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Technological Specialisation of Production and Export in Europe

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TECHNOLOGICAL SPECIALISATION OF PRODUCTION AND EXPORT IN EUROPE*

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Continuous specialisation of a nation, conducted by the dynamic comparative advantage, is not only the effect of free market forces accompanied by commercial openness, as it depends on many other factors, among which technological progress is essential.

In this study, we try to analyse the differences in the structure and relative specialisation level of production and export, as well as the evolution of territorial concentration of production by various groups of economic activities and products. We use a sample consisting of the main European countries, the USA, Japan and China.

Keywords: *RD&I, technological specialization, geographical concentration.*
JEL*: F14, O33, O47*

1. Introduction

The new theories of international trade point out that the type of products requiring specialisation is highly important, and the comparative advantage is dynamic in time.

As for the former aspect, the technological level of product plays an essential role. Technology-intensive or high-tech products hold an important share in world trade, owing to the advantages they provide: temporary monopoly rents brought on by the barriers against the other competitors' products; generation of a cumulative process (virtuous circle of specialisation), owing to steep learning curves and scale economies; positive externalities at intra- and interindustrial level, with a positive role in economic growth; high wages offered to employees from such activities; attractiveness of technology-intensive sectors to multinational companies is very high; the demand for such products on markets having a high growing potential is very high. Unfortunately, in Europe, only a few countries (Western countries) are competitive in such sectors. The CEE countries are specialized in low technology products, which are natural resources and labour-intensive, as we shall see below.

Nevertheless, not only the type of activities in which an economy is specialized is important, but also the quality and novelty of products are important, irrespective of the industry to which they belong. Vertical differentiation (quality) and horizontal differentiation (variety) of production raise the efficiency of

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innovative companies and contribute to the growth of the national stock of knowledge, as two complementary factors of economic growth. The continuous introduction of new assortments of the same type of products into the world market brings on a new variety and quality scale: on lower levels one finds old, obsolete products and on higher levels, new products and services of a higher quality and different design, etc. The higher the production and export of a country is placed on this scale, the higher the benefits for economic growth are. Also here, the cumulative character of specialisation is valid. As in the previous case, the CEE countries are specialized in low-level products.

The second aspect of the novelty of the "new theory" of international trade is the dynamic character of the comparative advantage. If it were static, the international model of specialisation in an equilibrium state would not change in time, which contradicts statistics. Technological superiority acquired through a cumulative process of learning from practice determines the comparative advantage, by generating new products/production processes. The advantage is still temporary (at least, theoretically), until external competitors manage to understand the production technologies and imitate the products, since the cost of imitation is much below the cost of innovation. When the initial gap is closed, the traditional factors play again a decisive role in trade. The initial leaders may become even importers of the new products, if the production cost is now disadvantageous to them. Then, companies try again to get profit from the innovation monopoly, which brings about other gaps, and so on.

The continuous process of industrial restructuring, due to the dynamics of comparative advantage, is not only the consequence of free market forces that operate along with trade openness. It depends on the influence of RDI on the efficiency of production factors and on specialisation. Therefore, the omission to include technological dynamics among the objectives of economic policy has a major negative impact on economic growth and development.

As regards the process of structural adjustment of the economy – required by full integration into the European production and trade circuit – the CEE countries were initially confronted, and still are, with a gap in productivity, differentiated by industrial branches. Usually, the gaps are wider in medium and high technology branches. That is why convergence takes a longer time for the above activities. On the other hand, the difficulty to achieve convergence differs by industrial branch. The higher the technological level of an industry is, the higher the effort required by convergence is to achieve practical learning, employees' training and higher managerial capacity. But there is a positive aspect, too: the wider the gap is, the higher the opportunities of the backward country to develop that industry are. The capitalisation of this potential depends on several factors: support to RDI sector, human capital, business environment, etc.

Further, we intend to analyse, mainly on the European level, the dynamics of differences in production and export, as well as the territorial concentration of production by various groups of economic activities and products. The purpose is

to study the existing convergence/divergence in specialisation between CEE and WE countries[1].

2. Specialisation and territorial concentration of production

2.1. Structure and specialisation of production by technological groups of activities

Production restructuring based on relative costs aroused fear concerning the non-uniform territorial distribution of production of some industrial branches. More exactly, those having a high potential of economic growth are mostly located in developed areas of Western and Central Europe, while labour-intensive branches are expected to emerge in Eastern Europe.

To check the above-mentioned, we present in the figures below the structure and the degree of relative specialisation of production, by groups of processing industry branches, in relation to technology intensity, in accordance with an OECD classification (2005) of leading European countries[2].

As for the production structure (Figure 1), industries with high and medium-high technologies represent over 30% of production in 14 out of 16 WE countries, while in the CEE area, only half of the countries reach the same level (6 out of 12). One may notice that differences between the two categories of countries, although significant, do not match those occurring in labour productivity and labour cost, which shows that these factors are not the main determinants of production structure.

As for the relative specialisation index (Figure 2), more than half of the WE countries (9 out of 16) are specialized in high and medium-high technologies, as against one-third (4 out of 12) in the case of CEE countries. Among the latter, one notices Malta and Hungary, with index values even higher than those of the WE countries. They represent, beside Slovenia, the only Eastern countries specialized in high technology production. In a contrary position, we find the very low performance of the Baltic countries (Estonia, Latvia and Lithuania) as well as of Cyprus, Romania and Bulgaria. As for Romania, it is obvious that the relative specialisation of production tends towards low (natural resource-intensive) technologies, followed by medium-low technologies.

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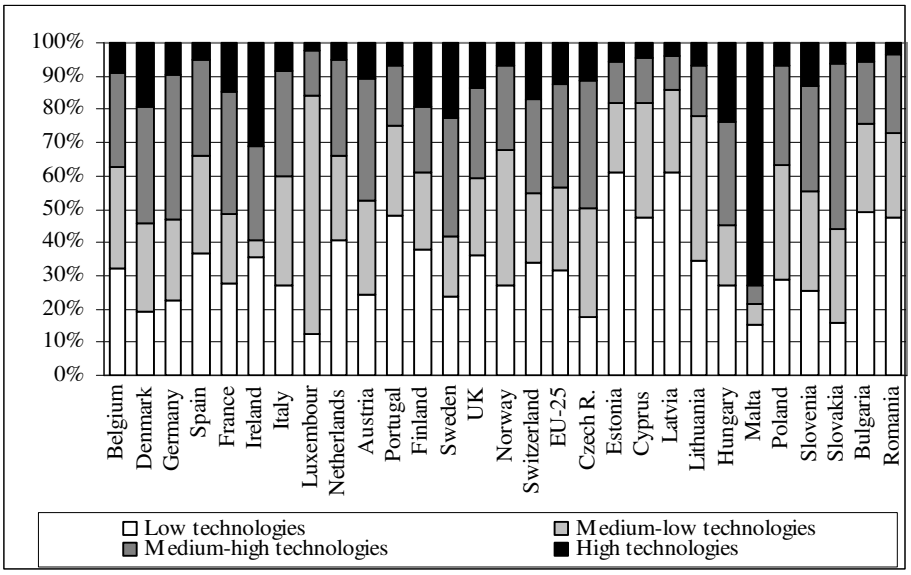
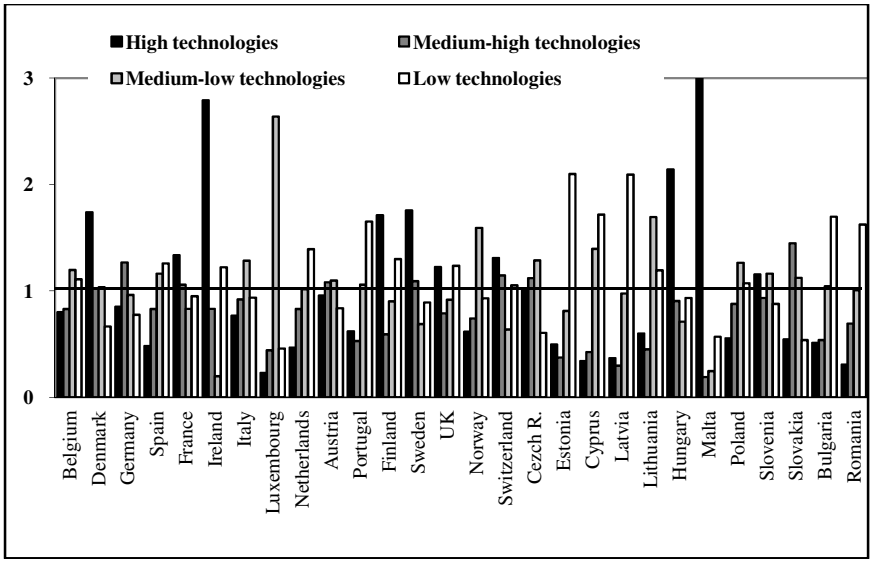
[1] *Central and Eastern European Countries (CEE):* Czech R., Cyprus, Estonia, Latvia, Lithuania, Greece, Hungary, Poland, Slovenia, Slovakia, Bulgaria, Romania, Turkey and Malta. *Western European Countries (WE):* Belgium, Denmark, Germany, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom, Norway, Switzerland, Iceland.

[2] Computation based on relations (1) and (2) in Annex.



Source: Own computation, based on Eurostat (http://epp.eurostat.cec.eu.int).

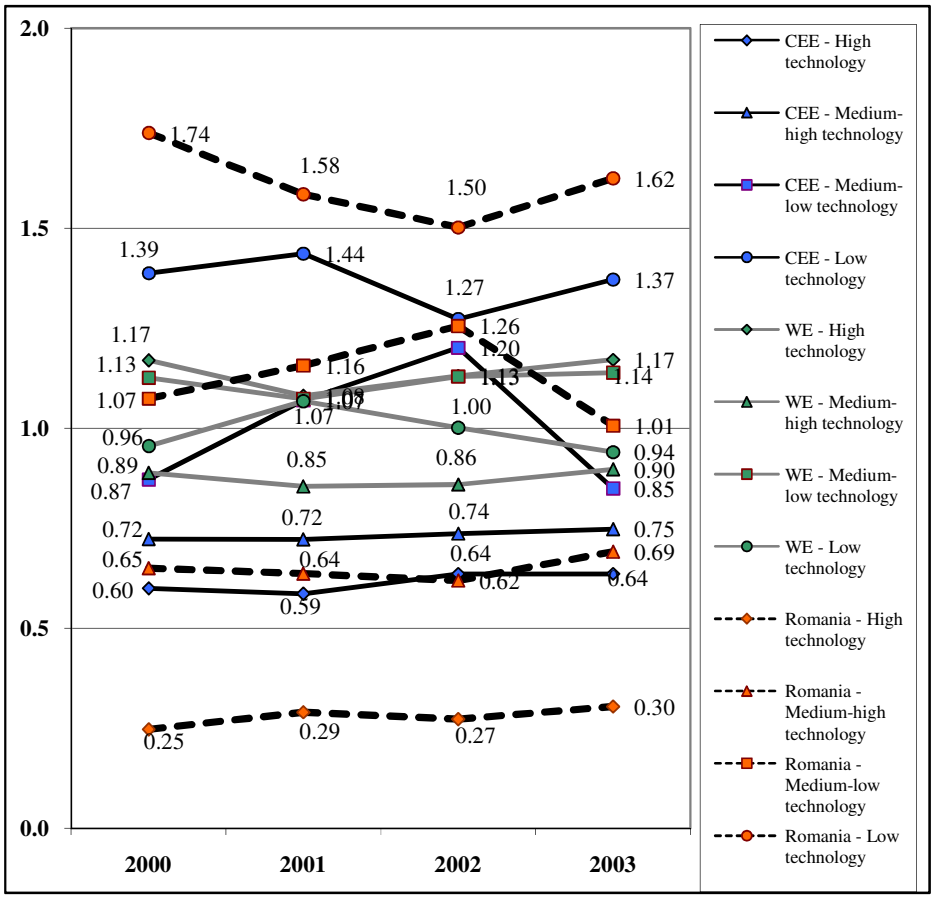
Figure 1. Production structure in processing industry by technological groups of activities, 2003.



Source: Own computation, based on Eurostat (http:epp.eurostat.cec.eu.int).

Figure 2. Relative specialisation index of production in processing industry by technological groups of activities, 2003.

As regards the relative specialisation dynamics in production, Figure 3. presents the evolution of the simple arithmetic mean of the indicator in the four groups of industries and two groups of countries.



Source: Own computation, based on Eurostat.

Figure 3. Evolution of the relative specialisation index of production in processing industry, by groups of activities, in WE countries, CEE countries and Romania, 2000-2003.

As for the CEE countries (black line), the chart shows that the higher the specialisation is, the lower the technological intensivity of the group of industries is. One should also note the considerable difference between the groups, which means a non-uniform structure of the countries' production. Specialisation in high technologies is lower in value than that of the WE countries (grey line) and evolves almost constantly, with a slightly upward trend, which suggests a persisting gap in production between the East and the West.

If compared to the average of the CEE countries, Romania's situation (dotted line) is unfavourable. The production specialisation in high and medium-high technologies is below CEE average, and the specialisation in medium-low and low technologies is above that average. As for high technologies, the gap between Romania and the other CEE countries is very wide and tends to maintain if its evolution is consistent with the previous trend. One may say that Romania's production is obviously specialized in low-technology goods.

2.2. Territorial concentration of production

The removal of trade barriers caused by the creation of the Single and by various European trade agreements concluded between the East and the West increased the mobility of goods and production factors towards areas of maximum profitability. Consequently, territorial concentration of various categories of economic activities was expected to occur. To check it, we computed the index of territorial concentration of the manufacturing production in 28 European countries, by technological groups, during the period 2000-2003[3].

On the average, the absolute concentration index takes on much higher values than the relative one. This also happens because the analysed countries have very different shares in total production. For example, in 2003 Estonia, Latvia and Lithuania each had a contribution of 0.1%, Bulgaria 2%, while Germany reached 27% and France, 18.7%. We may say that there is a growing trend of absolute concentration, as a whole, since the trends of the groups are almost parallel, which means that their average - corresponding to the processing industry as a whole - follows the same trajectory. What differs is the value of this group indicator, higher in case of high and medium-high technologies; this difference is maintained over the period considered, which proves that the concentration degree in certain European areas (See Figures 1, 2 and 3 for the specialisation index) is higher.

The relative concentration index did not vary too much during the period 2000-2003 and took on much lower values. This fact, associated with the growing trend of absolute concentration, reveals that production is asymmetrical both as a whole and by groups of branches. The relative index is lower since the concentration of the groups of industries is almost similar in level to the concentration within all industry.

One may notice only the high technologies, with higher relative values, but a lowering trend. On the contrary, the relative index of low technology industries takes on low values, but the trend is slightly growing. Between the two groups, we find the evolution of the two categories of medium technology activities, with a degree of relative concentration almost constant in time.

[3] The methodology is shown in Annex: relations (3) and (4).

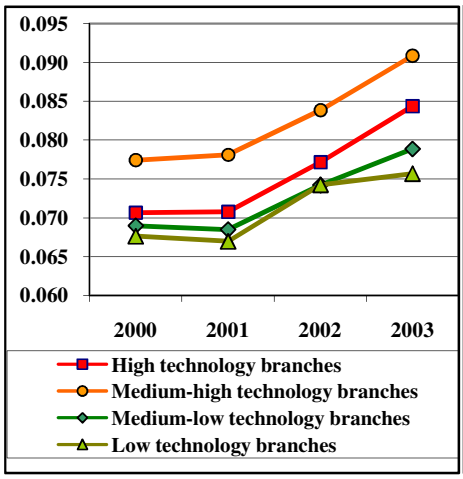


Fig. 4. Index of absolute territorial concentration of production in the European countries, by technological groups, 2000-2003.

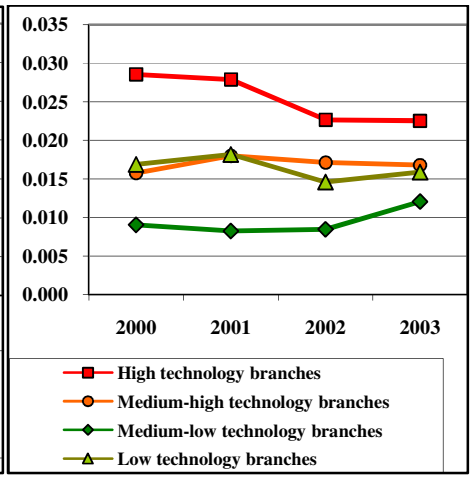


Fig. 5. Index of relative territorial concentration of production in the European countries, by technological groups, 2000-2003.

Source: Own computation, based on Eurostat.

As a whole, we estimate a growing trend of the divergent shares of the analysed European countries in the total production of the processing industry. This means that the share of developed countries continues to increase in all industry, while less developed countries produce less and less than the others. On the other hand, Figure 5 shows converging trends of the production structures of the European countries, during the considered period.

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The classification of industrial branches by technological intensity is not always conclusive. In practice, industries are not high-technology or low-technology one hundred per cent. Each of them makes not only technology-intensive products, but also labour-intensive or natural resource-intensive goods. Of course, the proportion of the two categories of products varies significantly from one industry to another, and that is why the OECD classification (2005) was required. However, during the last decades, technological progress has influenced all branches. Therefore, due to vertical and horizontal differentiation between products, the technological specialisation is essentially done by category of products within the same economic activity, not only by industry as a whole. Also, the specialisation by production stages is very important since the value added differs significantly as regards various segments of the value chain (basic intermediate products, semifabs, machinery and equipment, etc.). Classifications of this type are not

available for production, but only for trade. This is the reason why we are going to further analyse the technological specialisation of export and import.

3. Trade structure and specialisation by groups of products

3.1. Specialisation by groups of products and by technological intensity

During the reform the trade model of the CEE countries has undergone several changes. The strongest tendency has been the intensification of trade with the OECD member countries, especially with the EU, while the interregional trade of former COMECOM member countries has diminished dramatically. Similarly, the strong geographical re-orientation of trade has brought about significant changes in trade structure. Trade specialisation significantly depends on the economic and social level from which the CEE countries started the restructuring process as well as on many other factors such as the level of development of the market economy, entrepreneurship and trade openness. Also, foreign direct investments play an essential role in determining the model of trade of the CEE countries.

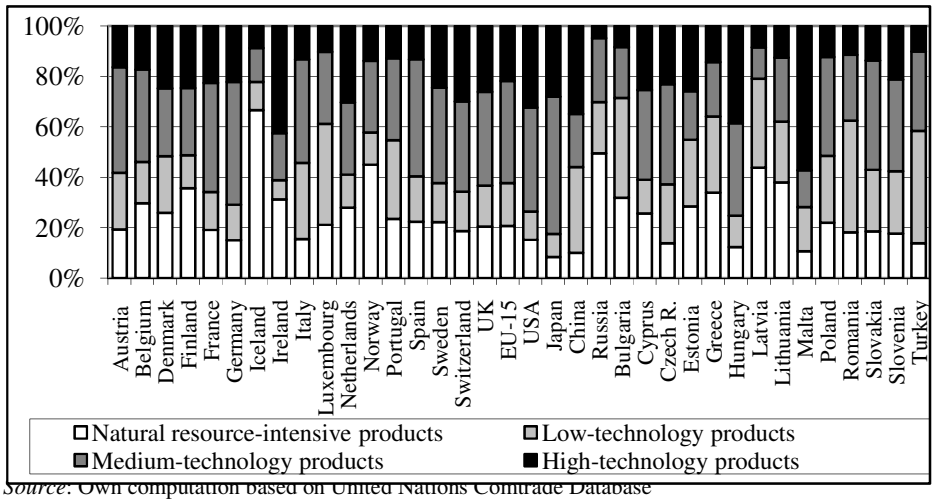
Further we present the evolution of the share of various types of products in exports and imports, especially those of the CEE countries, in the last 10-15 years. We are going to analyse the trade structure and classify the traded goods both by technology intensity and by qualitative levels and production stages (elements of the value chain) in order to determine the trend of convergence/divergence of specialisation of European countries.

Although most foreign exchanges of the Eastern countries are made with Europe (as for Romania, about 85%), we think it is quite useful to include in our analyses the USA, Japan and China, besides the European countries.

In the beginning, we analyse export structure and specialisation[4] by four technological groups of products, using the UNIDO classification (2005): natural resource-intensive products; low-technology products; medium technology products; high technology products (Figures 6 and 7).

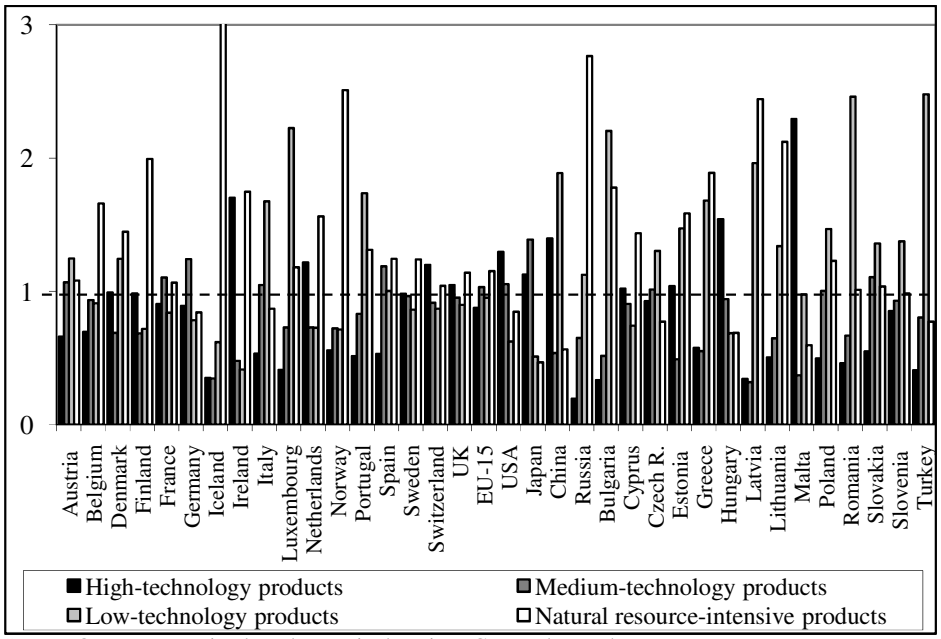
First, we analyse the structure and specialisation of export by four technological groups of products, in accordance with the UNIDO classification (2005): natural resource-intensive products, low-technology products, medium-technology products, high-technology products. Figures 8 and 9 show export structure and relative specialisation for European countries, the USA and Japan.

[4] According to relations (5) and (6) in Annex.



Source: Own computation based on United Nations Comtrade Database (http://unstats.un.org/unsd/comtrade).

Figure 6. Export structure by technological groups of products, 2004.



Source: Own computation based on United Nations Comtrade Database (http://unstats.un.org/unsd/comtrade).

Figure 7. Index of relative specialisation of export by technological groups of products, 2004.

One may notice the asymmetrical structure and specialisation of export, by groups of products. In general, symmetry increases with the country's size and development level. This happens because large countries have diversified resources and can produce a wide range of products, and developed countries, achieving high performance in the RDI sector, are specialized in high quality products, in all industrial branches, as we shall see in the next sections. On the one hand, countries like Germany, France, Sweden, the United Kingdom and Switzerland (a country with a small territory, but a high development level) have close specialisation indices of the groups of products. On the other hand, there are small or less developed countries, like Iceland, Luxembourg, Portugal, Latvia, Lithuania, Estonia, Malta, Romania and Turkey, with considerable differences between groups.

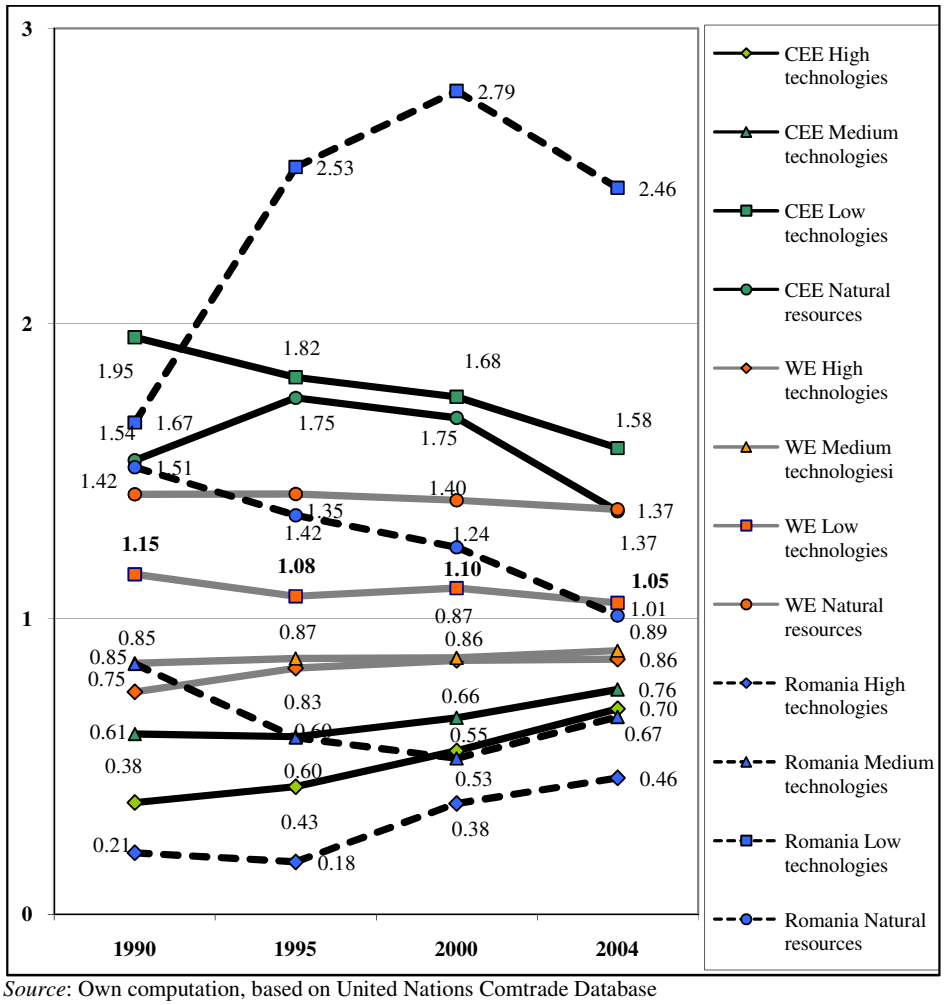
A special group is that of the Northern countries (Finland, Norway, Iceland, Latvia and Lithuania), which export large quantities of natural resource-intensive products, if compared to other categories of products. Leaving these countries and Malta aside, we consider that WE countries have a relatively balanced specialisation by groups of products, while CEE countries are essentially specialized in exporting low-technology products and natural resources. Romania has an obvious relative specialisation in low technology exports, with an index of 2.46, while for high and medium technologies the indices are 0.67 and 0.46. (Figure 8).

To follow the evolution of the difference in comparative advantage between the two groups of countries (WE and CEE), we produced the simple arithmetic means of relative specialisation for 1990, 1995, 2000 and 2004.

While the trends corresponding to the WE countries (grey line) have very slight stopes, the CEE countries' evolution (black line) is positive: diminution in comparative advantage for natural resources and low technologies, along with increase in the same index for high and medium technologies. Although the convergence of Eastern Europe and Western Europe was achieved in 2004 only for the specialisation in natural resources exports, it could be also achieved for high and medium technologies in the next 5-10 years, if the trend of the last 15 years is maintained. Only the specialisation in low technologies is characterized by considerable differences.

As in the case of production specialisation, Romania (dotted line) is characterized by indices of export specialisation below the CEE countries' average, for high and medium technologies, and above average for low technologies. Only the natural resources exports are slightly smaller than those of the other countries of the same group. As a whole, Romania's export is definitely specialized in low-technology products and less in natural resources.

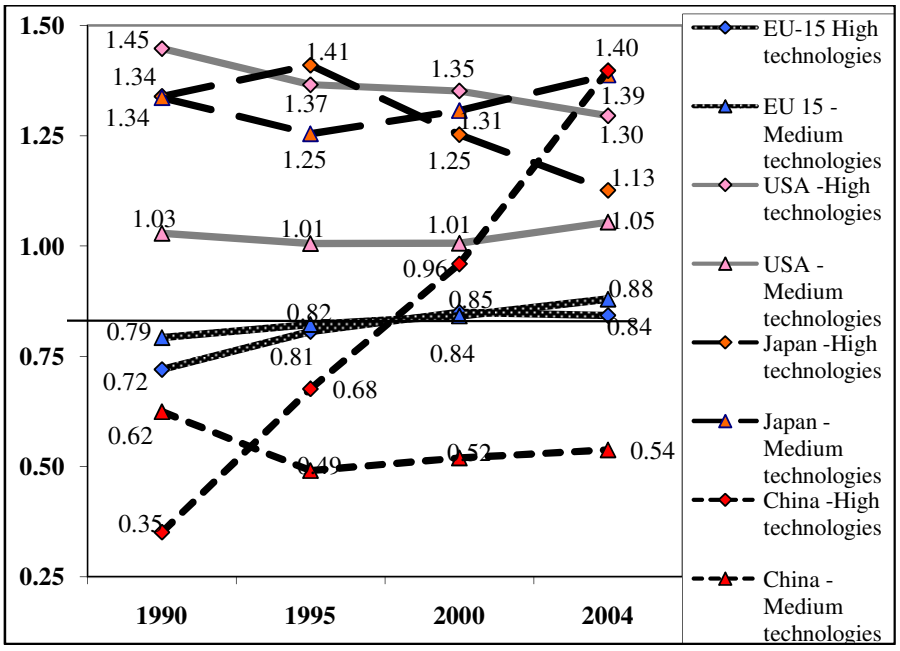
Figure 9 shows the export performance of EU-15 in comparison with the USA, Japan and China, only for medium and high technologies, for simplification reasons.



Source: Own computation, based on United Nations Comtrade Database (http://unstats.un.org/unsd/comtrade).

Figure 8. Evolution of the index of relative specialisation of exports, by technological groups of products, for WE, CEE countries and Romania, 1990-2004.

If compared to the USA (continuous line) and Japan (dashed line), the position of EU-15 concerning the export specialisation in medium and high technologies is clearly lower. As regards dynamics, the EU-15 evolution is slightly decreasing, while the trend of the two countries is oscillating, but increasing for medium technologies and diminishing for high technologies. While no changes are expected for EU-15, the USA and Japan, China's evolution (dotted line) is quite surprising. The index of export specialisation in high technology products increased four times during the considered period, exceeding even Japan's index, in 2004.



Source: Own computation, based on United Nations Comtrade Database (http://unstats.un.org/unsd/comtrade).

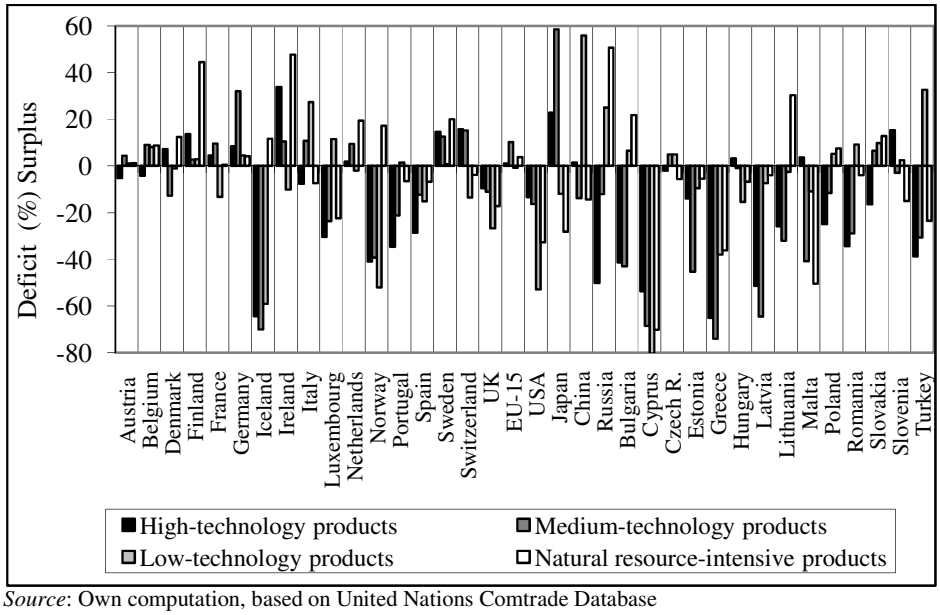
Figure 9. Evolution of the index of relative export specialisation in medium and high-technology products, for EU-15, the USA, Japan and China, 1990-2004.

By comparing export and import, we can determine the trade balance by groups of products. To diminish the great differences between countries in absolute values, we computed the share of the balance in total trade (Figure 10). As expected, CEE countries are confronted with major trade deficits in all categories of products, but especially in high and medium-technology products. Also, some WE countries (Iceland, Luxembourg, Norway, Portugal and Spain) are confronted with considerable deficits, but, generally, EU-15 countries have a more favourable balance.

Romania's balance is only positive for low technologies. The balance of trade in high and medium-high technologies is negative and at the level of the CEE countries' mean.

It is worth mentioning that a high deficit in high and medium technology products is not always disadvantageous. The same trade deficit, in absolute value, might require higher of lower simultaneous volumes of export and import. The import of such products is one of the main channels of technological transfer and contributes to the increase in the national stock of knowledge, especially for

countries with lower technological performance. Only if the deficit share in total trade is high, one may say that the situation of that country is unfavourable.



Source: Own computation, based on United Nations Comtrade Database (http://unstats.un.org/unsd/comtrade).

Figure 10. Share of trade balance (export-import) in all trade, by technological groups of products, 2004.

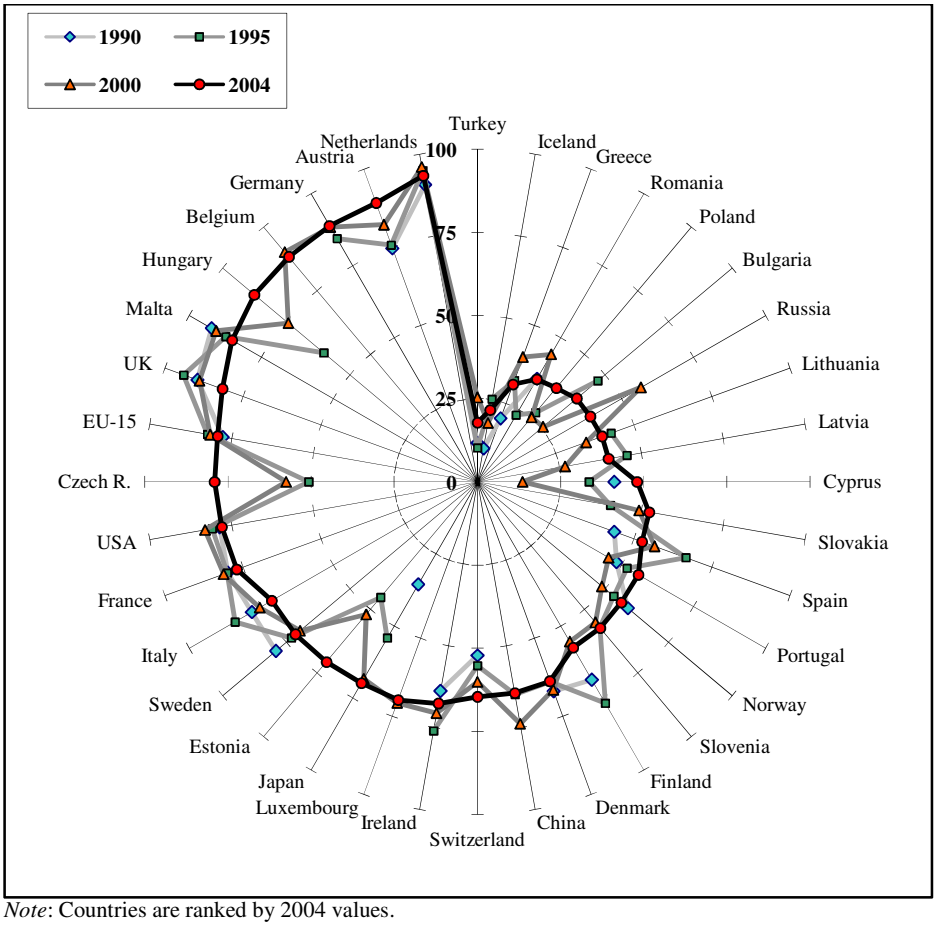
3.2. Intra-Industry Trade (IIT). Vertical specialisation

The vertical and horizontal goods differentiation brings on the simultaneous export and import of the same categories of goods (IIT), either with different quality levels (vertical differentiation) or with different characteristics (horizontal differentiation).

The higher a country's IIT is, the more specialized that country is in exporting certain qualities/varieties of products and in importing from another one. For example, the countries with a high stock of knowledge are supposed to specialize in exporting high quality products, and take advantage of high export prices. At the some time, they import lower quality and cheaper products to the extent the diversity of internal incomes require it.

Further, we intend to compute IIT level of the European countries[5], and then we estimate the difference in quality of goods[6] exported by these countries.

The figure below shows the evolution of the share of IIT in high-technology products, since we assume that the differentiation in products is the highest for this group. The countries are ranked by 2004 values.



Note: Countries are ranked by 2004 values.
Source: Own computation, based on United Nations Comtrade Database (http://unstats.un.org/unsd/comtrade).

Figure 11. Share of IIT in high-technology products in total processed goods trade, 1990-2004.

[5] See relation (7) in Annex.
[6] See relations (10)-(12) in Annex.

Similarly to the specialisation by technological groups of products, the higher the share of IIT is, the higher the development level and size (to a lesser extent) of the country are. Therefore, most of the CEE countries have a low share of this type of trade. Hungary, Malta, the Czech Republic and Estonia are excepted, since their growth was substantial in 2000 and 2004, as against the previous years. As for Romania, the IIT share is oscillating; the average is about 30% of all trade.

The IIT share does not tell us anything about the *quality of products* in which every country tends to specialize. To determine it, one has to compute the unit value of the exported goods, since the price is a measure of quality, maybe the only one that can be statistically quantified[7].

Since we did not have complete data on the quantities exported by the countries under analysis, we took unit values of export from a UNCTAD/WTD database[8]. Figures 16 and 17 show the above values, corresponding to the main branches of the processing industry, for CEE countries, WE countries, EU-15, USA, China and Japan.

We present again the composition of the two groups of European countries, used for computing the mean: (i) Central and Eastern European Countries (CEE): Czech R., Cyprus, Estonia, Latvia, Lithuania, Greece, Hungary, Poland, Slovenia, Slovakia, Bulgaria, Romania and Turkey (we excluded Malta, because of accidental values, which might distort the mean of the group); (ii) Western European countries (WE): Belgium, Denmark, Germany, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom, Norway and Switzerland (Iceland was excluded for the same reason as Malta).

As for the world average, both WE countries and CEE countries export medium and high quality products (R_{cj}>0.85). If the average had been computed for the countries considered, differences would have been more significant. Still, in Figure 12 we see that WE countries export most of the categories of processed products at higher prices. The CEE countries are ranked higher only with respect to clothing and IT and electronic products.

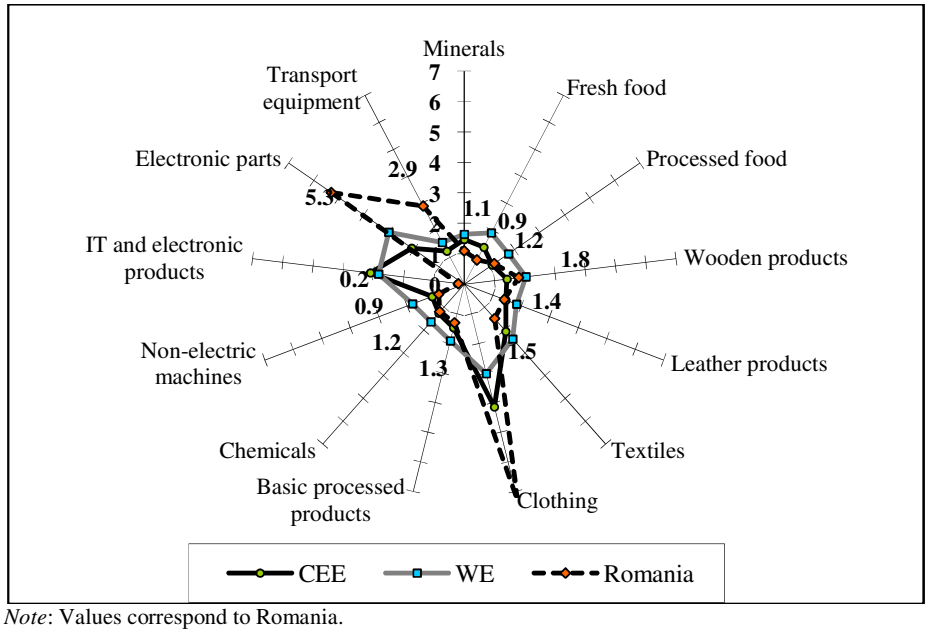
As for clothing, as well as other branches on the right side of Figure 16 (textiles, leather products, etc.), the production processes use intensively labour and natural resources. The low cost of the above factors, specific to CEE countries, brings on higher attractiveness of these areas to foreign investors, who locate here their production units and export their (high quality) products to West-European countries, at higher prices. This has a positive impact on employment, but not on labour qualification.

[7] The calculation procedure is shown in Annex.

[8] International Trade Centre, UNCTAD/WTO (http://www.intracen.org).

As for IT and electronic products, the higher unit value is due to the fact that such goods are final products, assembled in CEE countries (Hungary, Latvia, Estonia, Cyprus, etc.) for reasons of low labour cost, as in the previous case. The component and subassemblies are usually made in WE countries, as we shall see in the next section, dealing with the specialisation by production stages. In this case, the amounts obtained from sales are transferred to the countries of origin of the companies. Only as long as both the components and the final products are made at home (a rare case) one may speak about qualitative superiority. The same is valid for non-electric machines and transport equipment.

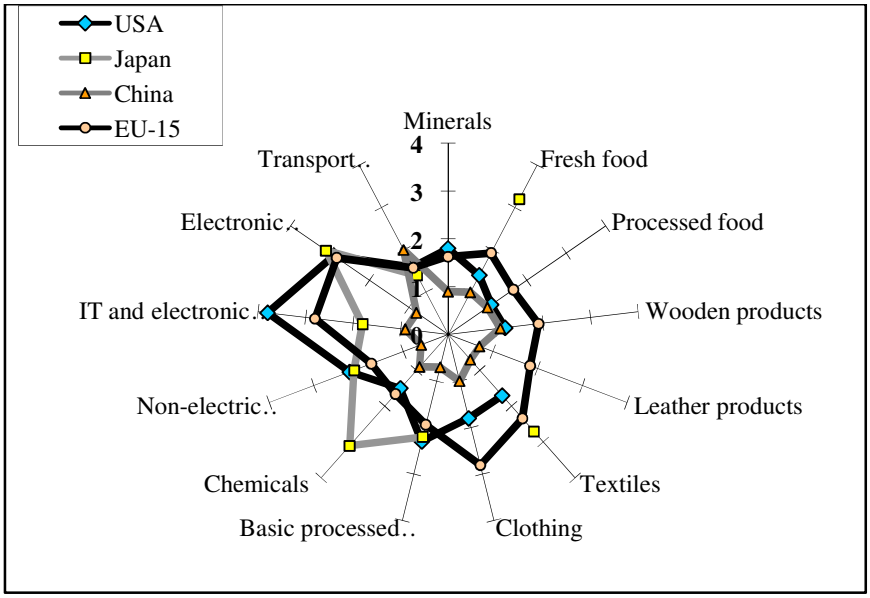
Romania offers very asymmetrical unit values of export by categories of products. For 8 out of 13 groups of products, the unit value of Romania's export is slightly below the CEE countries' average. The remaining five groups, the unit value of which is higher than the CEE average, include transport equipment, articles of clothing and electronic components. The reason could be outward processing for clothing, or assembling of final products for transport equipment. Only in the case of electronic components the higher price of export could be a real gain to national economy.



Note: Values correspond to Romania.
Source: Data from International Trade Centre UNCTAD/WTO (http://www.intracen.org).

Figure 12. Unit value of export (world average = 1) of CEE countries, WE countries and Romania, 2003.

Figure 17 shows a higher quality of EU-15 export, as against the main competitors, for low-technology, labour and natural resource-intensive products. As for the industries of the USA and Japan, the unit values and product quality are higher. As expected, the lowest quality of exports occurs in China, the values of which are clearly below those of the other countries, except for transport equipment.



Source: Data from International Trade Centre UNCTAD/WTO (http://www.intracen.org).

Figure 13. Unit value of export (world average= 1) of EU-15, USA, Japan and China, 2003.

3.3. Specialisation by production stages

Owing to some advantages offered by certain regions/countries (low cost of labour, availability of certain raw materials or of human capital, etc.), companies are more and more tempted to locate some production stages in a certain country, other than that in which its headquarters is located. Intermediary products (spare parts, components, etc.) can be exported to the country of origin of the company, where the production cycle goes on until the final product is obtained, or to other country in which the company located the next production stage. Final products can be sold locally or exported to other countries, including the country of origin (see Box 1, below).

Fragmentation and international location of production generated another type of trade specialisation: by production stages. Taking into account their

advantages, countries "host" various production stages. They specialize either in making basic, less processed products or in producing subassemblies, spare parts and capital goods or only in assembling components of the final product.

Each of the categories of products requires certain factors of production. Usually, basic products are natural resource-intensive and, for this reason, they will be made in regions having such resources. Spare parts, subassemblies and capital goods require high qualification of employees (human capital) and advanced production technologies which, in turn, need specialized firms for maintenance, etc.; that is why the level of knowledge stock is the main criterion for selecting the location of the production line. In case of simple assemblage of final products, it is necessary to provide cheap labour, as well as an enlarged market (both the domestic market and the neighbouring markets).

Considering the above-mentioned criteria, WE developed countries are expected to specialize in exporting categories of physical and human capital-intensive products, while CEE countries will essentially make intermediary and final products (Figures 20-22). The implications of specialisation are connected with the varied prices of the above-mentioned categories of products as well as with the spillovers of various activities (their contribution to the national stock of knowledge, etc.).

To determine specialisation by production stages, we used the trade classification by Large Economic Categories (LEC), which we restructured according to the product processing level. This resulted in five categories of products: consumer goods, intermediary basic products, intermediary processed products, components and accessories, and capital goods.

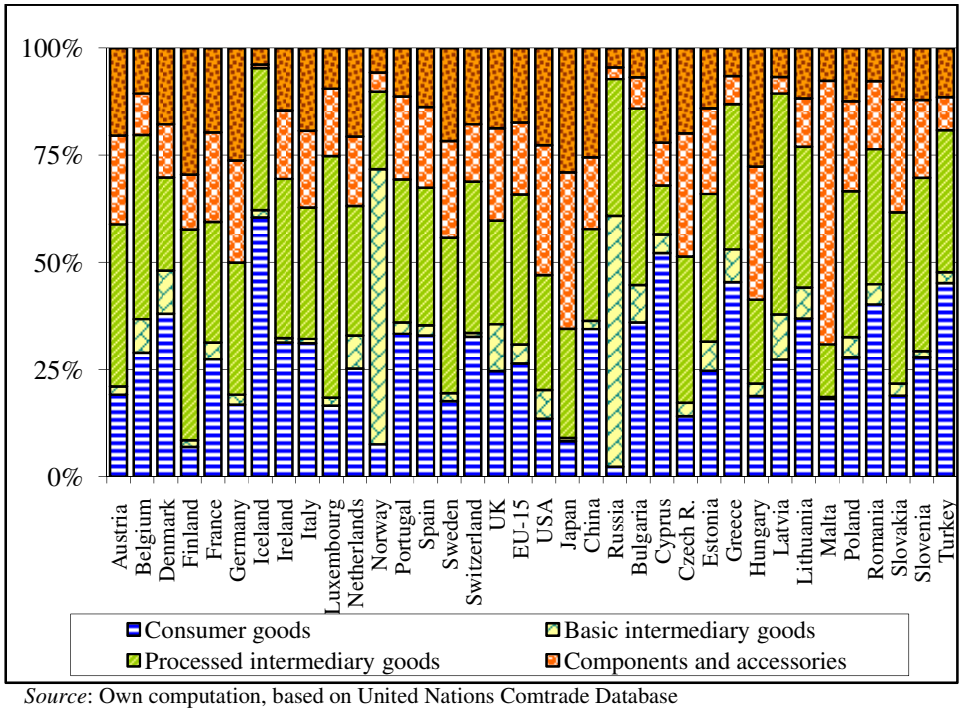
Box 1: Categories of products by processing level

Consumer goods are for selling to final consumers. They do not undergo further changes during the production process or assemblage. Therefore, the importing country does not add value to this type of product. That is why the import of final products contributes the least to the domestic product (only by distribution activities).

Intermediary goods (basic, processed, components and accessories) require further processing in the importing country before selling to final consumers. Therefore, these products accumulate further value added. By processing level, they may be divided into basic and processed intermediary goods, and components and accessories. Usually, the latter include most of the knowledge, while further activity of assemblage requires only medium-skilled employees. Moreover, trading this type of products represents an important channel for technology transfer.

Capital goods are provided for immediate utilisation and essentially used by firms, as production inputs in order to make other goods: intermediary or final. Importation of such goods is vital for technology transfer and, consequently, for maintaining the external competitiveness of domestic producers. Importation of capital goods requires additional costs of know-how, technical assistance, etc.

According to the above classification, we present, in Figures 14-17, the export structure, trade balance and evolution of the specialisation index. The Comparison of the WE countries with the CEE countries in Figure 14 shows that the former have a more symmetrical structure of export. Except for Iceland and Norway, capital good prevail, beside components and accessories, and processed intermediary products, that is goods including the largest quantity of knowledge and value added and, consequently, benefiting by higher prices. They are followed by processed intermediary goods and consumer goods.



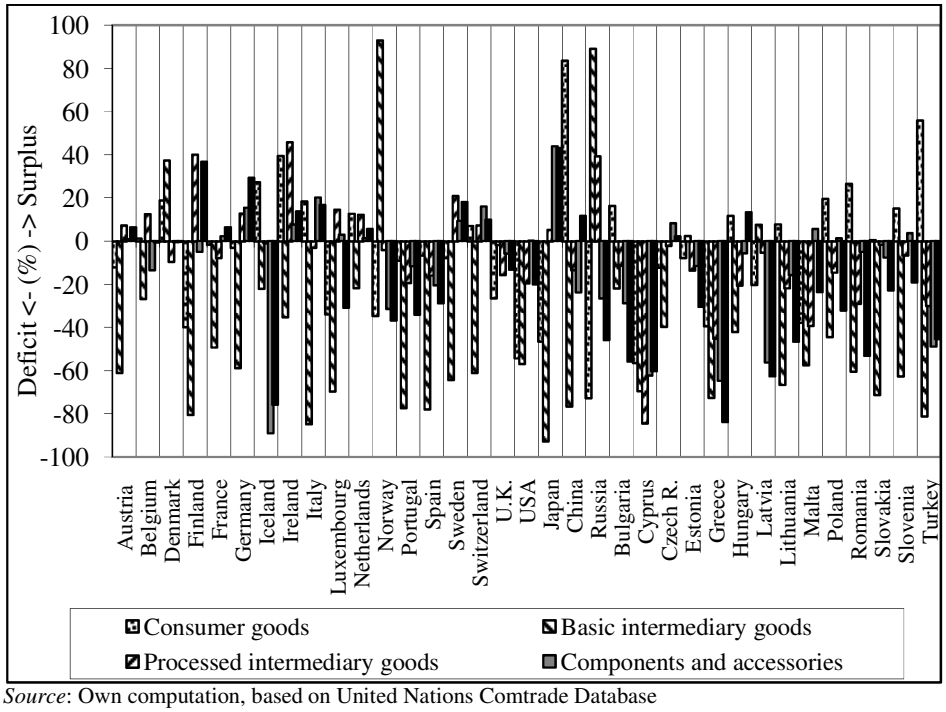
Source: Own computation, based on United Nations Comtrade Database (http://unstats.un.org/unsd/comtrade).

Figure 14. Export structure by groups of products and by processing level, 2004.

CEE countries have a very differentiated structure of export. In Malta, Hungary and Cyprus, capital goods and components and accessories prevail, having a share even higher than that of the WE countries; in the opposite position we find Bulgaria, Greece, Latvia, Lithuania, Turkey and Romania, with a very low share. One may notice that while the share of the above-mentioned products is decreasing, the share of consumer goods is increasing, which means that those countries confine themselves to assembling essential components from other countries. As for Romania, the highest share is held by consumer goods (39.8%),

followed by processed intermediary goods (32%), components and accessories (15.7%), capital goods (7.6%) and basic intermediary goods (4.6%).

We notice in Figure 15 that CEE countries' balance is negative for most types of goods; the lowest values are attached to capital goods, and components and accessories.



Source: Own computation, based on United Nations Comtrade Database (http://unstats.un.org/unsd/comtrade).

Figure 15. Share of trade balance (export-import) in total trade, by groups of products and by processing level, 2004.

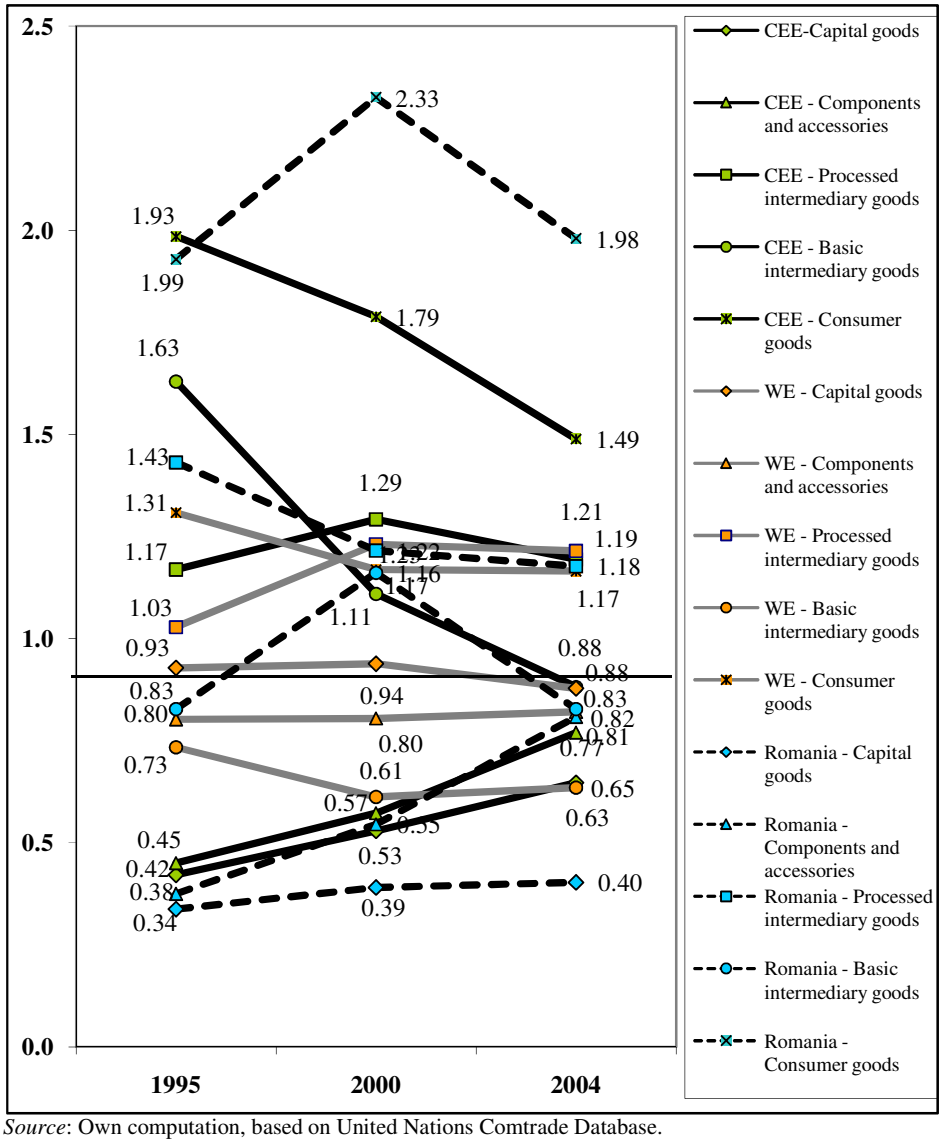
Final products take on positive values, while capital goods (Hungary and Czech R.) and components and accessories (Czech R., Malta and Slovenia) take on, not very often, lower values. Turkey's and Romania's trade balances are the most favourable for final products.

On the contrary, many WE countries (Finland, France, Germany, Ireland, Italy, Netherlands, Sweden, Switzerland) have a positive trade balance of capital goods and components or of processed intermediary goods (Belgium, Finland, Ireland, Sweden, etc.).

One may notice that developed WE countries tend to specialize in exporting categories of physical and human capital-intensive products (capital goods,

components, accessories), while CEE countries essentially produce basic intermediary goods and final products.

The figure below presents the evolution of the specialisation index by groups of countries.



Source: Own computation, based on United Nations Comtrade Database.

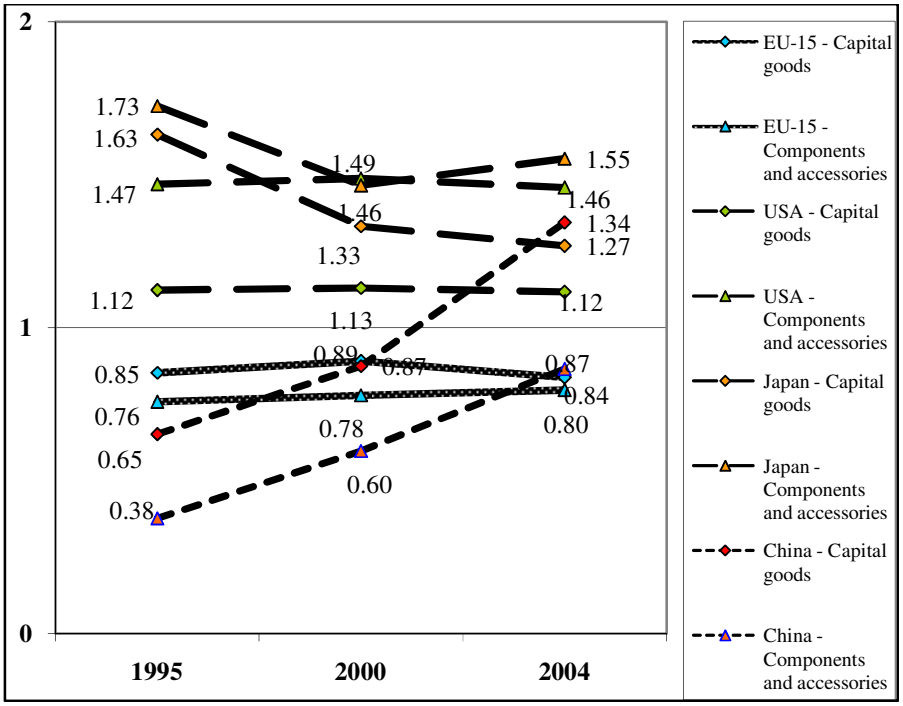
Figure 16. Evolution of the index of relative specialisation of export, by production stages, in WE countries, CEE countries and Romania, 1995-2004.

The figure shows that tendency in the CEE countries is to reduce the level of specialisation (very high) in consumer goods and basic intermediary goods, along with increasing specialisation in capital goods, and components and accessories, which is lower than that of the WE countries.

Since the latter evolved constantly during the considered period, we anticipate a tendency towards the convergence of Eastern and Western Europe on the specialisation by production stages.

Romania's export undergoes a very high specialisation in final products and a lower one in capital goods, as against the CEE countries' average. As for the other types of products, there is a tendency towards the convergence with the CEE group.

The index of relative specialisation in capital goods, and components and accessories is below unit for both categories of goods. This happens because we included in our computation the USA and Japan, countries with a remarkable performance in this area (Figure 23). Even EU-15, consisting of the most developed countries of Europe, has indices below those of the two countries, and differences seem to continue if the trend goes on. Only China's evolution was positive, especially in respect to capital goods, with a specialisation index higher than that of the USA and Japan in 2004, as shown in the figure below.



Source: Own computation, based on United Nations Comtrade Database.

Figure 17. Evolution of the relative specialisation of export by production stages, in EU-15, USA, Japan and China, 1995-2004.

4. Conclusions

The computations reveal major differences in production and export specialisation between the leading European countries, divided into two groups: CEE countries, including Romania, and WE countries. The latter countries that invest in research and achieve a high innovation level specialize in technology-intensive activities, which benefit the entire economy. As for product differentiation (irrespective of industry), countries produce and export goods of higher quality, which include important expenses on RDI and human capital, taking advantage of the high prices of exports. Finally, in accordance with the classification by production stages, specialisation occurs in the case of goods with the highest value added, which also include expenses on RDI (components, accessories and capital goods).

Unlike these countries, the technological performance of the CEE countries is low. Therefore, they produce and export cheap labour and natural resource-intensive goods. Among the CEE countries, Romania's performance is lower than the group average. Both the structure and the relative specialisation of production and export indicate that there is a trend of specialisation in low-technology products, stronger than in other CEE countries.

The analysis of production dynamics reveals a rising trend regarding the difference in the share of the European countries in the total production of the processing industry. It means that the share of the developed countries continues to grow in all industries, while the less developed countries in the East produce less than the other ones. One the other hand, at the level of technological groups of industries there is a converging trend of production structures of the European countries in the period considered.

As for export, the WE trends follow slow slopes, while the CEE countries' evolution is positive: diminution in the comparative advantage for natural resources and low technologies, along with an increasing index for high and medium technologies. Although the convergence of Eastern Europe and Western Europe in 2004 was achieved only for specialisation in natural resources, if the trend in the last 15 years is maintained, convergence is to be also achieved for export of high and medium technologies in the next 5-10 years. Only the specialisation in low technologies shows considerable differences.

As a whole, the analyses do not indicate a tendency towards widening the gap between Eastern and Western Europe in accordance with the principle of vicious/virtuous circles, caused by specialisation, as the theory of economic gap suggests. During the considered period of 10-15 years, the tendency is to maintain or even slightly reduce differences between CEE countries and WE countries in specialisation.

ANNEX

Methodological notes

1. *The relative specialisation structure and degree* of production by groups of branches of the processing industry, by technological intensity are computed as shown below.

The share of each industry in all processing industry reveals the structure or *absolute specialisation* (S_{ci}^{A}):

$$S_{ci}^{A} = P_{ci} / \sum_{i} P_{ci} \in (0,1) \tag{1}$$

We denoted by i=groups of industries, by C=countries, and by P=production value.

The relative specialisation degree (S_{ci}^{R}) was computed by means of the Balassa index (1965), for comparing the share of the production of a certain industrial branch in the total amount of the analysed countries with the share of total production of a country. The index is above unit in case of relative specialisation of an economy in the production of an industry i, and below unit in a contrary case:

$$S_{ci}^{R} = \frac{P_{ci} / \sum_{c} P_{ci}}{\sum_{i} P_{ci} / \sum_{i} \sum_{c} P_{ci}} \in (0, \infty) \ , \tag{2}$$

denotations being identical to those in the previous relation.

2. *The territorial concentration of production* is computed as follows:

Absolute concentration index: $C_{i}^{A} = \sqrt{1/n \sum_{c} \left(P_{ic} / \sum_{c} P_{ic} \right)^{2}}$ (3)

Relative concentration index: $C_{i}^{R} = \sqrt{1/n \sum_{c} \left(P_{ic} / \sum_{c} P_{ic} - \sum_{i} P_{ic} / \sum_{i} \sum_{c} P_{ic} \right)^{2}}$ (4)

We denoted by i = industry/technological group of industries, c = country, n = number of countries considered, P = analysed variable (value of production, in this case).

In Figures 4 and 5 we present the values of the indicators during the period 2000-2003 for all European countries. The values and evolutions of the two indices are very different.

3. *The relative specialisation of each country* – which reveals the comparative advantage in trade – will be computed in relation to the average of all above-mentioned countries, and not only European countries, as in the case of production.

The formulae are the same:

Absolute specialisation:

$$S_{ci}^{A} = X_{ci} / \sum_{i} X_{ci} \in (0,1) ; \tag{5}$$

Relative specialisation (comparative advantage):

$$S_{ci}^{R} = \frac{X_{ci} / \sum_{c} X_{ci}}{\sum_{i} X_{ci} / \sum_{i} \sum_{c} X_{ci}} \in (0, \infty) \tag{6}$$

We denoted by i = groups of products, c = countries, and x = export value.

4. *Intra-industry trade (IIT)*

IIT is closely connected with the term "industry". Unfortunately, there is no single criterion for defining the concept, since there are some differences in the degree or type of homogeneity of products that form an industry. In the Heckscher-Ohlin model, "industry" represents the set of firms producing perfectly homogeneous products. But goods have a multitude of characteristics, which lead, in practice, to the non-existence of two perfectly interchangeable products in relation to all these characteristics. Statisticians recommend Standard Classification of International Trade at three-digit aggregation level (SCIT3) for optimum computation of IIT. The classification criterion is just the interchangeability of goods in consumption and in the required amount of production factors.

Taking the statisticians' advice, we determine the percent share of IIT, using SCIT3 and Grubel-Lloyd index (1975):

$$GL_{ci} = \frac{\left(X_{ci} + M_{ci}\right) - \left|X_{ci} - M_{ci}\right|}{\left(X_{ci} + M_{ci}\right)} * 100, \quad GLci \in [0,100]. \tag{7}$$

Xi and *Mi* represent the export and import of product *I*, of country *c*. Index *GL* takes on value zero, if *xi = 0* or *Mi = 0* and value 100, if *Xi = Mi>0*. The aggregation at the level of group *j* of products (with $i \varepsilon j$) or on the national level is done as follows:

$$GL_j = \sum_{i \in j} w_i * GL_i \,, \tag{8}$$

where *wi* represents the share of trade value of product *i* in total value of trade of group *j* (or in total trade of country *c*):

$$w_i = (X_{ci} + M_{ci}) / \sum_{i \in j} (X_{ci} + M_{ci}) \tag{9}$$

5. *Unit value of export*

The methodological steps for determining the qualitative level of exported goods are the following:

Unit value (price) is computed by dividing the value of the exports of a certain product (at the maximum desaggregation level), of a certain country, in a certain period of time, by exported quantity:

$$U_{ci} = V_{ci}/C_{ci} \tag{10}$$

where:

V = export value;

C = exported quantity;

i = product;

c = country.

Then, we determine the ratio of the unit value of export of each country to the average unit value of the countries under analysis:

$$R_{ci} = R_{ci} = U_{ci} / \overline{U}i \tag{11}$$

with $\overline{U_i} = \sum_c U_{ci} / n$, and n = number of countries considered.

This ratio may be aggregated for one group *j* of products or for all export, weighting it by the export value of each product pertaining to the export of group *j* or to the total export of the country:

$$R_{cj} = R_{cj} = \sum_{i \in j} v_i * R_{ci} \,, \tag{12}$$

where: vi = $v_i = X_{ci} / \sum_{i \in j} X_{ci}$

Ratio R_{cj} reflects the quality of exported products. By means of R_{cj} we can classify export into three qualitative categories, as follows:

- *high quality, if* R_{cj}*>1.15*;
- *medium quality,* if $0.85<R_{cj}<1.15$;
- *low quality,* if $R_{cj}<0.85$.

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