its level of industrial activity is still relatively low, Bulgaria is converging to the more advanced countries. In Romania, the opening of the forest sector is associated with a shrinking frontier of competitiveness.

In a similar way as the Czech Republic, sawnwood is become the dominating product in producing a trade surplus in Bulgaria and Romania. Concentration has been reinforced by shrinking domestic demand and by the attempt to keep the forest sector alive in general. This is because significant economies of scale and scope exists in the production of roundwood and processed products. It may be better to keep sawnwood production at the maximum level even if it is not always profitable.[47] This is valid also for the Nordic countries with an advanced forest sector, albeit for different reasons.

Hence, the overall challenges for Bulgaria and Romania are the stagnating domestic markets and high dependence on sawnwood trade associated with increased roundwood exports. For these countries, the policy agenda is more complicated because the most important issues are not only related to the forest sector, but the whole economy needs profound restructuring. Preconditions for a real recovery and balanced growth of the forest sector are the transition into a market system and setting up credible institutional frameworks in general. With a predictable and stable economic environment, it is possible to attract more foreign direct investments needed to catch up with the more advanced candidate countries.

Because of the ongoing economic integration between the current EU and the candidate countries, policy measures that are implemented at the national level have multiple impacts across countries. Hence, it is imperative to achieve the coordination of forest sector policies before full membership of the candidate countries is implemented. The rationales for a common forest sector policy in Europe are not hard to find. Being the most valuable natural resource and asset, forests should be utilized according to generally accepted rules providing equal competitive conditions for a sustainable business activity.

The promotion of balanced growth of forest-based industries is of special importance in order to meet the requirements of the Kyoto Protocol. The third related rationale is to facilitate technology diffusion and spillovers from the West to the East. This necessitates the implementation of appropriate FDI policies and effective country specific restructuring programs. Finally, since the ultimate rationale for a common forest sector policy is to enhance the competitiveness of the European forest sector, the creation of a science oriented policy-research framework is needed (see, e.g.,Viitamo, 2001).

[47] This seems to be the case especially for Romania having a quality index of 1.6 on average for sawnwood trade.

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Appendix

The yearly changes in per capita consumption and export of forest products in the candidate countries (Percentages of volumes).

Panels	1993	1994	1995	1996	1997	1998	Average	Standard deviation
Consumption: Czech Republic		-10.9	16.3	-8.8	13.5	8.5	**3.7**	**12.7**
Export: Czech Republic		93.5	3.4	34.0	20.3	5.3	**31.3**	**36.9**
Consumption: Poland	7.9	17.1	14.6	20.0	22.7	12.3	**15.8**	**4.1**
Export: Poland	-9.4	24.5	67.8	-0.2	40.8	54.4	**29.6**	**26.5**
Consumption: Romania	6.7	-53.1	0.0	26.7	-5.3	-11.1	**-6.0**	**28.8**
Export: Romania	-42.9	60.9	-10.1	-23.3	7.8	-26.4	**-5.7**	**35.7**
Consumption: Bulgaria	4.3	8.3	3.8	-14.8	13.0	0.0	**2.5**	**10.6**
Export: Bulgaria	-45.5	-25.0	-66.7	683.3	-19.1	0.0	**87.8**	**318.9**
Sawnwood								
Consumption: Czech Republic		2.8	-5.4	3.3	-3.7	10.0	**1.4**	**6.1**
Export: Czech Republic		46.0	29.4	-9.1	0.9	-9.1	**11.6**	**24.9**
Consumption: Poland	-3.8	35.1	15.4	-4.2	28.7	28.7	**16.7**	**15.7**
Export: Poland	26.1	0.3	-13.7	-27.4	37.3	-10.7	**2.0**	**24.5**
Consumption: Romania	6.5	-53.5	-2.2	-20.0	-22.2	3.6	**-14.7**	**22.3**
Export: Romania	-39.3	231.7	11.3	18.9	40.0	24.2	**47.8**	**93.6**
Consumption: Bulgaria	3.6	-10.3	-7.7	-16.7	-60.0	0.0	**-15.2**	**23.7**
Export: Bulgaria	-78.3	44.0	58.3	101.8	78.3	0.0	**34.0**	**38.3**
Paper								
Consumption: Czech Republic		1.6	7.8	4.3	15.3	-8.4	**4.1**	**7.8**
Export: Czech Republic		56.0	3.9	-7.4	53.4	14.1	**24.0**	**26.0**
Consumption: Poland	14.8	9.7	17.6	10.0	18.2	3.8	**12.4**	**5.4**
Export: Poland	40.4	8.9	11.5	27.1	17.5	13.0	**19.7**	**6.6**
Consumption: Romania	6.7	-25.0	8.3	15.4	-13.3	15.4	**1.2**	**16.4**
Export: Romania	-13.3	400.0	89.2	-36.6	39.7	-21.1	**76.3**	**159.5**
Consumption: Bulgaria	11.8	15.8	-13.6	21.1	17.4	0.0	**8.7**	**13.1**
Export: Bulgaria	-69.2	50.0	133.3	78.6	-44.0	0.0	**24.8**	**61.9**