Cluster analysis in primary roundwood production of 25 countries of European Union

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Abstract. Main objective of this research is the effects of the political and economic enlargement of Europe in the market of wood products, especially for primary production of conifers and broadleaves round timber. The research consists in the application of the hierarchical cluster analysis to classify the 25 member countries, based on the roundwood coniferous and non-coniferous production during the period 1992-2002. Valuable conclusions came out regarding the market changes due to the participation of the new member states in E.U., which finally strengthen the wood and wood products European trade. Many of these new member states are covered by extended forested areas and they contribute significantly to both coniferous and non coniferous round wood European production. The entrance of the new ten member states, combined with the sustainable management of the forest resources, contributes to strengthen the EU timber production, exploiting internal productions but also to promote sustainable forest management and conservation for every country.

Keywords: wood products, European wood market, forest sector, timber production, enlargement, sustainability

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Introduction

The forests constitute example of reserved natural resource. As a lot of other organic natural resources, the timber constitutes simultaneously productive flow and capital good. Cutting the trees offers a merchandise that can be put in the market, while if not they constitute a good capital that could produce more product the next year (Tietenberg 1996).

Europe is an important timber and timber-based products exporter, covering roughly half of the world exports, but its importance as world exporter falls because the high increase of other countries exports, mainly from Asiatic Continent (FAO 2000). The main historical trends in consumption and production of forest industry products in Europe are similar and seem to follow major macroeconomic variables related to economic growth at the global and regional scale (Solberg 2003). It is useful to investigate by all sides how the political and economic enlargement of Europe, with the entry of ten new countries, influence and will influence, the market and the growth of forest sector economy. The effects of this enlargement in the market of wood products are important as they were expected to be.

Although, from 1993 (before the enlargement of 2004) both exports and imports between E.U.15 and countries of COMECON (USSR and countries of former USSR, Bulgary, Czechoslovakia, Hungary, Poland, Romania and Germany DR) have expanded dramatically (Wardle & Michie 2000).

The establishment of bigger internal market encourages the trade, but also helps in the economic growth of European countries and in the increase of living standards. It is certain that new coming countries will play an important role in the European forest sector. Trade in forest products of CEE (Central and Eastern European Countries) is already highly oriented to European Union (Kangas & Niskanen 2003). The 10-12 new EU-Accession Countries have their own long forestry tradition with high scientific standards, which should create the sound basis for further development of their forestry activities. These countries have some special needs for reforms and rethinking for changes in forest economics, forest policy (legislation, rules and regulations), accounting and business administration in forest-based sector (Efthymiou 2005).

The widen European Union can offer better opportunities to the forest sector because: (i) the decreased duties because of free borders, (ii) the free locomotion of merchandises, (iii) the consequence in the control of quality and regulations of trade, (iv) the better distribution of information on the purchase and (v) roughly 25% more forest available on exploitation (FAO 2005).

The main objective of this research is to define some of the effects of the political and economic enlargement of Europe in the market of wood products, especially for primary production of conifers and broadleaves round timber.

Materials and methods

The study examined the period 1992-2002 for all the European countries in order to obtain results comparable from each other. As examined quantities are considered the annual means of production of round timber of conifers or broadleaves in thousands cubic meters (Table 1). The sample of study contains

Austria, Belgium, France, Germany, Denmark, Greece, United Kingdom, Ireland, Spain, Italy, Holland, Luxembourg, Portugal, Sweden, Finland and new coming countries (at 2004): Estonia, Latvia, Lithuania, Cyprus, Hungary, Poland, Slovakia, Slovenia, and Czech Republic. The data of the Table 1 in a first level analyzed to appoint each country contribution to the total new coming countries production and to the total EU (25) production. Finally becomes a regrouping, base of production of primary roundwood conifers or broadleaves production for time period 1992-2002 with the help of cluster analysis. Cluster analysis is a statistical method of analysis in groups and it concerns the study how much, with base concrete variables, the observations are similar from each other as a part of homogeneous group, so much so that it is considered that each one of them constitutes part of one and unique common group. In the cluster analysis

Table 1 Centralized data for mean roundwood timber production for EU (25), for the period 1992-2002

	Average	
	coniferous round wood (1000m^3)	non coniferous round wood (1000m^3)
Austria	11841.18	2230.30
Belux	2912.36	1546.64
Denmark	1513.73	647.73
Finland	41390.18	8143.00
France	22425.27	17769.45
Germany	29483.82	9869.09
Greece	525.91	1496.36
Ireland	2215.73	51.64
Italy	1489.64	7591.82
Netherlands	651.82	400.64
Portugal	4716.73	4740.09
Spain	8047.09	6821.00
Sweden	54042.82	5553.55
Uk	6758.45	683.64
Cyprus	34.91	1.91
Czech republic	11620.91	1339.27
Estonia	3654.27	2293.55
Hungary	535.64	4394.27
Latvia	5612.18	3090.64
Lithuania	3167.18	1887.55
Poland	16268.09	5733.18
Slovakia	2985.18	2396.45
Slovenia	1117.73	861.36

are created groups in which are included the observations and are not known before nor the number of groups, neither their classification in concrete group. Cluster analysis is an inquiring tool that helps to realise how much exist at the disposal of researcher, natural and useful regroupings of data. The analysis in groups can become, or with, the technique of hierarchical analysis in groups or with the technique of analysis in groups of K-means. In this paper was used the hierarchical analysis in groups, without to exclude also the use second technical as dead-end. The determination of the way of measurement of distance between the prices of observations, as well as the suitable criteria of resemblance with base, which will become the combination of observations in groups, is the square of Euclidian distance at the relation.

$$Si = (Xi - Yi)_{\smile} \qquad (1)$$

The method that was used for the combination of observations in groups according SPSS (SPSS/PC Version 13.0, 2005) is the Ward method. Ward's method, squared euclidean distances are commonly used with this method. According this, they are calculated as numerical averages of all variables for every group, and afterwards the squared Euclidean distances of each one of observation divided to average of group. In each stage, the two groups that are incorporated are those that give the smaller increase in the total sum of square of distances inside the group. The provided with the accumulative drawing information is presented in the dendrogram in which the vertical lines imply combinations of groups of observations, while the length of each one of line implies the distance at which the groups are combined. Also, for the particular analysis roundwood, conifers, non-conifers and production data terms are provided by FAO (2000).

According to Christodoulou et al. (1998), the above method was helpful to the clustering of countries which export wood and wood products in Greece, and to the determination of the most important per cluster categories of wood and of its products. Whereas the cluster analysis have been used mostly for forest management planning (Newham 1992), the classification of the EU countries from the view-

point of their timber production aiming to the construction of low, medium or high productivity groups important for policy and decision makers.

Results and discussion

Each country contribution to the European timber production could be presented in the Table 1 and the Figures 3-6. According to Figure 3, Czech Republic produced, in the period 1992-2203, 26% of the total new coming countries conifers roundwood production but also the 5% of the total EU (25) production (Fig. 5). More impressive quantities are produced for the same period in Poland, in which provided 37% of the total new coming countries production and 7% of the total EU (25) roundwood production. These percentages are larger, or similar, than the percent of Spain, Italy, Denmark or Austria. In regard to non-coniferous production, it's important to underline that according to Figure 4, Poland produces 26 % of the total new coming countries production and Hungary respectively 20 %. Also, together, they produced 11 % of the EU (25) total production for the considered decade (Fig. 6).

Analyzing Figure 1 resulted from the utilization of the cluster analysis, we have the classification of 25 countries in three groups of common characteristics about the primary coniferous roundwood production. In the first group are included: Greece, Holland, Portugal, Spain, United Kingdom, Denmark, Italy, Ireland, Belgium-Luxembourg, Slovakia, Lithuania, Estonia, Latvia, Hungary, Cyprus and Slovenia. These are characterized by small quantity of timber productions from 35 thousands cubic metres on average for Cyprus until 8048 thousands cubic metres on average for Spain. These countries are poor ones in production of conifers roundwood and provided that they have also small share in the total production and small contribution in the determination of wood prices and the dynamic of the wood market. The second (medium productivity) group of countries includes Austria, Czech Republic, Poland, France and Germany. The production of these countries oscillates from 11620 thousands cubic metres on average for

Czech Republic and 16268 thousands cubic metres on average for Poland, up to 22425 thousands cubic metres on average for France and 29483 thousands cubic metres on average for Germany. Characteristic of this group is that two countries, e.g. Poland and Czech Republic (new coming countries), are included in the group and they will start playing important role in the configuration of new market strategies for the coniferous timber and wood products. The third group includes Finland and Sweden with productions of 41390 thousands cubic metres and 54042 thousands cubic meters on average each other, receiving an important percentage of total production of round timber of conifers for the European union of 25 countries. These countries, as it is presumable, contribute to the configuration of situation in the offer and in the demand of coniferous timber and wood products, generally. With their rich domestic production, but also with their traditional intensive exploitation of their forest resources, they control the European forest economy.

Analyzing Figure 2 resulted from the application of the cluster analysis, we have the classification of 25 countries in three groups of common characteristics about the primary non coniferous roundwood production. The first group includes Greece, Belgium - Luxembourg (counted together because of their small production), Austria, Denmark, Holland, Ireland, United Kingdom and from new comings countries Slovenia, Cyprus, the Republic of Czech Republic, Estonia, Slovakia, Lithuania and Latvia. These countries are characterized by the production of non-coniferous roundwood timber between 1.9 thousands cubic metres for Cyprus up to 3090.64 thousands cubic metres on average for Latvia. Characteristic of the group is that seven from ten new comings countries of European Union are classified in this group. Their natural ecosystems probably don't support big productions of timber, so that their classification in the low productivity group is unavoidable. The second group includes Sweden, Portugal, Finland, Italy, Germany, Spain but also Poland and Hungary. The production from this group varies between 4394.27 thousands cubic metres, on average, for Hungary up to 9869.09 thousands cubic metres on average, for Germany. This particular group includes eight countries and including France of third group, with 17169.45 thousands cubic metres on average round timber from broadleaves, are those that determine the future of non coniferous wood market but also the prices of products
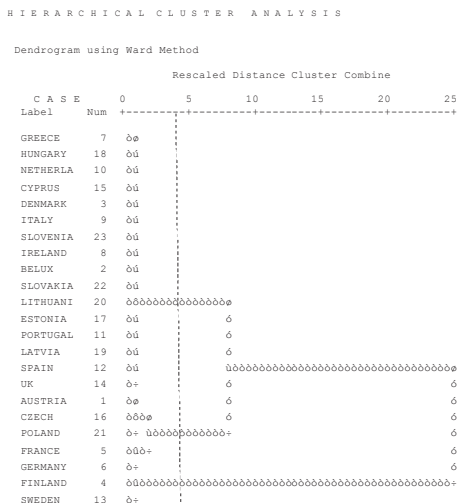

Figure 1 Cluster analysis in groups for E.U (25) according their coniferous roundwood timber production for the period 1992-2002
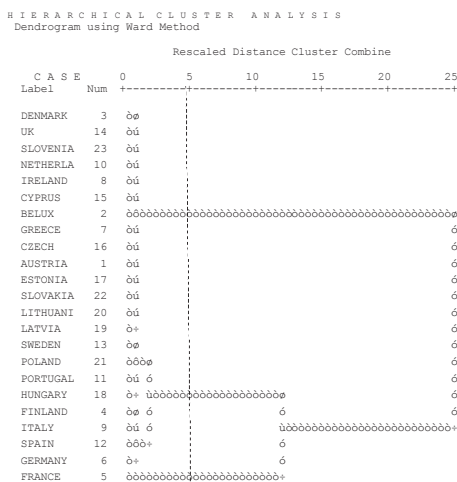

Figure 2 Cluster analysis in groups for E.U (25) according their non coniferous round wood timber production for the period 1992-2002
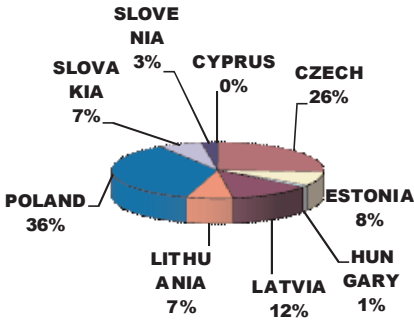
Figure 3 The new coming countries conifers round wood production (% of the total new coming countries production) for the period 1992-2002
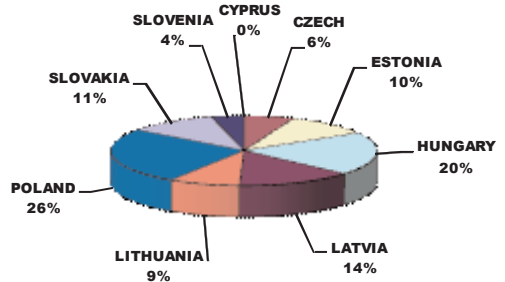

Figure 4 The new coming countries non conifers roundwood production (% of the total new coming countries production) for the period 1992-2002
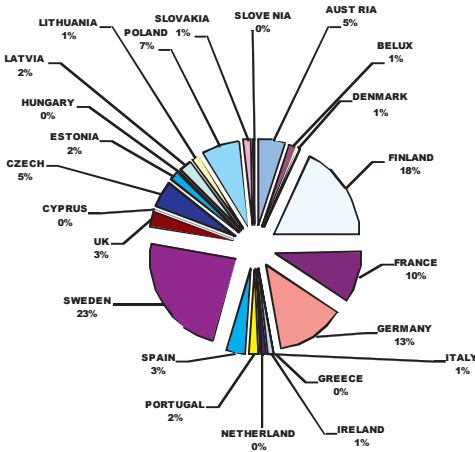

Figure 5 EU 25 conifers roundwood production (% of the total EU 25 production) for the period 1992-2002
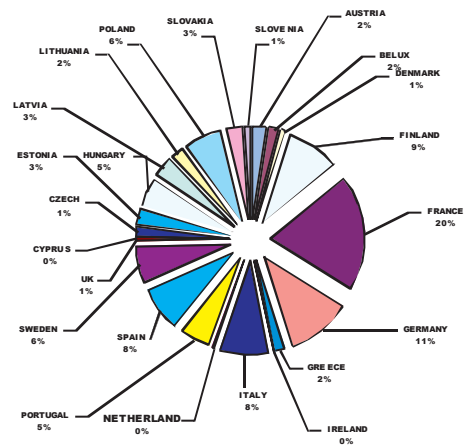

Figure 6 EU 25 non conifers roundwood production (% of the total EU 25 production) for the period 1992-2002

that are produced by the broadleaves.

Conclusions

The study considers that the following conclusions are plausible. We must give special emphasis to some characteristics.

Thus, the production of Poland in conifers and broadleaves is important for the forest sector of European Union. Not only with 16268.09 thousands cubic metres production of conifers, but also with 5733.18 thousands cubic metres production of broadleaves, Poland can be considered an important European wood production country. Because of

these quantities, cluster analysis classifies Poland in the medium productivity group concerning both categories of timber.

Cluster analysis also classifies Sweden and Finland in the high productivity group concerning coniferous, and in medium productivity group concerning non-coniferous production. Those countries are considered in the European countries group that play a leading role in the production of timber in Europe.

Germany, also, is included in the leading countries. With 29483.82 thousands cubic metres, on average production for the conifers, for the considered period, and with 9869.09 thousands cubic metres for the broadleaves, in

combination with the existence of dynamic and active industry of forest products, it leads and will lead in the configuration of wood timber offer, demand and trade for the European Union.

Austria, Czech Republic, Italy but also Spain and Portugal - in the production of round timber of broadleaves they are mainly included in the leading countries, with important annual productions.

The high productivity countries, for the both categories of wood that examined, like Finland, Sweden or France, could find new markets to promote their products in the low productivity countries.

The remaining low-productivity countries contribute in the European forest sector specific in the configuration of prices, as main importers, in order to cover their consumers needs. A wide market provides more opportunities for the importers to find more advantageous prices. Efficient market planning and increase of investments of reforestations in the sector of primary production could be some development measures. Also, minimisation of wastefulness of timber at the harvest and the application of new technologies, could improve their production and their domestic forest exploitations as for best.

Since its origin, the EU has established a single economic market across the territory of all its members. This economic market it is patently strengthen for the exploitation of the European forests. Some of the new coming countries, such as Czech republic, Poland and Hungary, have outstanding features considered their forest resources. Sustainable management, according to the forest principles adopted at the United Nations Conference on Environment and Development (UNCED) from Rio de Janeiro (1992), and the Council Rsolution (1999/C 56/01) of 15 December 1998 on a forestry strategy for the European Union, it is a primal priority for these countries, as well. FAO reports that the most important recent changes in the legal framework, for forestry in Europe, have taken place in Eastern Europe, where a majority of countries have reported an increase in private ownership of forests. The *status quo* about forests for these countries begins to change or is already changed, but

long term intentions, like the sustainability of the EU forests, render sustainable management and harvesting with certified timber as a sustainability tool, primary perspective for the forest policy makers especially in Poland, Hungary, Czech Republic, Latvia, Slovakia that have important conifers and non conifers timber productions.

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