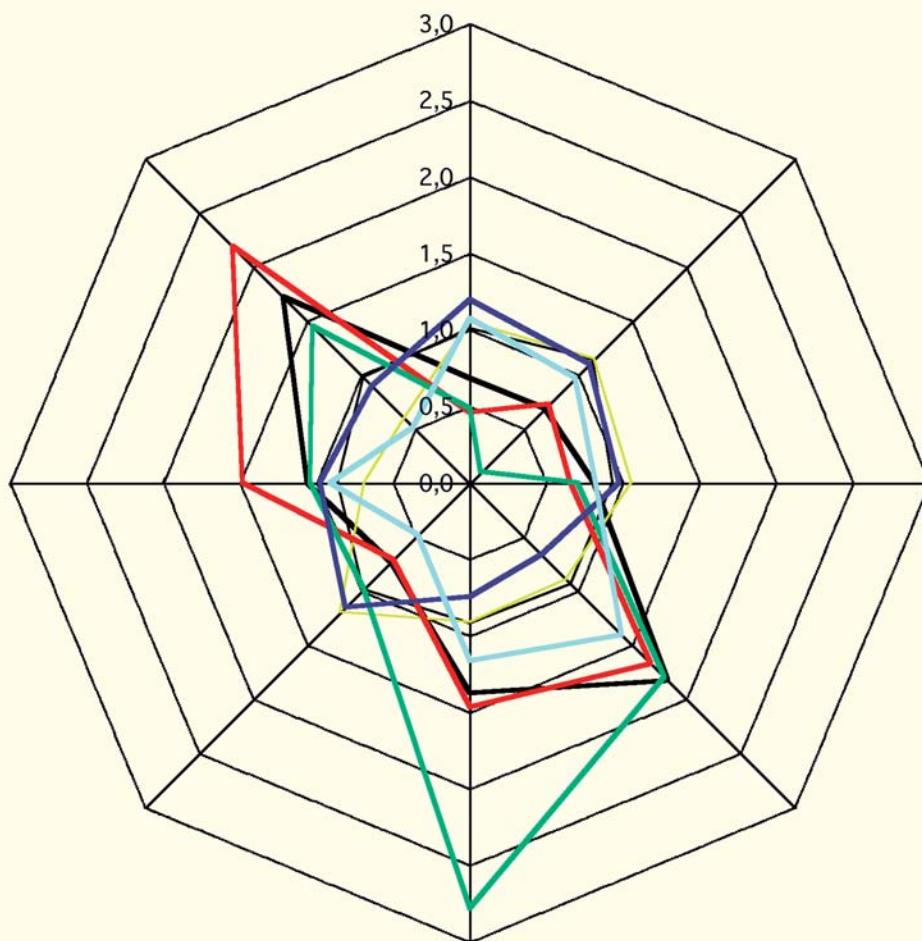


SCIENTIFIC PROFILE ACTIVITIES IN CEEC

*A Comparative Study Based on Scientific Publication
Indicators and International Co-publications*



A report prepared for the UNESCO Regional
Bureau for Science in Europe (ROSTE)
by Yann Cadiou and Laurence Esterle



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Preface

Building a European Research Area is an ambitious objective which was proposed by the European Council in Lisbon in March 2000.

The European countries have the willingness, now, to achieve this objective while Europe is facing a major challenge with the enlargement of the European Union to Central and Eastern European countries. Furthermore, this comes in a context where science and technology are recognized as important and catalytic factors of the development of modern societies and key components of international cooperation, in particular in Europe.

Taking into account the importance of all these challenges in the international context, the UNESCO's Regional Bureau for Science in Europe, ROSTE, has taken recently several initiatives. Firstly, together with the EU's sponsored group of experts Europolis, it has organized a workshop on "European Science and Technology Policies in the EU Enlargement". This workshop, held in Venice in May 2000, has identified key science policy issues in the context of EU enlargement. One of them was the necessity of building tools for policy-making, science and technology indicators being one of them among a few others. Later, ROSTE, with the support of the Academia Europaea and ESF, convened an international Conference of Experts on the "Reconstruction of Scientific Cooperation in South East Europe" which took place in Venice, March 2001. This conference envisaged means to enhance scientific cooperation in the region in order to both strengthen the national science and technology systems and catalyse some political consolidation in the region. Objectives and priorities identified during this Conference of Experts were further discussed and endorsed during a ministerial Round Table on "Rebuilding Scientific Cooperation in South East Europe", organized by UNESCO in Paris, 24 October 2001.

The integration of Central and Eastern European countries in the European Research Area require an effort to provide science policy makers with tools which can help them to formulate priorities and strategies and benchmark their national policies with those of their partners. This effort has been undertaken by all EU member states since several years.

This has motivated UNESCO-ROSTE in collaboration with the Observatoire des Sciences et des Techniques (OST) which was the coordinator of the Europolis project to undertake a study in order to analyse the positioning of each "non EU" European country in the world scientific literature and to appreciate their strengths and weaknesses in the major scientific specialities. The results of this study are presented in this report.

The data that are presented consist in indicators on scientific activities as estimated by the volume of scientific publications recorded by the Science Citation Index (SCI) data base. World share of each European country has been calculated with its evolution over the period 1991-1999; co-publications between countries are also analysed.

The methodology used by OST is currently standard and commonly used by national organizations, in Europe and USA, as well as by international organizations such as the European Commission and the OECD. It is based on the bibliometric observation of publications in scientific journals and on the application of various quantitative techniques (statistics, data analysis, etc.). We must meanwhile emphasize several important issues. A crucial one is that output indicators cannot be interpreted independently from global factors as the institutional, social and economic context in which scientific communities are working. The approaches in terms of scientific productivity should thus be undertaken with caution. Furthermore, science indicators may have several biases. Firstly they do not include social sciences and humanities for methodological reasons. Secondly there exist linguistic biases as the overwhelming majority of publications listed in the SCI are published in English. Nevertheless, publications in English can be considered now as an international standard of the scientific activity. Despite these important concerns, science indicators produced by bibliometric methods are considered as solid tools to assess national contributions to the international scientific production.

ROSTE with the support of OST fulfils with this report one of its missions which is to contribute to the debate on the future of the European Research Area through tools which it can help to elaborate.

25 February 2002

Pierre Lasserre
Director of the UNESCO Regional
Bureau for Science in Europe
(ROSTE)

Pierre Papon
Chairman of the Board of OST, Paris,
Member of the ROSTE
Scientific Council

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Abstract

One of the most important challenges that the Central and Eastern European Countries¹ (CEECs) are facing is the development of integrated scientific and technology competencies as well as the integration of Research and Development systems into the network of European and international scientific cooperation.

In this context, it is interesting to provide science policy makers with the tools helping them in drawing up priorities and strategies.

The UNESCO- ROSTE has commanded this study to OST. OST is a Public Interest Group (GIP) set up in 1990 at the initiative of the Ministry of Research. Thirteen other institutions (public research organisations and ministries) are members of OST. OST missions include the production of indicators about the scientific, technological and innovative activities, in order to assess the strategies of the actors, to provide policy analysis and to produce knowledge relevant to policymaking. OST has set up a database that brings together various sets of data: scientific publications, patents, OECD data, foreign trade data, etc...

The purpose of this study is to perform a state-of-the-arts positioning of each CEEC in the world scientific literature and to appreciate their strengths and weaknesses in the major scientific specialities. Moreover, in the context of enlargement of the EU to the CEECs, it is interesting to document the past and existing scientific collaborations between the CEECs and the Member States. This study measures the "certified collaborations" between researchers, expressed in co-authoring of scientific publications.

A further understanding results from comparing the situation among eight scientific disciplines. A time series analysis allows the characterisation of the evolution of these collaboration patterns.

The bibliometric study consists in tables and figures with the appropriate comments. We used the Science Citation Index database (SCI) to produce computed data, according to the 10-years OST experience in the bibliometric field.

This study distinguishes two parts:

- The first part concerns the world shares and specialisation indexes based on the scientific publication indicators. In this part, we provide two types of analysis²:

- The scientific profiles of the zones (EU, the EU candidate countries, other CEECs, EFTA, and USA, Japan, Russia, which are considered as a zone);
- A comparison between the country scientific profiles;

- The second part concerns the scientific collaboration between the countries. We both present the scientific co-publications at the zone level (the EU, the EU candidate countries, the other CEECs, EFTA, and the USA, Japan, and Russia, which are considered as a zone) and at the country level.

¹ The CEECs include the 13 European Union candidate countries (Bulgaria, Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, Slovakia and Turkey) and five other countries (Albania, Croatia, Bosnia, Macedonia and Yugoslavia).

² A zoom on the countries, which have a share higher (or around) than 0,1% in the world scientific literature, by presenting a "country file", is given in the additional tables and figures part.

Context

By enlarging the European Union to include the Central and Eastern European countries (CEECs) including the Baltic States, Cyprus, Malta and Turkey, Europe is becoming a unified whole. This process could also concern the other Central and Eastern European Countries: Albania, Croatia, Bosnia, Macedonia and Yugoslavia.

The achievement of this enlargement requires many decisions to be taken and many compromises to be reached. The scope and scale of the enlargement challenge must be understood.

Future evolutions should be analysed through different approaches. Many indicators are yet mobilised: Gross Domestic Product or population indicators can give an overall overview of the macroeconomic dimension of the enlargement.

However, many other dimensions should be taken into account. Political, economical, linguistic, religious, and social dimensions interact in complicated ways.

The need for research to improve our knowledge and the decision-making bodies is a major key to enrich European Union by incorporating the diversity of the Central and Eastern European countries and other countries.

Objectives and methodology of the study

One of the most important challenges that the Central and Eastern European countries (CEECs) are facing is the development of integrated scientific and technology competencies. In this context, it is worth providing science policy makers with the tools helping them in drawing up priorities and strategies. CEECs include the 13 European Union Candidates countries (Bulgaria, Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, Slovakia and Turkey) and some other countries (Albania, Croatia, Bosnia, Macedonia and Yugoslavia). Another possible aggregation can be made and allows to distinguish among the CEECs zone: the South-East European countries (Albania, Bulgaria, Bosnia, Croatia, Cyprus, Malta, Macedonia, Romania, Slovenia, Turkey and Yugoslavia) and the Central European countries (Estonia, Hungary, Latvia, Lithuania, Poland, Czech Republic and Slovakia).

As a rule, the scientific community is heavily interconnected, with a portion of this retaining some kind of usable trace in publications. The number of co-signatories evidences the real co-operative networks, whereas the virtual, information-sharing networks are reflected in the citation-based relationship. The networks of actors built around a group of topics are even more abstract, by virtue of the co-citation relationship, the co-activity relationship or even the lexicological overlap within the published materials.

If we consider that the scientific reinforcement, within the reorganisation of the scientific co-operation, is a condition of the economic and political stability and a way to solve the brain drain problem, it is interesting to perform a state of the art by:

- Positioning each Central and East European country in the World (worldwide positioning);
- Positioning each Central and East European country in the "CEECs zone" scientific activities (positioning within the CEECs area);
- Appreciating their strengths and weaknesses in the major scientific specialities.

The purpose of this study is to perform a state of the arts by positioning each CEEC country in the World scientific literature and by appreciating their strengths and weaknesses in the major scientific specialities.

Regarding the size of the considered countries, we compare the positioning of each CEEC with the positioning of the other CEECs and some European countries (Spain, Greece, Portugal, which are countries that are more comparable) and their positioning in the CEECs zone. Moreover, in the context of the enlargement of the EU to candidate countries, it is interesting to document the past and existing scientific collaboration between CEECs and the European Member States.

A state-of-the-art for the year 1989, 1995, and 1999 allow analysing evolutions of these collaboration patterns.

Main results of the study

In order to give an overview, we can observe that in 1999 the EU as a whole counts for 33,9% of the international scientific literature. The Large Europe, which includes all EU countries, the EU candidate countries and the other CEECs, represents 38,6% of the world scientific literature.

The CEECs aggregate represents 2,8% of the world scientific literature. The share of the CEECs considered as a zone in the world scientific activities (all fields combined) is relatively stable between 1989 and 1995 but the evolution between 1995 and 1999 is close to + 10,5%.

93% of the scientific activity of the zone essentially concerns the EU candidate countries (2,6% of the world scientific literature in 1999).

The other CEECs represent 0,2% of the world scientific publications in 1999. After a decrease of its world share from 1989 to 1994, the other area has a relatively stable world share between 1995 and 1999. Then the candidate countries have a more dynamic evolution (+ 12% between 1995 and 1999 and + 14% between 1989 and 1999) than the other CEECs area and than the EU considered as a whole (+ 12,7% between 1989 and 1999).

Furthermore, the world share analysis at the zone level between 1989 and 1999 highlights both:

- The decreasing weight of the USA (from 35,6 to 30,5% i.e. nearly - 10%) and Russia (from 7,3 to 2,7% i.e. nearly - 23%) in the world scientific literature (between 1989 and 1999);
- The increasing weight of Japan (from 7,6% to 8,8% i.e. nearly + 7% during the considered period of time).

In 1999, the CEECs appear more represented in four fields of the scientific literature: chemistry (WS = 5,2%), mathematics (WS = 5%), physics (WS = 3,9%) and engineering and technology (WS = 3,1%). On the other hand, their world share is under the mean in fundamental biology (WS = 1,9%), medical research (WS = 2,0%), applied biology and ecology (WS = 2,3%) and earth & space sciences (WS = 2,1%). At this moment of the analysis, it is important to highlight that evolution of the USA influences all these observations.

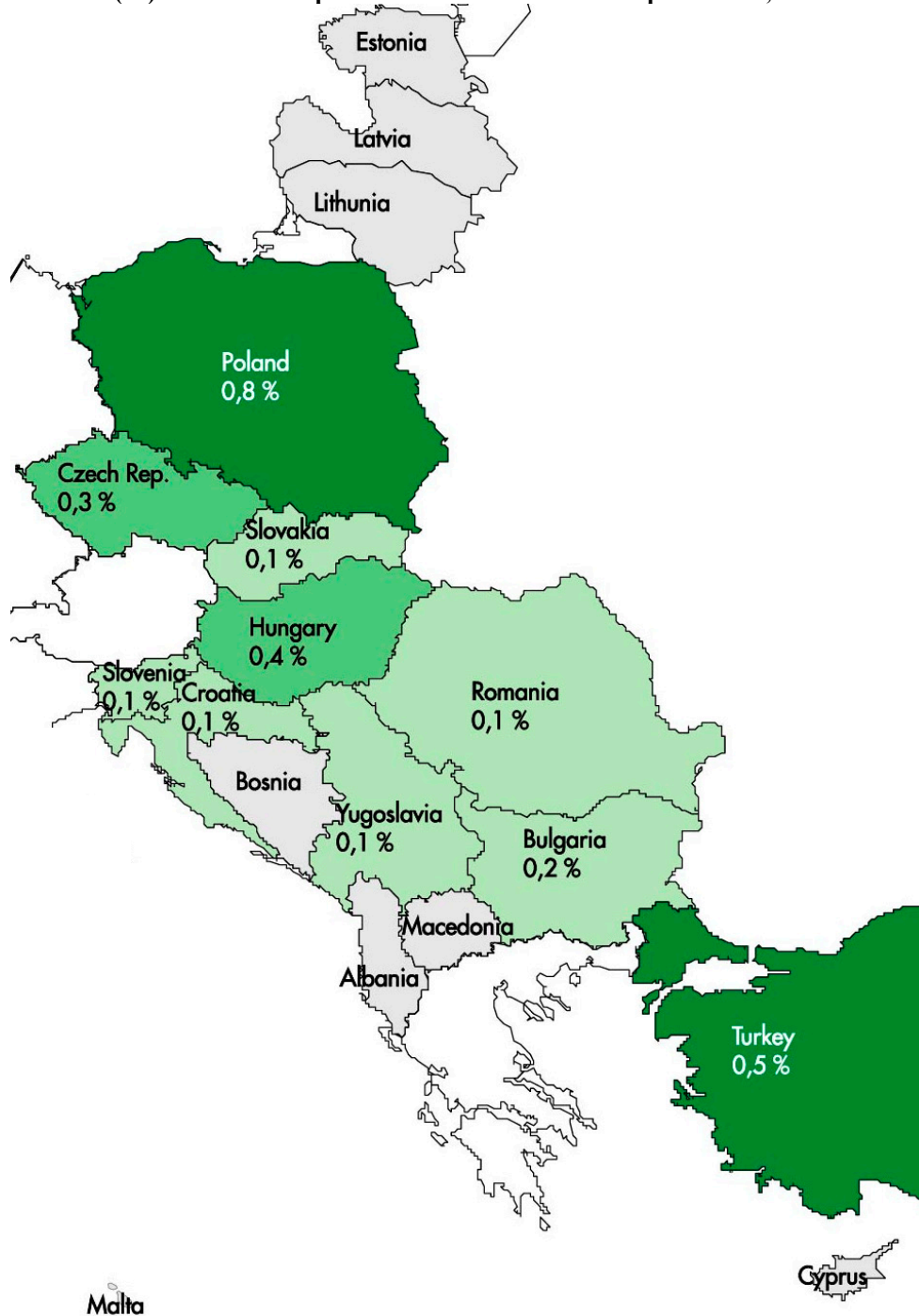
Between 1989 and 1999, the CEECs increase their world share (+ 10,6%). This evolution concerns in particular medical research (1,2% to 2% i.e. +69%), earth and space sciences (1,5% to 2,1% i.e. + 40,3%), applied biology and ecology (1,8% to 2,3% i.e. + 24,8%), physics (3,5% to 3,9% i.e. + 11,2%). On the contrary, between 1989 and 1999, the CEECs zone decreases slightly its world share in three fields: fundamental biology (- 6,9%), chemistry (- 2,2%) and mathematics (- 2,1%).

Regarding the positioning of the CEECs and their scientific patterns, the most important is to note the fact that Greece, Portugal, Ireland and Luxembourg appear significantly comparable with most of the CEECs, which have a share higher than 0,1% in the World scientific literature.

Within five years, Portugal, Greece, Spain and Austria significantly increase (more than 15%) their world share. During the same period, the United Kingdom decreases its world share by 5%. Spain wins a position in the EU ranking (from position 6 to position 5), thus preceding the Netherlands in 1999.

We can observe that, in 1999, only four Central and Eastern Europe Countries present a world share higher than 0,2%: Poland, Turkey, Hungary and Czech Republic.

Within four years, Turkey knows a remarkably positive evolution (nearly + 80%) of its participation in the world scientific literature from 0,13% to 0,54%. The evolution of Slovenia is also remarkable (close to 30%). Bulgaria and Czech Republic present a reduction of their world share between 1995 and 1999 (respectively - 14% and - 17%) but stay among the first publication producers of the CEECs area.

Map 1: World share (%) of the most important countries for scientific production, all fields combined - 1999

Sources: OST

In 1999, Poland appears as the most active country in the CEECs zone with 26,4% of the scientific production of the zone. Turkey, Hungary, Czech Republic follow with a share close to respectively 19,1%, 12,1% and 11,9%. The first five CEECs countries represent nearly 70% of the scientific publication of the zone all fields combined.

Through the time, we observe that:

- Bulgaria and Poland decrease their share in the scientific literature of the CEECs zone;
- Turkey particularly increases its share in the scientific literature of the CEECs zone;
- Hungary and Romania maintain their positions;
- Ex-Yugoslavia recomposed in Yugoslavia, Croatia, Macedonia, Bosnia maintains its position;
- In the case of Ex-Czechoslovakia, the emergence of the Slovakia does not compensate the decreasing weight of the Republic Czech.

We also observe that, in each discipline, the first four countries generate more than 60% of the scientific production of the zone. In addition, they realise more than 80% in medical research and more than 70% in fundamental research, applied biology and ecology and earth and space sciences.

In 1999, Slovakia appears as the only specialised country of the CEECs zone in fundamental biology (IS=1,1). All the other CEECs are despecialised in this field (the specialisation index is lower than 1).

In 1999, Turkey appears with a strong specialisation in medical research (IS=1,59), and is the only CEEC with a world share higher than 0,1% (all fields combined).

Czech Republic appears as the only CEEC with a world share higher than 0,1% (all fields combined) and specialised in applied biology and ecology (IS=1,43 in 1999).

Finally, we can observe that the first five CEECs decrease their specialisation in chemistry between 1989 and 1999.

All the CEECs except for Albania, Hungary, Malta and Turkey appear to be specialised in physics. Between 1995 and 1999, Czech Republic, Yugoslavia, Slovakia, Romania, Slovakia and Turkey increase their specialisation in physics.

Slovakia appears as the only CEEC with a world share higher than 0,1% all fields combined and which reinforces its specialisation in earth and space Sciences. Meanwhile, there is no CEEC specialised in this field.

Romania and Bulgaria are the only CEECs, which have a world share higher than 0,1% and reinforce their specialisation in engineering and technology.

All the CEECs appear to be specialised in mathematics, except for Turkey.

The following table summarises for each of the eight considered scientific disciplines, the position of each considered country in the world scientific literature, according to the world share indicators.

Table 1. Five categories of country based on the world share indicators (%) in the international scientific literature - per discipline – 1999

World share Fields	> 5%	1%<...<5%	1%<...<0,2%	0,2%<...<0,1%	< 0,1%				
All fields combined	EU The USA Japan The U.-K. Germany France	Italy Spain The Netherlands Sweden	Belgium Denmark Finland Austria	Greece Portugal Ireland	Luxembourg				
CEECs			Poland Turkey	Hungary Czech Republic	Bulgaria Slovakia Romania	Yugoslavia Slovenia	Bosnia Croatia Estonia	Lithuania Latvia Cyprus	Macedonia Malta Albania
fundamental biology			Poland Turkey	Hungary Czech Republic	Slovakia	Bulgaria	Romania Yugoslavia Slovenia Bosnia	Croatia Estonia Lithuania Latvia	Cyprus Macedonia Malta Albania
medical research			Poland Turkey	Hungary	Czech Republic		Slovakia Bulgaria Romania Yugoslavia Slovenia	Croatia Estonia Lithuania Malta	Latvia Macedonia Cyprus Albania Bosnia
applied biology and ecology			Poland Turkey	Hungary Czech Republic	Bulgaria		Slovakia Romania Yugoslavia Slovenia Bosnia	Croatia Estonia Lithuania Latvia	Cyprus Macedonia Malta Albania
chemistry			Poland Turkey Hungary Czech Republic	Romania Bulgaria Slovakia	Bosnia Yugoslavia	Slovenia	Croatia Estonia Lithuania	Latvia Cyprus	Macedonia Malta Albania
physics			Poland Turkey Hungary	Czech Republic Romania Bulgaria	Slovakia Yugoslavia	Slovenia Bosnia	Croatia Estonia Lithuania	Latvia Cyprus	Macedonia Malta Albania
earth & space sciences			Poland Turkey	Czech Republic	Hungary Bulgaria		Slovakia Romania Bosnia Yugoslavia Slovenia	Croatia Estonia Lithuania Latvia	Cyprus Macedonia Malta Albania
engineering & technology			Poland Turkey Czech Republic	Hungary	Bulgaria		Romania Bosnia Yugoslavia Slovakia Slovenia	Croatia Estonia Lithuania Latvia	Cyprus Macedonia Malta Albania
mathematics			Poland Hungary Czech Republic Romania Turkey	Yugoslavia Bulgaria Slovakia Slovenia	Bosnia		Croatia Estonia Lithuania	Latvia Cyprus	Macedonia Malta Albania

Sources: OST

Table 2. Zoom per discipline on the CEECs which have a World share > 0,2% - 1999

fundamental biology	medical research	applied biology - ecology	chemistry	physics	earth and space sciences	engineering and technology	mathematics	All fields combined
Czech Republic Hungary Poland	Czech Republic Hungary Poland	Czech Republic Hungary Poland	Bulgaria Czech Republic Hungary Poland Romania	Bulgaria Czech Republic Hungary Poland Romania	Czech Republic Hungary Poland	Bulgaria Czech Republic Hungary Poland Romania	Bulgaria Czech Republic Hungary Poland Romania Slovenia Slovakia	Czech Republic Hungary Poland
Turkey	Turkey	Turkey	Slovakia Turkey Yugoslavia	Turkey Yugoslavia	Turkey Yugoslavia	Turkey Yugoslavia	Turkey Yugoslavia	Turkey Yugoslavia
4 countries	4 countries	4 countries	8 countries	7 countries	5 countries	6 countries	9 countries	5 countries

Sources: OST

In the second part of this study, we are interested in the level of cooperative activities, as expressed by the number of co-publications (co-signed articles). Determining the number of co-publications does presume a series of methodological choices. The first of these choices pertains to the type of counting technique³.

The set of indicators published in this study are then calculated using the principle of "fraction-based counting" adapted to the level of macro-analysis, whether this level pertains to documents (each document is ascribed an equal unitary weight, to be split among the authors) or to journals (a journal's contribution spread across several fields of specialisation is to be split up on a fractional basis among these fields).

In 1995, the most important scientific partners of the EU candidate countries are the EU (55,4% of the EU candidates international scientific co-publications), the USA (20,6% of the EU candidates international scientific co-publications), Russia, (5,5% of the EU candidates international scientific co-publications), Canada (4,2% of the EU candidates international scientific co-publications) and EFTA (3,0% of the EU candidates international scientific co-publications).

For the case of the EU candidate countries, the analysis between 1995 and 1999 indicates the increasing weight of the EU (+4%), Japan (+36%), other ISC (+7%), and the decreasing weight of the USA (-9%) in the international scientific co-publications of the EU candidate countries, as well as the increasing weight of Canada (-21%), Russia (-27%), and EFTA (-7%).

Then, in 1999, the most important scientific partner of the EU candidate countries aggregate remains the EU (nearly 58% of the EU candidates international scientific co-publications), which is followed by the USA (nearly 19%), Russia and Japan (around 4%).

For the other CEECs area, the most important scientific partners in 1995 are respectively the EU (nearly 45% of the other CEEC international scientific co-publications), the USA (26,4%), the EU candidate countries aggregate (9,3%), Canada (4,2%) and Australia - New Zealand (3,7%).

The analysis between 1995 and 1999 for the other CEEC area indicates the increasing weight of the EU (+7% in the international scientific co-publication of the other CEECs area), Japan (+48%) and the EU candidate countries aggregate (+32%). We also observe the decreasing weight of the USA (-26% in the international scientific co-publication of the other CEECs area), the EU candidate countries (-21%), Russia (-27%), and EFTA (-7%).

Finally, for the other CEECs area, the most important scientific partner in 1999 is also the EU (48,2% of the international scientific publications of the other CEECs area), which is followed by the USA (19,5%), the EU candidate countries (12,3%), Australia-New Zealand (3,4%) and Japan (3,1%).

In the EU candidate countries, the overall range of the first scientific partner is stable between 1989 and 1999. We can observe that the EU and Japan reinforce their presence in the EU candidate countries international scientific publications.

For the other CEECs area, we observe the progression of the EU candidate countries (from 8,0% to 12,3% between 1989 and 1999) in the international scientific co-operation of the other CEECs area.

Within the same period of time, the EU candidate countries reinforce their position in the EU international scientific publication in terms of rank (4 to 3) and of share (7,3% in 1989 to 7,6% in 1999).

³ See methodological annex.

Analysed by disciplinary field (8 disciplines), the evolutions are contrasted.

USA and Germany appear as the two privileged scientific partners of the CEECs, which have a world share higher than 0,1% in the world scientific literature. Meanwhile, according to their own scientific specialisation, the historical cultural links, the geographical or political proximities, the specialisation of the considered CEECs, France and United Kingdom also appear as privileged scientific partners of some CEECs. Romania particularly collaborates with France for 16,6% of its international scientific co-publications.

All the analysed evolutions highlight the US and European attraction due to their weight in the international scientific literature.

Germany appears as a new privileged scientific partner of the CEECs. This fact is certainly due to the reorientation between the 1990's of the CEECs collaborations. Indeed, Germany progressively increases its presence in the CEECs scientific collaborations. During the same period, Russia decreases its presence in the CEECs international scientific publications. The analysis of those evolutions is not detailed in this study, even if it could be completed with the CEECs positioning analysis in the World scientific activities.

In addition, we observe the importance of the geographical proximities and complexity of the relationship between the EU candidate countries and the other CEECs. For example, Czech Republic particularly collaborates with Slovakia, which is its fifth scientific partner (with 4,7% of its international scientific co-publications). During the same time, Slovakia has relatively close scientific links with Czech Republic, which is its third scientific partner (with nearly 11% of its international scientific co-publications). Slovenia particularly collaborates with Croatia (5,9% of its international co-publications) and Hungary (2,7% of its international co-publications). Yugoslavia is relatively close to Hungary, which is its sixth scientific partner (with 4,0% of its international scientific publications).

Part A.

Scientific profiles based on scientific publication indicators - evolution between 1989 and 1999

Part A.I.

The zones scientific profiles: world share and specialisation index indicators

I. World share in the scientific literature at the zone level - between 1989 and 1999 -

1. World share (%) of scientific publication at the zone level - between 1989 and 1999 - all fields combined

Table 3. World share (%) of scientific publication at the zone level - between 1989 and 1999 - all fields combined

World share (%) of scientific publication at the level of the zone (1989 to 1999)												1999	1999
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	base 100=1989	base 100=1995
EU	30,1	30,2	30,4	30,8	31,4	32,0	32,5	33,1	33,5	33,8	33,9	112,7	104,3
EU candidates	2,3	2,3	2,3	2,2	2,3	2,3	2,4	2,4	2,5	2,6	2,6	114,0	111,6
EFTA	1,6	1,6	1,6	1,6	1,7	1,7	1,8	1,8	1,8	1,8	1,8	117,2	103,9
Other CEEC	0,3	0,3	0,3	0,3	0,3	0,2	0,2	0,2	0,2	0,2	0,2	80,1	102,0
Russia	7,3	7,2	6,9	6,2	5,1	4,1	3,5	3,3	3,2	3,0	2,7	37,2	77,3
USA	35,6	35,4	35,4	35,2	35,0	34,3	33,8	33,1	32,2	31,2	30,5	85,9	90,3
Japan	7,6	7,6	7,7	7,9	8,0	8,2	8,3	8,4	8,4	8,6	8,8	116,4	106,6
Total of the selected countries	84,7	84,6	84,6	84,2	83,6	82,9	82,5	82,2	81,8	81,3	80,7	95,3	97,8
Other countries	15,3	15,4	15,4	15,8	16,4	17,1	17,5	17,8	18,2	18,7	19,3	126,0	110,2
World	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Large Europe	34,3	34,3	34,5	35,0	35,6	36,3	36,9	37,4	38,0	38,4	38,6	112,7	104,7
South East countries	n	0,8	0,8	0,8	0,8	0,8	0,9	0,9	1,0	1,0	1,1	n	126,5
Central Europe countries	n	1,8	1,8	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7	n	99,8
CEEC zone	2,6	2,6	2,5	2,5	2,5	2,6	2,6	2,6	2,7	2,8	2,8	110,6	110,8

Sources: ISI data, OST treatments.

- The CEECs zone can be divided into the EU candidate countries aggregate and other CEECs or into the South-East European countries (Albania, Bulgaria, Bosnia, Croatia, Cyprus, Malta, Macedonia, Romania, Slovenia, Turkey and Yugoslavia) and the Central European countries (Estonia, Hungary, Latvia, Lithuania, Poland, Czech Republic and Slovakia).
- EU candidate countries: 13 Candidate countries engaged in the process of enlargement of the European Union: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia and Turkey.
- The other Central and Eastern European countries: Albania, Croatia, Bosnia, Macedonia and Yugoslavia.
- EFTA: Island, Liechtenstein, Norway and Switzerland.
- Large Europe includes all EU countries, the EU candidate countries aggregate and the other CEECs aggregate.

➤How to read this table?

The first part of the table: in 1989, the EU as a whole represents 30,1% of the world scientific publication. Between 1989 and 1999, the world share of the EU increases from 30,1% to 33,9% (i.e. nearly + 13%). The considered zones (EU, the EU candidate countries, EFTA, the other CEECs, Russia, the USA and Japan) represent approximately 80% of the total number of the world scientific publications.

In the second part of the table, the world share of the Large Europe includes all EU countries, the EU candidate countries and the other CEECs. In addition, we distinguish two aggregations of the CEECs zone: the South-East European countries and the Central European countries.

In 1999, the CEECs aggregate represents 2,8% of the world scientific literature. The share of the CEECs considered as a zone in the world scientific activities (all fields combined) is relatively stable between 1989 and 1995 but the evolution between 1995 and 1999 is close to 10,5%, which approximately represents an average growing rate close to 2,6% each year.

When we look at the first possible aggregation of the CEECs (geopolitical dimension) into the Candidate countries aggregate and the other CEECs aggregate, we can observe that 93% of the scientific activity of the zone essentially concerns the Candidates countries (2,6% of the world scientific literature in 1999).

The other CEECs aggregate (Albania, Croatia, Bosnia, Macedonia and Yugoslavia) represents 0,2% of the world scientific publications in 1999. After a decrease of their world share from 1989 to 1994, these countries have a relatively stable world share between 1995 and 1999. Then the Candidate countries have a more dynamic evolution (+ 12% between 1995 and 1999 and + 14% between 1989 and 1999) than the other CEECs and than the EU considered as a whole (+ 12,7% between 1989 and 1999).

When we look at the second possible aggregation of the CEECs zone (geographical dimension) into the South-East European countries aggregate and the Central European countries aggregate, we observe that the weights of the two considered sub-zones are more comparable. The South-East European countries represents more than 1,1% of the world scientific literature and the Central European countries has a world share close to 1,7%.

Meanwhile, we observe:

- Firstly the decreasing weight (nearly - 11%) of Central European countries in the world scientific literature between 1990 and 1995 (1989 is not available). The world share is stable between 1995 and 1999.
- Secondly the increasing weight of the South-Eastern European countries between 1995 and 1999, which goes from 0,8% to 1,1% (approximately + 26,5% on 10 years).

The EU as a whole counts for 33,9% of the international scientific literature in 1999. It is a higher world share than the US world share. The increase between 1989 and 1999 is close to 12,7% (from nearly 30,1% to 33,9%). The Large Europe, which includes all EU countries, the EU candidate countries and the other CEECs, represents 38,6% of the world scientific literature. The Large Europe world share goes from 34,3% to 38,6% (i.e. + 12,7% between 1989 and 1999, equal to the evolution of the EU considered as a whole).

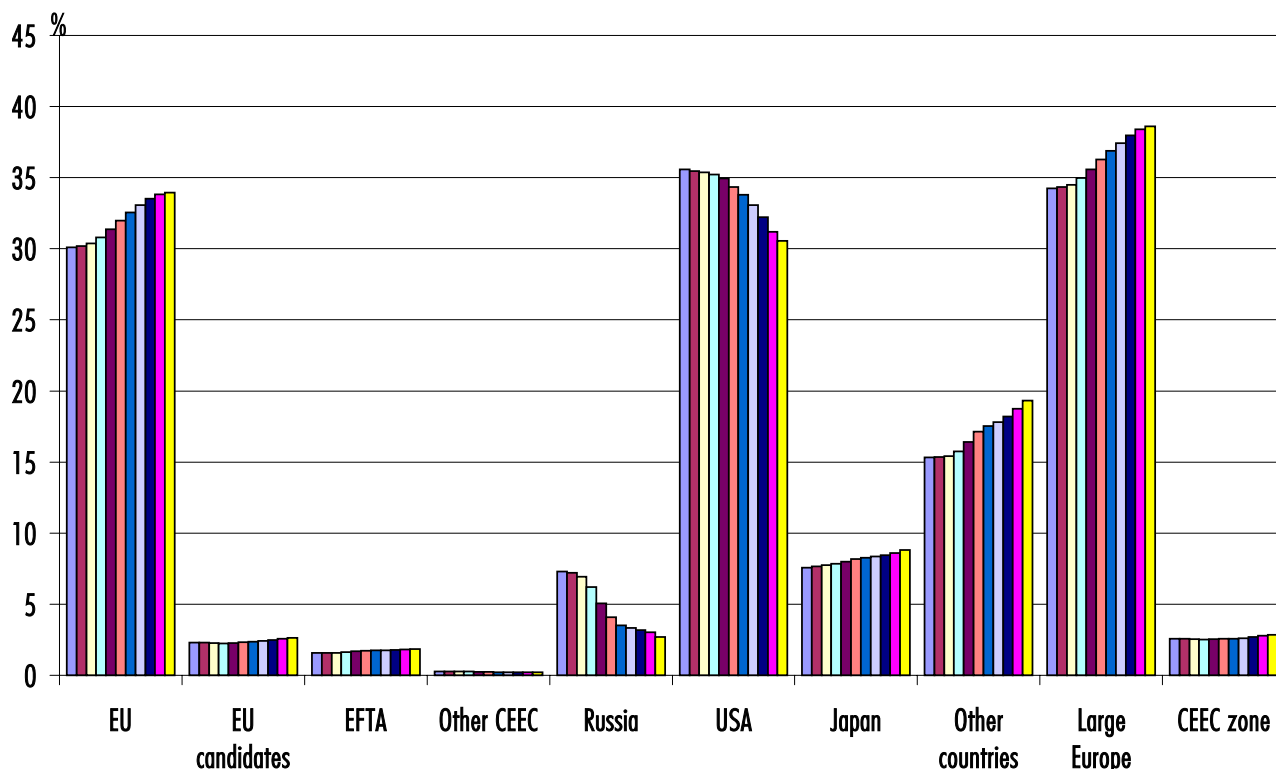
The world share analysis at the zone level between 1989 and 1999 highlights both:

- The decreasing weight of the USA (from 35,6 to 30,5% i.e. nearly - 10%) and Russia (from 7,3 to 2,7% i.e. nearly - 23%) in the world scientific literature (between 1989 and 1999);
- The increasing weight of Japan (from 7,6% to 8,8% i.e. nearly + 7%).

We can observe that the curves of evolution of the scientific production (downward for the United States and rising for the European Union) cross in 1996. In 1999, the United States and European Union respectively carry out 33,9% and 30,5% of the world scientific publications. Japan produces 8,8% of the world scientific publications. From the middle of the Eighties, the world share of the United States decreases slowly initially, then more quickly. The European Union knows an opposite evolution with a slow growth until 1992, then a faster one. Japan has known a slow and regular growth over all the period.

The two following figures represent the evolution of the share of the considered zones in the world scientific literature between 1989 and 1999. The first one gives an overview of all the considered zones and the second one is a zoom on the CEECs zone, which is presented both in the political dimension (13 EU candidate countries and the other CEECs) and in the geographical dimension (South Eastern European countries and the central European countries).

Figure 1. Evolution of the world shares (%) in the scientific literature at the zone level - between 1989 and 1999 - all fields combined

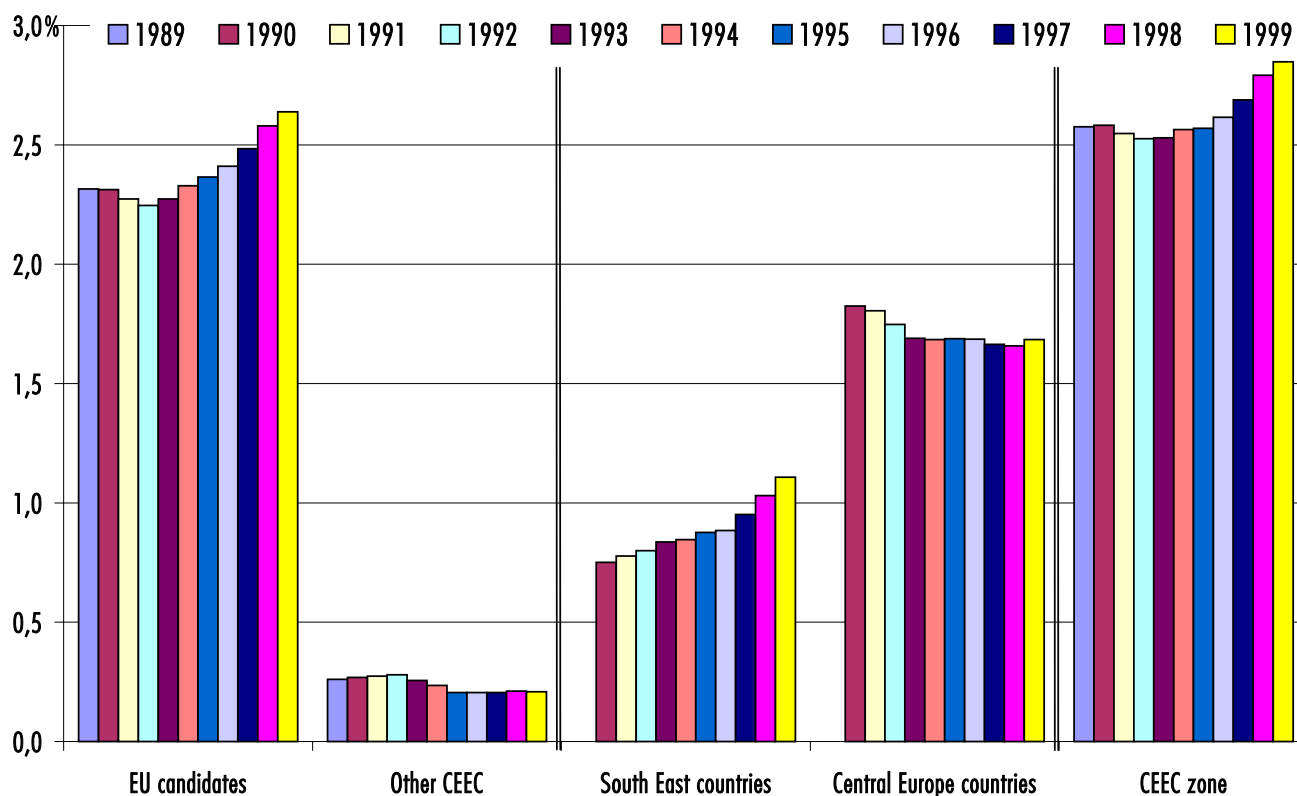


Sources: ISI data, OST treatments.

- The CEECs zone can be divided into the EU candidate countries aggregate and the other CEECs aggregate or into the South-East European countries (Albania, Bulgaria, Bosnia, Croatia, Cyprus, Malta, Macedonia, Romania, Slovenia, Turkey and Yugoslavia) and the Central European countries (Estonia, Hungary, Latvia, Lithuania, Poland, Czech Republic and Slovakia).
- EU candidate countries: 13 EU candidate countries engaged in the process of enlargement of the European Union: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia, and Turkey.
- The other Central and Eastern European countries: Albania, Croatia, Bosnia, Macedonia, and Yugoslavia.
- EFTA: Island, Liechtenstein, Norway, and Switzerland.
- Large Europe includes all EU countries, the EU candidate countries aggregate and the other CEECs aggregate.

➤ *How to read this figure? This figure illustrates table 1, i.e. the evolution of the share of the considered zones in the world scientific literature. We study seven zones: EU, the EU candidate countries, EFTA, the other CEECs, Russia, the USA and Japan. We also take into account the Large Europe and the CEECs zone. For each country and each year between 1989 and 1999 (from the left to the right), the world shares in the scientific literature of the zones are represented.*

Figure 2. Zoom on the CEECs zone: evolution of the world shares (%) in the scientific literature at the zone level - between 1989 and 1999 - all fields combined -



Sources: ISI data, OST treatments.

••• The CEECs zone can be divided into the EU candidate countries aggregate and the other CEECs aggregate or into the South-East European countries (Albania, Bulgaria, Bosnia, Croatia, Cyprus, Malta, Macedonia, Romania, Slovenia, Turkey and Yugoslavia) and the Central European countries (Estonia, Hungary, Latvia, Lithuania, Poland, Czech Republic and Slovakia).

➤ *How to read this figure? This figure is a zoom on the evolution of the world share of the CEECs zone between 1989 and 1999 (from the left to the right). We distinguished two possible aggregations of the Central and Eastern European countries:*

- *the EU candidate countries and the other CEECs;*
- *The South Eastern European countries and the Central European countries.*

2. The world share (%) in the scientific literature at the zone level - 1989 and 1999 - per discipline

Table 4. Evolution of the world shares in the scientific literature at the zone level – per discipline – 1989, 1999, and 1999 base 100 = 1995

World share (%) in the scientific literature at the zone level - per discipline											1989	
	EU	EU candidates	EFTA	Other CEEC	Russia	USA	Japan	Large Europe	CEEC zone	South East countries	Central Europe countries	
Fundamental biology	31,1	1,9	1,8	0,1	4,4	39,7	8,3	34,9	2,0	0,4	1,7	
Medical research	35,7	1,0	1,9	0,2	2,8	38,6	6,2	38,7	1,2	0,4	0,8	
Applied biology and ecology	25,6	1,6	1,2	0,2	2,6	37,3	6,4	28,7	1,8	0,4	1,4	
Chemistry	28,5	4,9	1,2	0,4	15,6	23,2	11,2	35,0	5,3	1,3	4,0	
Physics	27,5	3,1	1,6	0,4	13,5	30,3	9,6	32,7	3,5	0,9	2,6	
Earth & space sciences	25,6	1,3	1,7	0,2	7,3	40,7	3,2	28,7	1,5	0,6	0,9	
Engineering & technology	24,6	2,7	1,0	0,4	6,0	38,8	9,2	28,6	3,0	1,0	2,1	
Mathematics	29,7	4,7	1,2	0,5	4,9	36,1	4,9	36,0	5,1	1,9	3,7	
All fields combined	30,1	2,3	1,6	0,3	7,3	35,6	7,6	34,3	2,6	0,8	1,8	

World share (%) of scientific publication per discipline at the zone level											1999	
	EU	EU candidates	EFTA	Other CEEC	Russia	Other CEI	USA	Japan	Large Europe	CEEC zone	South East countries	Central Europe countries
Fundamental biology	34,3	1,8	1,9	0,1	1,3	0,2	36,7	9,5	38,2	1,9	0,4	1,7
Medical research	38,6	1,8	2,1	0,2	0,3	0,1	33,6	8,6	42,7	2,0	1,2	0,8
Applied biology and ecology	31,6	2,1	1,9	0,1	1,9	0,2	29,9	7,3	35,9	2,3	0,7	1,6
Chemistry	31,8	4,8	1,6	0,4	4,9	1,1	20,3	12,4	38,6	5,2	1,8	3,4
Physics	31,1	3,6	1,7	0,3	7,5	2,0	22,7	10,2	36,7	3,9	1,4	2,5
Earth & space sciences	33,3	1,9	2,2	0,1	2,6	0,4	35,1	4,2	37,6	2,1	0,8	1,3
Engineering & technology	29,2	2,8	1,3	0,3	2,8	0,8	29,8	8,0	33,6	3,1	1,7	1,5
Mathematics	33,1	4,5	1,1	0,5	3,9	1,2	27,4	4,5	39,2	5,0	0,0	0,0
All fields combined	33,9	2,6	1,8	0,2	2,7	0,6	30,5	8,8	38,6	2,8	1,1	1,7

Evolution (%) of the World share in the scientific literature at the zone level - per discipline - between 1989 and 1999											1999 base 100 = 1989	
	EU	EU candidates	EFTA	Other CEEC	Russia + other CEI	USA	Japan	Large Europe	CEEC zone	South East countries	Central Europe countries	
Fundamental biology	110,5	95,1	107,3	66,9	30,2	92,3	114,0	109,3	93,1	97,5	97,2	
Medical research	108,2	187,1	112,1	77,8	9,6	87,1	137,5	110,3	169,0	289,5	102,6	
Applied biology and ecology	123,6	130,7	155,7	72,9	73,7	80,1	114,0	125,1	124,8	175,8	112,7	
Chemistry	111,7	99,2	132,3	81,8	31,3	87,7	110,8	110,3	97,8	135,5	85,5	
Physics	112,9	115,8	105,0	75,6	56,0	75,1	106,8	112,3	111,2	159,4	96,2	
Earth & space sciences	130,3	152,3	129,1	69,2	36,0	86,2	133,4	130,7	140,3	131,5	143,0	
Engineering & technology	118,6	104,8	129,6	86,8	47,1	76,9	87,0	117,3	102,7	166,1	69,0	
Mathematics	111,4	97,5	96,3	101,6	80,4	75,8	92,7	109,0	97,9	121,1	86,5	
All fields combined	112,7	114,0	117,2	80,1	37,2	85,9	116,4	112,7	110,6	138,5	93,6	

Sources: ISI data, OST treatments.

●●● See annex for explanations on OST classification in 8 disciplines.

●●● The CEECs zone can be divided into the EU candidate countries aggregate and the other CEECs aggregate or into the South-East European countries (Albania, Bulgaria, Bosnia, Croatia, Cyprus, Malta, Macedonia, Romania, Slovenia, Turkey and Yugoslavia) and the Central European countries (Estonia, Hungary, Latvia, Lithuania, Poland, Czech Republic, and Slovakia).

●●● EU candidate countries: 13 EU candidate countries engaged in the process of enlargement of the European Union: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia, and Turkey.

●●● The other Central and Eastern European countries: Albania, Croatia, Bosnia, Macedonia, and Yugoslavia.

●●● EFTA: Island, Liechtenstein, Norway, and Switzerland.

●●● Large Europe includes all EU countries, the EU candidate countries aggregate and the other CEECs aggregate.

●●● Base 100 calculations are made with three decimal numbers.

●●● In the first two tables, data are written with the red colour when the share in the considered discipline is higher than the share 'all fields combined' (in blue colour in the other cases). In the third table, data are written in red colour and bold character when the evolution is higher than 100 (blue colour in the other cases).

➤ *How to read these tables? We distinguish for 1989 (table on the top) and 1999 (table in the middle) the world shares of 7 zones (EU, the EU candidate countries, EFTA, other CEECs, Russia, and Japan) in each of the eight scientific disciplines considered. We also analyse both the Large Europe, which includes all EU countries, the EU candidate countries and the other CEECs. We also take into account the geographical aggregate of the CEECs. In the third table, we provide the base 100 indicators, which indicate world share evolutions between 1989 and 1999 for each considered zone.*

In 1999, the CEECs appeared more represented in four fields of the scientific literature: chemistry (WS = 5,2%), mathematics (WS = 5%), physics (WS = 3,9%) and engineering and technology (WS = 3,1%). Their world share is under the mean in fundamental biology (WS = 1,9%), medical research (WS = 2,0%), applied biology and ecology (WS = 2,3%) and earth & space sciences (WS = 2,1%). At this level of the analysis, it is important to integrate the fact that the evolutions of the USA influence all these observations.

Between 1989 and 1999 (see tables 1 and 2), the CEECs zone increases its world share 'all fields combined' (+ 10,6%). This evolution concerns particularly medical research (1,2% to 2% i.e. +69%), earth and space sciences (1,5% to 2,1% i.e. + 40,3%), applied biology and ecology (1,8% to 2,3% i.e. + 24,8%), physics (3,5% to 3,9% i.e. + 11,2%). On the contrary, between 1989 and 1999, the CEECs zone decreases slightly its world share in three fields: fundamental biology (- 6,9%), chemistry (- 2,2%) and mathematics (- 2,1%).

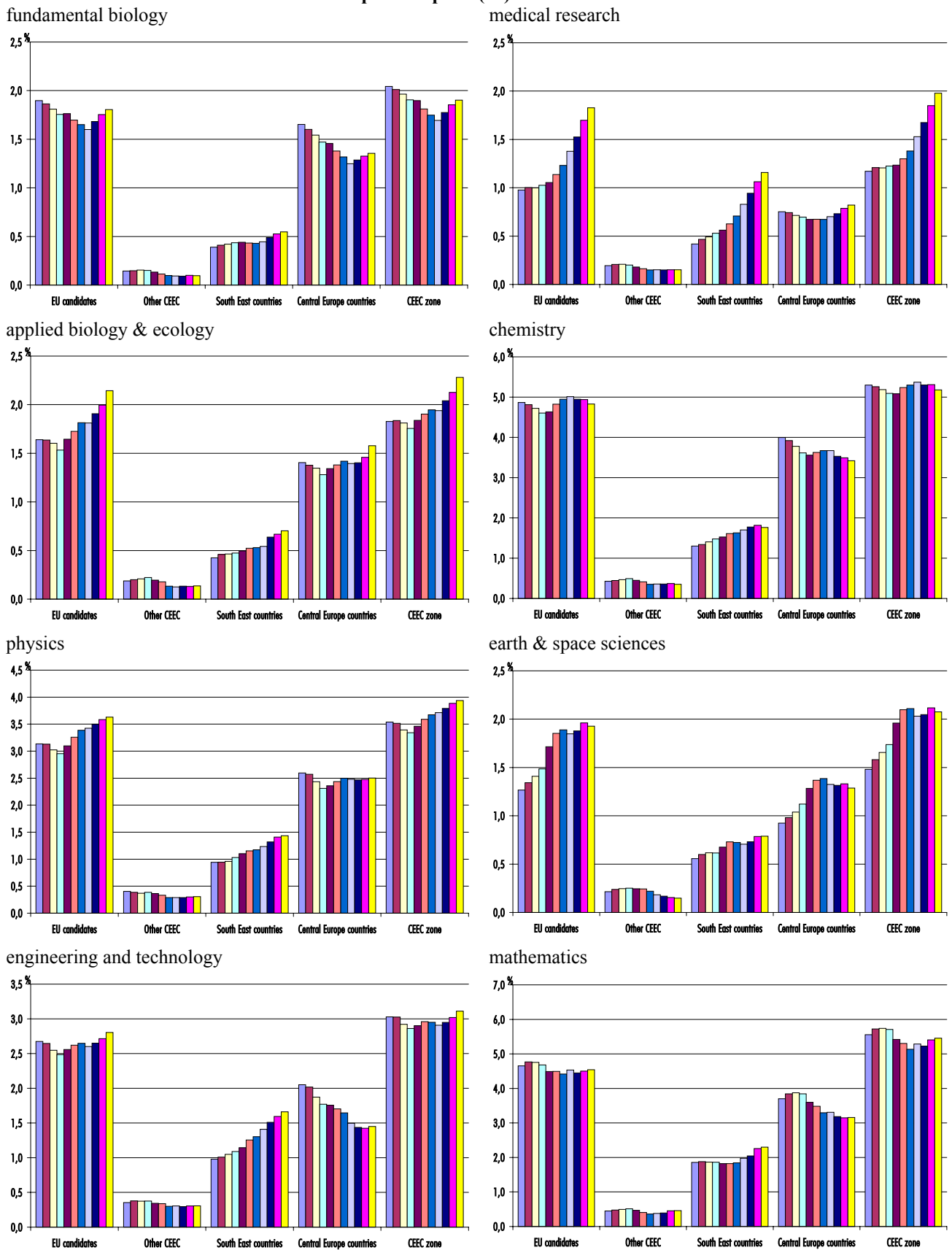
The EU candidate countries aggregate increase its world share 'all fields combined' (+ 11,4%). This evolution particularly concerns medical research (1,0% to 1,8% i.e. +87% in 10 years), earth and space sciences (1,3% to 1,9% i.e. + 52%), applied biology and ecology (1,6% to 2,1% i.e. nearly + 30%). On the contrary, between 1989 and 1999, the EU candidate countries aggregate decreases slightly their world share in two fields: fundamental biology (- 5%), and mathematics (- 2,5%).

The European Union presents a relatively homogeneous scientific profile without major disparities between scientific disciplines. We observe the EU is particularly present in medical research, but it is less in engineering sciences and applied biology and ecology.

In 1999, the USA show a more contrasted scientific profile, with three very strong disciplines, which are fundamental biology, medical research and earth and space sciences, and two disciplines where their presence is decreasing, which are physics and chemistry. In fundamental biology and medical research, USA and EU generate together around 70% of the world scientific publications. In these two disciplines, all the other zones are quasi non-existent except for Industrial Asia and Oceania (data not shown). Chemistry and Physics have an atypical profile: the EU and the USA together weigh less than 55% (and we observe the strong position of the CEI). Finally, it is worth noting that EU and the Large Europe increase their world share in all the considered fields whereas the US world shares decrease in all the scientific disciplines.

All the tables and figures concerning the evolution at the zone level of the world shares per discipline between 1989 and 1999 can be found in the Annex. Nevertheless, the following figure (figure 3) specifically zooms on these evolutions, in the case of the CEECs zone considered in both the geopolitical and the geographical dimensions.

Figure 3. Zoom on the two (geographical and political) dimensions of the CEECs zone: evolution between 1989 and 1999 of the world shares - per discipline (%) - in the scientific literature at the zone level



Sources: ISI data, OST treatments.

II. Specialisation indexes at the zone level - between 1989 and 1999 -

Table 5. Specialisation index at the zone level - 1999

Specialisation Index at the zone level (1999)								
Zone	Fundamental biology	Medical research	Applied biology and ecology	Chemistry	Physics	Earth & space sciences	Engineering & technology	Mathematics
EU	1,01	1,14	0,93	0,94	0,92	0,98	0,86	0,98
EU candidates	0,69	0,69	0,81	1,83	1,38	0,73	1,06	1,72
EFTA	1,05	1,15	1,06	0,89	0,91	1,20	0,69	0,60
Other CEEC	0,46	0,73	0,66	1,68	1,47	0,71	1,48	2,19
Russia	0,49	0,10	0,70	1,80	2,78	0,98	1,04	1,45
USA	1,20	1,10	0,98	0,67	0,74	1,15	0,98	0,90
Japan	1,07	0,97	0,83	1,41	1,16	0,48	0,91	0,52

Sources: ISI data, OST treatments.

- See annex for explanations on OST classification in 8 disciplines.
- The CEECs zone can be divided into the EU candidate countries aggregate and the other CEECs aggregate or into the South-East European countries (Albania, Bulgaria, Bosnia, Croatia, Cyprus, Malta, Macedonia, Romania, Slovenia, Turkey and Yugoslavia) and the Central European countries (Estonia, Hungary, Latvia, Lithuania, Poland, Czech Republic and Slovakia). This table only provides the specialisation of the EU candidate countries aggregate and other CEECs aggregate.
- EU candidate countries: 13 Candidate countries engaged in the process of enlargement of the European Union: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia, and Turkey.
- The other Central and Eastern European countries: Albania, Croatia, Bosnia, Macedonia, and Yugoslavia.
- EFTA: Island, Liechtenstein, Norway, and Switzerland.
- The sectorial specialisation index (the "activity index" for bibliometricians) relates the weight of a given country in a specific discipline to the country's weight in all disciplines combined, or the weight of a given discipline within the country to the discipline's weight world-wide. This probabilistic index is one that enables establishing and comparing the discipline-by-discipline profile of various countries. The dispersion observed in these index values for a given country provides a perception of the overall level of specialisation in the country's research strategy.
- When the specialisation index is higher than 1, that means that the considered zone is more specialised in the considered discipline than the average of the other zones.
- The red colour indicates zones, which are very specialised (the specialisation index is higher than 1,2) and blue colour indicates the weaknesses of the zones (the specialisation index is lower than 0,8).

➤ *How to read this table? In 1999, the EU is not specialised in fundamental biology but in medical research (SI=1,14).*

The European Union is strongly specialised in the field of medical research, where the index exceeds the United States one by five points. In chemistry, physics, applied biology and ecology, Europe shows a score a little lower than its average, whereas the United States is strongly "despecialised" in these disciplines. Engineering sciences constitute the weak point of the EU. The United States is much specialised in fundamental biology, earth and space sciences and medical research. Japan is specialised in chemistry and physics.

The EU candidate countries aggregate is specialised in the fields of chemistry (the specialisation index is very high: nearly 1,8), mathematics (nearly 1,7), and physics (nearly 1,3).

The other CEECs area is specialised in the same fields than the EU candidate countries aggregate (chemistry, mathematics, and physics and as well as in engineering and technology (SI close to 1,5).

On the other hand, the EU candidate countries aggregate and the other CEECs are much despecialised in Life sciences fields: fundamental biology, medical research, applied biology, and ecology, earth and space sciences.

Table 6. Specialisation index at the zone level - 1999 base 100 = 1995

Specialisation Index at the zone level	1999 base 100 = 1995							
	Zone	Fundamental biology	Medical research	Applied biology and ecology	Chemistry	Physics	Earth & space sciences	Engineering & technology
EU	100,7	101,8	95,5	101,5	99,5	94,4	94,5	97,8
EU candidates:	101,9	75,2	94,3	114,2	104,1	109,3	105,5	108,6
EFTA	104,9	100,5	85,5	95,0	105,3	98,3	96,5	115,1
Other CEEC	102,8	100,0	98,2	102,7	95,5	151,5	99,1	80,1
Russia	102,7	199,0	79,9	113,7	79,2	123,3	98,8	89,2
USA	96,3	98,9	100,5	102,3	107,0	97,2	106,3	107,4
Japan	102,1	92,1	110,7	102,2	102,7	94,8	109,3	100,8

Sources: ISI data, OST treatments.

••• See annex for explanations on OST classification in 8 disciplines.

••• The CEECs zone can be divided into the EU candidate countries aggregate and the other CEECs aggregate or into the South-East European countries (Albania, Bulgaria, Bosnia, Croatia, Cyprus, Malta, Macedonia, Romania, Slovenia, Turkey and Yugoslavia) and the Central European countries (Estonia, Hungary, Latvia, Lithuania, Poland, Czech Republic and Slovakia).

••• EU candidate countries: 13 Candidate countries engaged in the process of enlargement of the European Union: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia, and Turkey.

••• The other Central and Eastern European countries: Albania, Croatia, Bosnia, Macedonia, and Yugoslavia.

••• EFTA: Island, Liechtenstein, Norway, and Switzerland.

••• The sectorial specialisation index (the "activity index" for bibliometricians) relates the weight of a given country in a specific discipline to the country's weight in all disciplines combined, or the weight of a given discipline within the country to the discipline's weight world-wide. This probabilistic index is one that enables establishing and comparing the discipline-by-discipline profile of various countries. The dispersion observed in these index values for a given country provides a perception of the overall level of specialisation in the country's research strategy.

••• When the base 100 indicator is higher than 100, the number is red. That means that the considered zone is more specialised in the considered discipline in 1999 than in 1995. If not, it is blue.

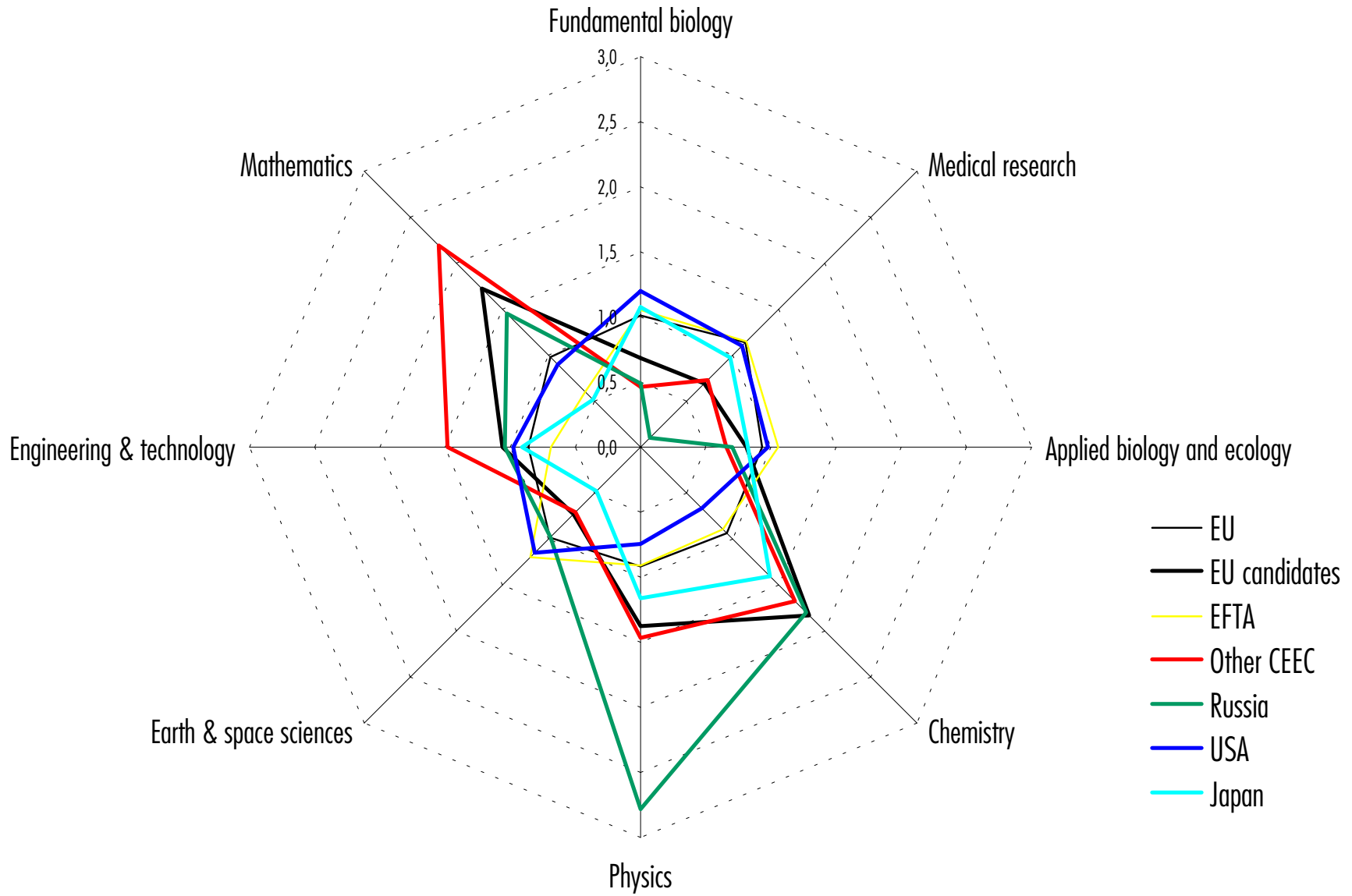
➤ *How to read this table? Between 1995 and 1999, the specialisation index of the EU slightly increases in medical research (+ 1,8 %), and chemistry (+1,5 %). On the contrary, between 1995 and 1999, the EU decreases its specialisation in four fields: earth and space sciences (-5,6%) engineering and technology, (- 5,5%), applied biology and ecology (- 4,5%), and mathematics, (-2,2%). The specialisation index is relatively stable in physics (-0,5%) and fundamental biology (+ 0,7%).*

Between 1995 and 1999, the EU candidate countries aggregate increase significantly their specialisation in all the fields except for life sciences e.g. medical research (nearly -24%) and applied biology (-5,7%). The specialisation reinforcement particularly concerns physics (+14%); earth and space sciences (+9,3%), mathematics (+8,6%) and engineering sciences (+5,5%).

In the case of the other CEECs, we can observe a despecialisation in mathematics (nearly -20%), and physics (- 4,5%). Nevertheless, this zone significantly increases its specialisation in earth and space sciences (+51,5%).

The following figure illustrates the specialisation in 1999 of some selected zones in the eight considered disciplines.

Figure 4. Specialisation index at the zone level - all fields combined - 1999



Sources: ISI data, OST treatments.

Part A.II.

Comparison of the scientific profiles of the countries - between 1989 and 1999 -

I. The position of some countries in the world scientific literature - all fields combined -

In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets.

The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. The measure of scientific production must incorporate, among other parameters, the human and financial resources invested in the research.

Then, before comparing the scientific profiles of each of the Central and Eastern European countries, we must remember that it is necessary to interpret data with a very high degree of caution, especially for countries that have a world share lower than 0,1% all fields combined. The concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

We compare the position of some countries in the world scientific literature. Initially, we observe the the share of each country in the world scientific literature, in 1989, 1995, and 1999, as well as the evolution between 1989 and 1999, and between 1995 and 1999 with the indicator "base 100". Then we present the evolution of the share in the world scientific literature of each country between 1989 and 1999 (from the left to the right in three figures). We distinguish:

- Firstly, the EU countries, plus USA and Japan
- Secondly, the CEECs, which have a world share higher than 0,1% in 1999.
- Thirdly, the CEECs, which have a world share lower than 0,1% in 1999.

1. World share of some countries in the scientific literature

Table 7. World share (%) of some countries in the scientific literature - 1989-1995-1999 and evolution between 1989 and 1999 - all fields combined

World share in the scientific literature - all fields combined				Evolution between 1989 and 1999	
Country	1989	1995	1999	1999 base 100 = 1989	1999 base 100 = 1995
<i>Albania</i>	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>
<i>Bosnia</i>	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>
Bulgaria	0,3	0,2	0,2	62,5	86,3
Croatia	<i>na</i>	0,1	0,1	<i>na</i>	93,7
<i>Cyprus</i>	<i>na</i>	0,0	0,0	<i>na</i>	157,1
Czech Republic	0,6	0,4	0,3	58,1	83,0
<i>Estonia</i>	<i>na</i>	0,0	0,0	<i>na</i>	126,5
France	4,6	5,1	5,2	112,6	103,2
Germany	6,3	6,3	6,9	109,7	108,5
Greece	0,3	0,4	0,5	155,6	121,7
Hungary	0,4	0,3	0,3	90,6	109,2
Japan	7,6	8,3	8,8	116,4	106,6
<i>Latvia</i>	<i>na</i>	0,0	0,0	<i>na</i>	96,2
<i>Lithuania</i>	<i>na</i>	0,0	0,0	<i>na</i>	130,0
<i>Macedonia</i>	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>
<i>Malta</i>	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>
Poland	0,9	0,7	0,8	87,7	103,3
Portugal	0,1	0,2	0,2	258,5	151,9
Romania	0,1	0,1	0,1	128,6	116,4
Slovakia	<i>na</i>	0,1	0,1	<i>na</i>	106,7
Slovenia	<i>na</i>	0,1	0,1	<i>na</i>	129,5
Spain	1,3	2,1	2,5	193,3	119,9
Turkey	0,1	0,3	0,5	412,1	180,1
United-Kingdom	8,5	8,5	8,1	94,8	94,7
USA	35,6	33,8	30,5	85,9	90,3
Yugoslavia	0,3	0,1	0,1	41,9	110,1
World	100,0	100,0	100,0		

Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That would suggest extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted.

••• The countries, which are concerned by the methodological limitations and biases, are written in italic. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• When the base 100 indicator is higher than 100, the number is red, which means that the world share is increase in the course of time. If not, it is blue.

••• For the year 1989, Czech Republic shows the data for Ex-Czechoslovakia.

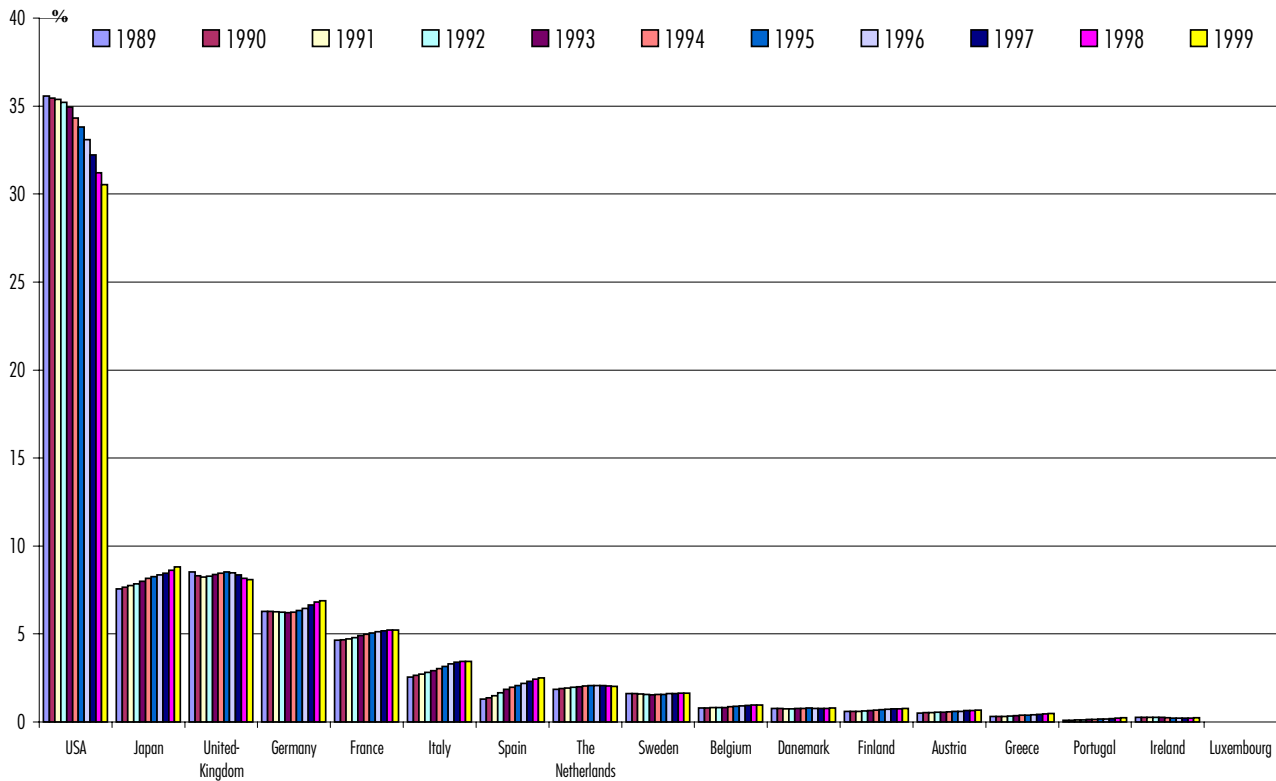
➤ *How to read these tables? For example, in 1989, Bulgaria represents nearly 0,25% of the world scientific literature, 0,18% in 1995 and 0,16% in 1999. The two last columns indicate evolutions between 1989 and 1999 and these between 1995 and 1999 measured with the base 100 indicators. Then Bulgaria decreases in the scientific literature by 37,5% between 1989 and 1995 and by 13,7% between 1995 and 1999. We can particularly observe that Turkey significantly increases its world share between 1989 and 1999 from 0,13% to 0,54%.*

It is easier to compare evolutions between 1995 and 1999 because of the data availability. We can observe that the following countries significantly decrease their world share in the scientific literature between 1995 and 1999: Bulgaria (- 13,7%), Czech republic (- 17%), the USA (- 9,7%), Croatia (- 6,3%), and United-Kingdom (- 5,3%).

All the following figures were established by ranking the countries according to the level of their world share in the scientific literature in 1999.

2. World share of the EU countries, Japan and the USA in the scientific literature

Figure 5. Share (%) of the EU countries, Japan and the USA in the world scientific literature (all fields combined) - evolution between 1989 and 1999 (ranking established for 1999)



Sources: ISI data, OST treatments.

- We establish the classification of the countries according to the level of their participation in the world scientific literature in 1999.
- In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in research.

During the period 1995-1999, France increases its world weight only by 3%, whereas Germany and Italy increase theirs by approximately 10%.

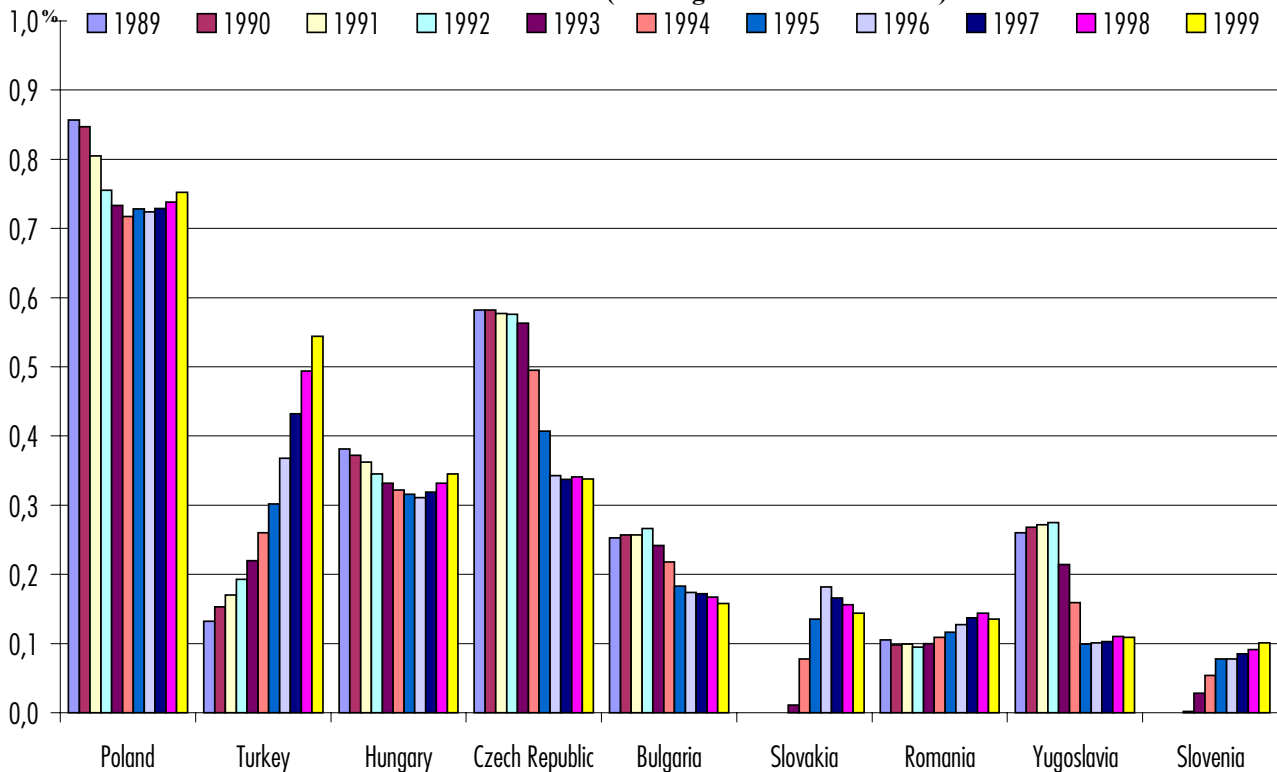
Regarding the positioning of the CEECs and their scientific patterns, it is most important to note that Greece, Portugal, Ireland and Luxembourg appear significantly comparable with most of the CEECs, which have a share higher than 0,1% in the World scientific literature.

Within five years, Portugal, Greece, Spain and Austria increase significantly (more than 15%) their world share. For the same period, the United Kingdom decreases its world share by 5%. Spain wins a position in the EU ranking (from position 6 to position 5), thus preceding the Netherlands in 1999.

The following figure shows the evolution between 1989 and 1999 of the share (%) of each CEEC in the world scientific literature (all fields combined).

3. The CEECs with a world share higher than 0,1% and these with a world share lower than 0,1%

Figure 6. Share of each CEEC (>0,1%) in the world scientific literature (all fields combined) - evolution between 1989 and 1999 (ranking established for 1999)



Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in research.

••• We establish the classification of the countries according to the level of their participation in the world scientific literature in 1999.

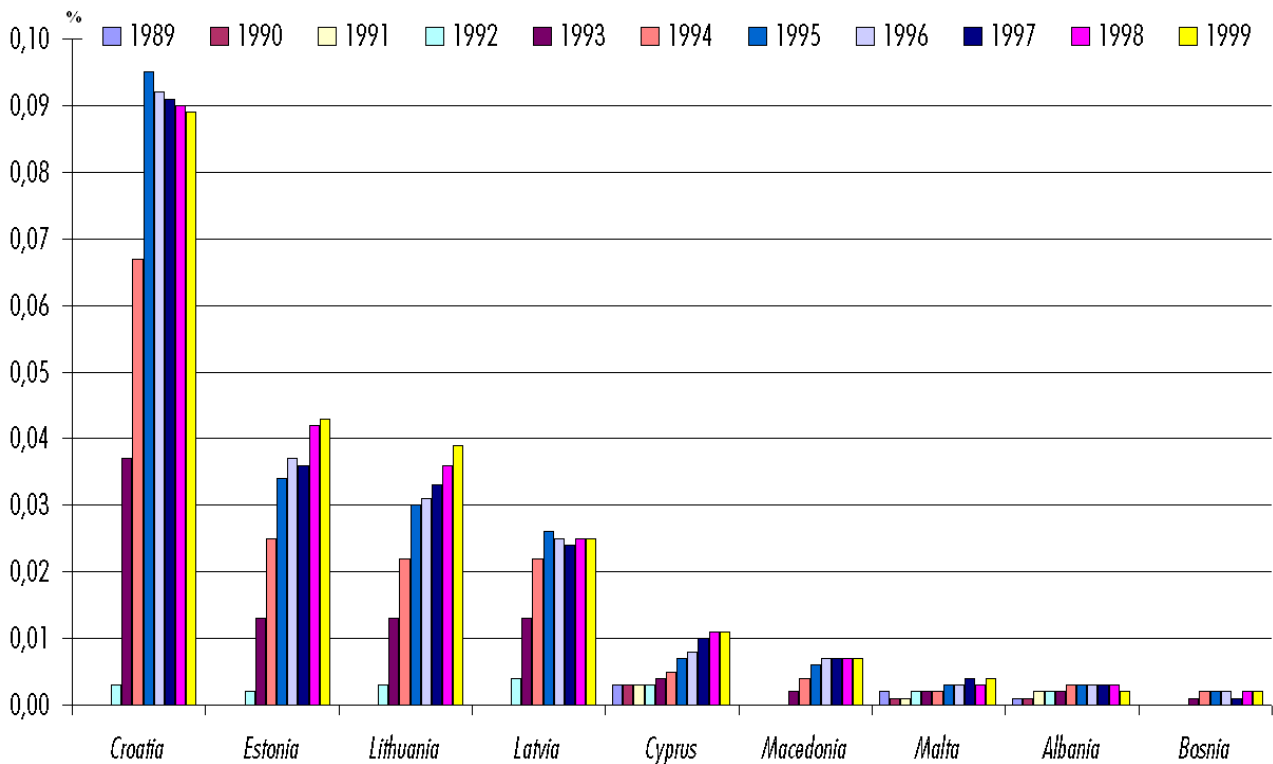
••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

We can observe that, in 1999, only four Central and Eastern Europe countries present a world share higher than 0,2%: Poland, Turkey, Hungary and Czech Republic. Poland and Turkey are the only candidate countries, which reach or exceed a weight of 0,5% in the world scientific literature. Then come Bulgaria, Slovakia, Romania, Yugoslavia, Slovenia and Croatia.

Within four years, Turkey knows a remarkably positive evolution (nearly + 80%) of its participation in the scientific literature from 0,13% to 0,54%. The evolution of Slovenia is also remarkable (close to 30%). Bulgaria and Czech Republic present a reduction of their world share between 1995 and 1999 (respectively – 14% and – 17%).

The countries located on the right of Croatia (figure 7) are concerned by the methodological limitations and biases problems. This is the reason why we only present these countries in this figure to give an overview related to the presence of the considered countries in the SCI database in 1999.

Figure 7. Share of each CEEC (<0,1%) in the world scientific literature - (all fields combined) -evolution between 1989 and 1999 (ranking established for 1999)



Sources: ISI data, OST treatments.

●● In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in research.

●● The countries, which are concerned by the methodological limitations and biases, are written in italic. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

●● We establish the classification of the countries according to the level of their participation in the world scientific literature in 1999.

II. The position of the CEECs in the world scientific literature - per discipline - (world share and specialisation index indicators)

In this part, we propose to analyse the position of the CEECs in the world scientific literature by using world share and specialisation index indicators, and by distinguishing eight scientific disciplines, which are elaborated by aggregation of ISI data (see annex or OST report [2002] for more methodological explanations).

Then, we distinguish the eight following disciplines:

- fundamental biology
- medical research
- applied biology and ecology
- chemistry
- physics
- earth & space sciences
- engineering & technology
- mathematics

For each of the eight disciplines, and for each CEEC and some EU countries as well as Japan and the United States, we propose two types of table.

The first type concerns the world share in the scientific literature in 1989, 1995, 1999 and the evolution between 1995 and 1999 measured with the base 100 indicators.

The second type provides specialisation indexes for the same years (1989, 1995, and 1999) and the evolution between 1995 and 1999 measured with the base 100 indicators.

1. World share and specialisation index of the selected countries regarding the World - fundamental biology

Table 8. World share (%) in the scientific literature and scientific specialisation index of the selected countries - evolution between 1989 and 1999 - fundamental biology

World share in the scientific literature					Specialisation Index (fundamental biology)				
Country	1989	1995	1999	1999 (base 100=1995)	Country	1989	1995	1999	1999 (base 100=1995)
Albania	na	na	na	na	Albania	na	na	na	na
Bosnia	na	na	na	na	Bosnia	na	na	na	na
Bulgaria	0,1	0,1	0,1	97	Bulgaria	0,6	0,6	0,7	128
Croatia	na	0,1	0,1	96	Croatia	na	0,5	0,6	119
Cyprus	na	na	na	na	Cyprus	na	na	na	na
Czech Republic	0,3	0,2	0,2	97	Czech Republic	1,1	0,9	0,9	104
Estonia	na	0,0	0,0	141	Estonia	na	0,7	0,9	124
France	4,4	4,8	4,8	99	France	1,1	1,1	1,1	99
Germany	5,7	5,7	6,7	117	Germany	1,0	1,0	1,0	102
Greece	0,2	0,3	0,5	144	Greece	0,6	0,6	0,5	93
Hungary	0,2	0,2	0,2	133	Hungary	1,3	0,9	1,0	104
Japan	6,2	7,4	8,6	116	Japan	1,1	1,1	1,1	98
Latvia	na	0,0	0,0	100	Latvia	na	0,5	0,6	109
Lithuania	na	0,0	0,0	133	Lithuania	na	0,8	0,7	91
Macedonia	na	na	na	na	Macedonia	na	na	na	na
Malta	0,0	0,0	0,0	140	Malta	na	na	na	na
Poland	0,3	0,2	0,3	131	Poland	0,7	0,6	0,6	102
Portugal	0,1	0,1	0,1	146	Portugal	0,9	1,0	0,9	91
Romania	0,0	0,0	0,0	111	Romania	0,3	0,2	0,2	91
Slovakia	na	0,1	0,1	113	Slovakia	na	1,1	1,1	100
Slovenia	na	0,0	0,1	159	Slovenia	na	0,7	0,7	96
Spain	1,0	2,0	2,3	116	Spain	1,3	1,0	1,0	95
Turkey	0,1	0,4	0,9	197	Turkey	0,5	0,5	0,4	92
United-Kingdom	12,3	12,0	10,8	90	United-Kingdom	0,9	1,0	1,0	103
USA	38,6	36,8	33,6	91	USA	1,1	1,2	1,2	104
Yugoslavia	0,2	0,1	0,1	105	Yugoslavia	0,6	0,5	0,4	82
World	100,0	100,0	100,0	100					

Sources: ISI data, OST treatments.

••• World share evolution are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• When the specialisation index is higher than 1,2 (strong specialisation), all the data are written with the red colour. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written with the blue colour. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

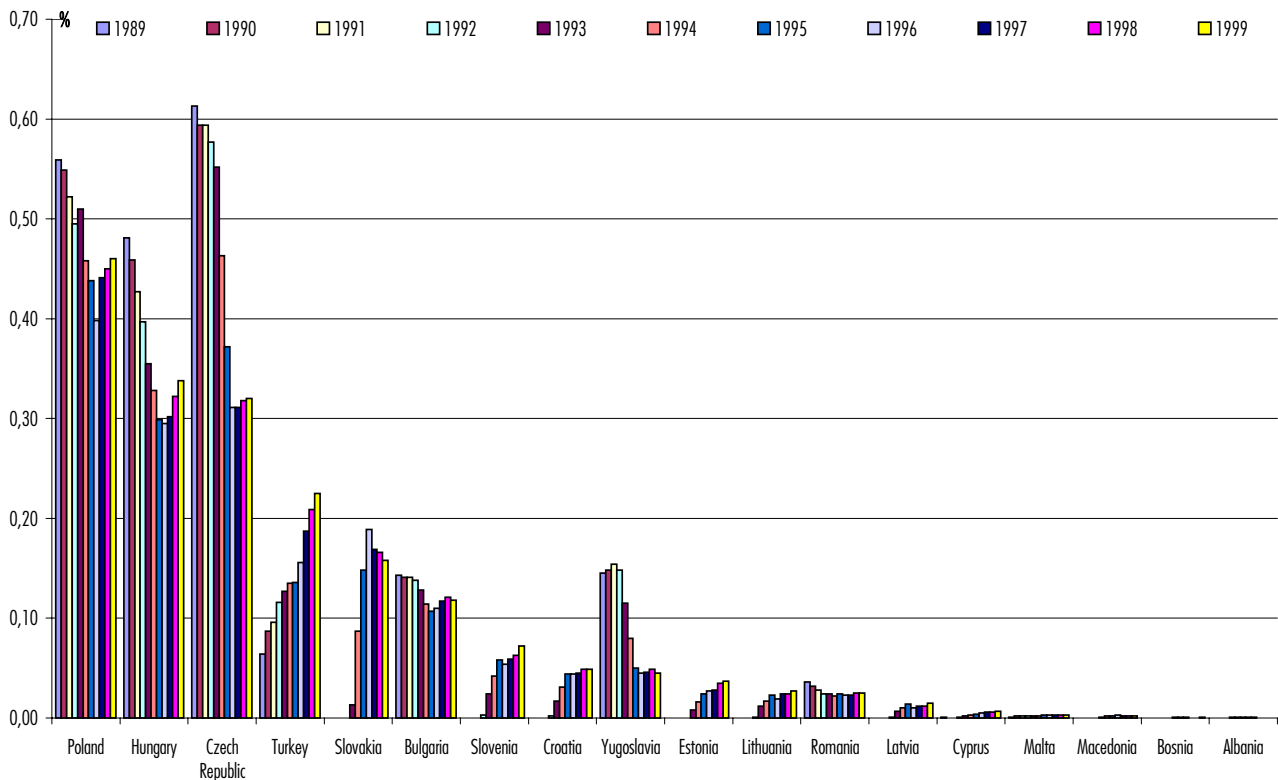
••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. That is why we provide data in the case of the countries which have a world share lower than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• na: not available.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

➤ *How to read these tables? In these two tables, we distinguish the world share of the considered countries in fundamental biology in 1989, 1995, and 1999. The evolution between 1995 and 1999 is measured with the base 100 indicator. In addition, we provide the specialisation index and its evolution for the same years. For example, in fundamental biology, Czech Republic represents 0,6% of the scientific literature in 1989, nearly 0,4% in 1995. In 1999, Czech Republic represents 0,32% of the world scientific literature, which means a decrease of 14% between 1995 and 1999. Regarding the specialisation, Czech Republic is specialised in fundamental biology in 1989 (SI=1,05) but not in 1995 (SI=0,91). Meanwhile Czech Republic increases its specialisation by nearly 4% between 1995 and 1999.*

Figure 8. World share (%) in the scientific literature of the CEECs (fundamental biology) evolution between 1989 and 1999 - (ranking established for 1999)



Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

Poland (WS=0.46%), Hungary (WS=0,34%), Czech Republic (WS=0,32%), Turkey (WS=0,22%) and Slovakia (WS=0,15%) appear at the first five positions in the CEECs zone in fundamental biology.

We can observe an overall top-down tendency between 1989 and 1999 of the world share in most of the CEECs cases, except for Turkey. Meanwhile most of the considered countries increase their world share between 1995 and 1999 in fundamental biology, except for Czech Republic, which is concerned by the transformation of Ex-Czechoslovakia, and must be analysed with a very high degree of caution.

Slovakia appears as the only CEEC specialised in fundamental biology in 1999 (IS=1,1). All the other countries among the CEECs are despecialised in this field (the specialisation index is lower than 1).

2. World share and specialisation index of the selected countries regarding the World - medical research

Table 9. World share (%) in the scientific literature and scientific specialisation index of the selected countries - evolution between 1989 and 1999 - medical research

World share in the scientific literature					Specialisation Index				Medical Research			
Country	1989	1995	1999	1999 (base 100=1995)	Country	1989	1995	1999	1999 (base 100=1995)			
Albania	na	na	na	na	Albania	na	na	na	na			
Bosnia	na	na	na	na	Bosnia	na	na	na	na			
Bulgaria	0,06	0,06	0,06	97	Bulgaria	0,22	0,32	0,35	111			
Croatia	na	0,08	0,08	96	Croatia	na	0,89	0,92	104			
Cyprus	na	na	na	na	Cyprus	na	na	na	na			
Czech Republic	0,26	0,16	0,15	97	Czech Republic	0,44	0,39	0,46	118			
Estonia	na	0,02	0,02	141	Estonia	na	0,51	0,56	109			
France	4,36	4,80	4,76	99	France	0,94	0,95	0,91	96			
Germany	5,68	5,70	6,68	117	Germany	0,91	0,90	0,97	108			
Greece	0,21	0,34	0,49	144	Greece	0,67	0,88	1,04	119			
Hungary	0,23	0,18	0,24	133	Hungary	0,60	0,57	0,70	122			
Japan	6,22	7,39	8,56	116	Japan	0,82	0,90	0,97	109			
Latvia	na	0,01	0,01	100	Latvia	na	0,21	0,19	91			
Lithuania	na	0,01	0,01	133	Lithuania	na	0,20	0,21	104			
Macedonia	na	na	na	na	Macedonia	na	na	na	na			
Malta	0,00	0,01	0,01	140	Malta	1,98	1,62	1,78	110			
Poland	0,27	0,24	0,31	131	Poland	0,31	0,33	0,41	127			
Portugal	0,05	0,10	0,14	146	Portugal	0,56	0,59	0,57	96			
Romania	0,02	0,02	0,02	111	Romania	0,21	0,15	0,15	98			
Slovakia	na	0,07	0,08	113	Slovakia	na	0,51	0,54	106			
Slovenia	na	0,04	0,06	159	Slovenia	na	0,51	0,62	122			
Spain	0,95	1,97	2,28	116	Spain	0,74	0,95	0,91	96			
Turkey	0,14	0,44	0,86	197	Turkey	1,06	1,44	1,58	110			
United-Kingdom	12,32	11,98	10,83	90	United-Kingdom	1,45	1,41	1,34	95			
USA	38,60	36,81	33,63	91	USA	1,09	1,09	1,10	101			
Yugoslavia	0,19	0,06	0,06	105	Yugoslavia	0,74	0,59	0,57	97			
World	100	100	100	100								

Sources: ISI data, OST treatments.

••• World share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• When the specialisation index is higher than 1,2 (strong specialisation), all the data are written with the red colour. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written with the blue colour. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

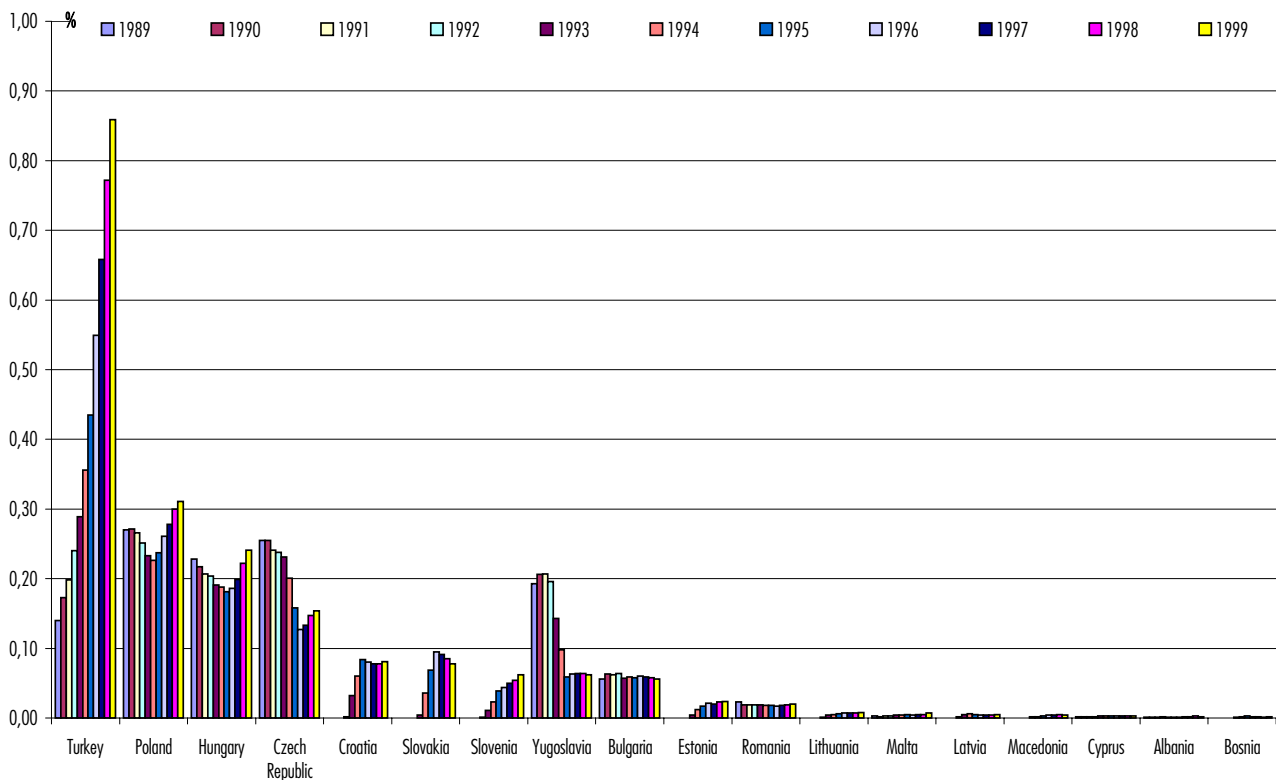
••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• na: not available.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

➤ *How to read these tables? In these two tables, we distinguish the world share of the considered countries in medical research in 1989, 1995, and 1999. The evolution between 1995 and 1999 is measured with the base 100 indicator. In addition, we provide the specialisation index and its evolution for the same years. For example, Turkey represents 0,14% of the world scientific literature in the medical field in 1989; 0,43% in 1995, and 0,86% in 1999. Then the increase 1995 and 1999 is remarkable (nearly 97%). Turkey reinforces its specialisation between 1989 and 1999. The specialisation index in medical research goes from 1,06 to 1,58 in ten years.*

Figure 9. World share (%) in the scientific literature of the CEECs (medical research) evolution between 1989 and 1999 - (ranking established for 1999)



Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

Turkey (WS=0,86%), Poland (WS=0,31%), Hungary (WS=0,24%), Czech Republic (WS=0,15%), and Croatia (WS=0,08%) appear at the first five positions in the CEECs zone in medical research.

We can observe an overall bottom-up tendency between 1989 and 1999 of the world share in most of the CEECs cases, except for Czech Republic.

Meanwhile, most of the considered countries increase their world share between 1995 and 1999 in fundamental biology, except for Czech Republic. Turkey particularly increases its world share from 0,14% in 1995 to 0,86% in 1999 i.e. + 18% each year during the last four years of the considered period.

In 1999, Turkey reveals with a strong specialisation in medical research (IS=1,59), and Turkey is in addition the only CEEC with a world share higher than 0,1% (all fields combined).

3. World share and specialisation index of the selected countries regarding the World - applied biology and ecology

Table 10. World share (%) in the scientific literature and scientific specialisation index of the selected countries - evolution between 1989 and 1999 - applied biology - ecology

World share in the scientific literature					Specialisation Index applied biology and ecology				
Country	1989	1995	1999	1999 (base 100=1995)	Country	1989	1995	1999	1999 (base 100=1995)
Albania	na	na	na	na	Albania	na	na	na	na
Bosnia	na	na	na	na	Bosnia	na	na	na	na
Bulgaria	0,1	0,1	0,2	120	Bulgaria	0,4	0,8	1,1	140
Croatia	na	0,1	0,0	86	Croatia	na	0,6	0,6	92
Cyprus	0,0	0,0	0,0	60	Cyprus	7,7	2,3	0,8	37
Czech Republic	0,5	0,5	0,5	106	Czech Republic	0,8	1,1	1,4	128
Estonia	na	0,0	0,1	190	Estonia	na	1,2	1,9	153
France	3,3	4,0	4,3	107	France	0,7	0,8	0,8	103
Germany	5,5	5,1	5,4	107	Germany	0,9	0,8	0,8	99
Greece	0,3	0,4	0,5	126	Greece	0,9	0,9	1,0	104
Hungary	0,3	0,3	0,3	103	Hungary	0,8	0,9	0,8	94
Japan	6,4	7,5	7,3	96	Japan	0,8	0,9	0,8	90
Latvia	na	0,0	0,0	144	Latvia	na	0,4	0,5	149
Lithuania	na	0,0	0,0	260	Lithuania	na	0,3	0,7	199
Macedonia	na	na	0,0	na	Macedonia	na	na	na	na
Malta	na	na	na	na	Malta	na	na	na	na
Poland	0,6	0,5	0,6	111	Poland	0,7	0,7	0,8	107
Portugal	0,1	0,2	0,3	164	Portugal	0,9	1,2	1,3	108
Romania	0,0	0,0	0,0	156	Romania	0,2	0,1	0,2	134
Slovakia	na	0,1	0,1	108	Slovakia	na	0,7	0,7	101
Slovenia	na	0,0	0,1	180	Slovenia	na	0,6	0,8	138
Spain	1,4	2,6	3,5	132	Spain	1,1	1,3	1,4	110
Turkey	0,1	0,2	0,3	157	Turkey	0,7	0,6	0,5	87
United-Kingdom	7,9	7,9	7,7	98	United-Kingdom	0,9	0,9	1,0	104
USA	37,3	33,2	29,9	90	USA	1,0	1,0	1,0	99
Yugoslavia	0,2	0,1	0,1	118	Yugoslavia	0,7	0,7	0,7	108
World	100,0	100,0	100,0	100					

Sources: ISI data, OST treatments.

••• World share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• When the specialisation index is higher than 1,2 (strong specialisation), all the data are written with the red colour. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written with the blue colour. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

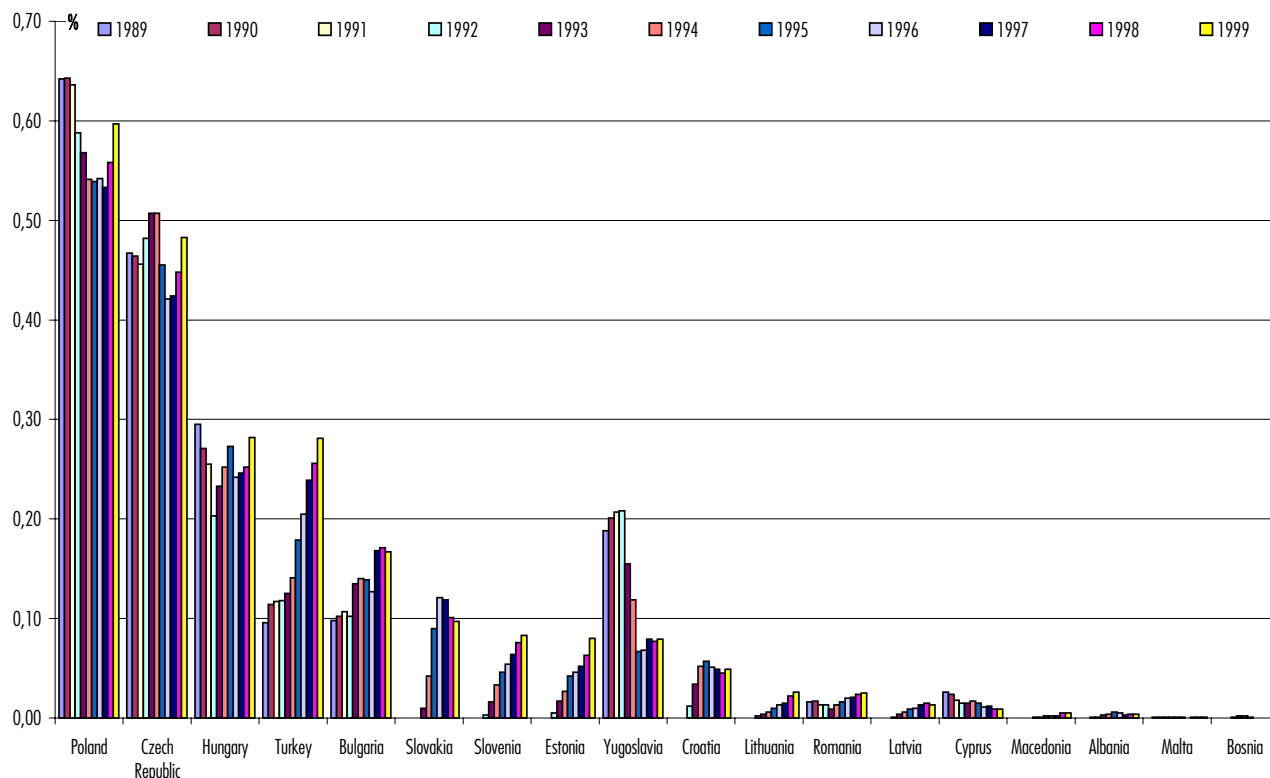
••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• na: not available.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

➤ *How to read these tables? In these two tables, we distinguish the world share of the considered countries in applied biology and ecology in 1989, 1995, and 1999. The evolution between 1995 and 1999 is measured with the base 100 indicator. In addition, we provide the specialisation index and its evolution for the same years. For example, Czech Republic represents nearly 0,46% of the world scientific literature in the applied biology and ecology field in 1989; 0,45% in 1995, and 0,48% in 1999. Then the increase between 1995 and 1999 is close to 6%. Czech Republic particularly increases its specialisation between 1989 and 1999 during the two considered periods. Between 1995 and 1999, the specialisation index goes from 1,12 to 1,43 (nearly +28%).*

Figure 10. World share (%) in the scientific literature of the CEECs (applied biology - ecology) - evolution between 1989 and 1999 - (ranking established for 1999)



Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

Poland (WS=0.60%), Czech Republic (WS=0,48%), Hungary (WS=0,28%), Turkey (WS=0,28%), and Bulgaria (WS=0,17%) appear at the first five positions in the CEECs zone in applied biology regarding the world share indicator.

Between 1989 and 1999, we can observe an overall bottom-up tendency of the world share in most of the CEECs cases.

Czech Republic appears as the only CEEC with a world share higher than 0,1% (all fields combined) and specialised in applied biology and ecology (IS=1,43 in 1999).

4. World share and specialisation index of the selected countries regarding the World - chemistry

Table 11. World share (%) in the scientific literature and scientific specialisation index of the selected countries - evolution between 1989 and 1999 - chemistry

World share in the scientific literature					Specialisation Index				
Country	1989	1995	1999	1999 (base 100=1995)	Country	1989	1995	1999	1999 (base 100=1995)
Albania	na	na	na	na	Albania	na	na	na	na
Bosnia	na	na	na	na	Bosnia	na	na	na	na
Bulgaria	0,4	0,4	0,3	72	Bulgaria	1,5	2,4	2,0	83
Croatia	na	0,2	0,2	85	Croatia	na	2,1	1,9	90
Cyprus	na	na	na	na	Cyprus	na	na	na	na
Czech Republic	1,5	0,9	0,7	72	Czech Republic	2,5	2,3	2,0	87
Estonia	na	0,0	0,0	92	Estonia	na	1,1	0,8	73
France	4,7	5,3	5,6	105	France	1,0	1,0	1,1	102
Germany	8,1	8,2	8,2	100	Germany	1,3	1,3	1,2	92
Greece	0,4	0,4	0,5	108	Greece	1,2	1,1	0,9	89
Hungary	0,7	0,6	0,6	102	Hungary	2,0	2,0	1,8	93
Japan	11,2	11,9	12,4	104	Japan	1,5	1,4	1,4	98
Latvia	na	0,1	0,1	103	Latvia	na	2,9	3,1	107
Lithuania	na	0,1	0,1	158	Lithuania	na	1,8	2,2	123
Macedonia	na	0,0	0,0	113	Macedonia	na	2,7	2,5	93
Malta	na	na	na	na	Malta	na	na	na	na
Poland	1,8	1,6	1,6	100	Poland	2,1	2,2	2,1	97
Portugal	0,1	0,2	0,4	165	Portugal	1,4	1,4	1,5	109
Romania	0,3	0,4	0,4	103	Romania	3,1	3,1	2,7	89
Slovakia	na	0,3	0,3	90	Slovakia	na	2,4	2,0	84
Slovenia	na	0,1	0,2	124	Slovenia	na	1,6	1,6	96
Spain	2,2	3,0	3,3	110	Spain	1,7	1,4	1,3	92
Turkey	0,2	0,4	0,6	162	Turkey	1,2	1,2	1,0	90
United-Kingdom	6,0	6,2	5,9	96	United-Kingdom	0,7	0,7	0,7	101
USA	23,2	23,0	20,3	88	USA	0,7	0,7	0,7	98
Yugoslavia	0,4	0,1	0,2	120	Yugoslavia	1,6	1,4	1,5	109
World	100,0	100,0	100,0	100					

Sources: ISI data, OST treatments.

••• World share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• When the specialisation index is higher than 1,2 (strong specialisation), all the data are written with the red colour. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written with the blue colour. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

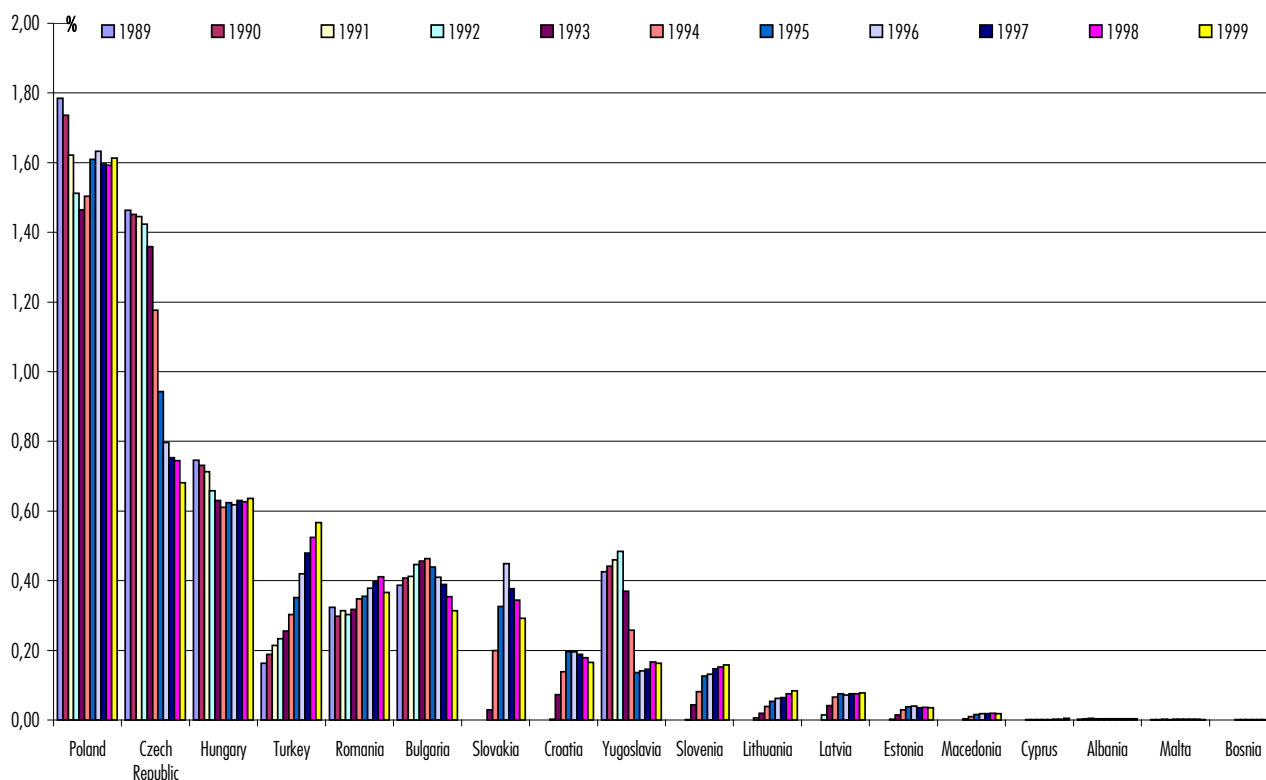
••• na: not available.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

➤ *How to read these tables? In these two tables, we distinguish the world share of the considered countries in chemistry in 1989, 1995, and 1999. The evolution between 1995 and 1999 is measured with the base 100 indicator. In addition, we provide the specialisation index and its evolution for the same years.*

For example, Poland represents nearly 1,8% of the world scientific literature in chemistry in 1989; but 1,6% in 1995 and 1999. Then the decrease between 1989 and 1995 stopped during the second analysed period. Meanwhile Poland is particularly specialised in chemistry with a specialisation index higher than 2,1 and relatively stable during the two considered periods.

Figure 11. World share (%) in the scientific literature of the CEECs (chemistry) - evolution between 1989 and 1999 - (ranking established for 1999)



Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

Poland (WS=1,6%), Czech Republic (WS=0,7%), Hungary (WS=0,6%), Turkey (WS=0,6%), and Romania (WS=0,4%) appear at the first five positions in the CEECs zone in chemistry regarding the world share indicator.

Between 1989 and 1999 and particularly between 1995 and 1999, we can observe an overall bottom-up tendency of the world share in most of the CEECs cases, except for Bulgaria and Slovakia (during the last available year) and except for the first three cases (Poland, Czech Republic and Hungary) which know a gap in the middle of the 1990's but reinforce their positions in the second analysed period.

All the CEECs except for Bosnia, Cyprus, Estonia and Malta appear to be specialised in chemistry. Meanwhile, except for the case of Turkey (IS goes from 1,37 in 1995 to 1,5 in 1999), there is no CEEC which has both a world share higher than 0,1% all fields combined and knows a reinforcement of their specialisation in this field.

Finally, we can observe that the first five CEECs decrease their specialisation in chemistry between 1989 and 1999.

5. World share and specialisation index of the selected countries regarding the World - physics

Table 12. World share (%) in the scientific literature and scientific specialisation index of the selected countries - evolution between 1989 and 1999 - physics

World share in the scientific literature					Specialisation Index				
Country	1989	1995	1999	1999 (base 100=1995)	Country	1989	1995	1999	1999 (base 100=1995)
Albania	na	na	na	na	Albania	na	na	na	na
Bosnia	na	na	na	na	Bosnia	na	na	na	na
Bulgaria	0,3	0,3	0,3	85	Bulgaria	1,1	1,8	1,7	99
Croatia	na	0,1	0,1	93	Croatia	na	1,3	1,3	100
Cyprus	na	0,0	0,0	158	Cyprus	na	1,8	1,7	93
Czech Republic	0,6	0,5	0,4	84	Czech Republic	1,1	1,1	1,1	101
Estonia	na	0,1	0,1	86	Estonia	na	2,1	1,5	68
France	5,2	5,2	5,6	108	France	1,1	1,0	1,1	105
Germany	7,5	8,1	8,5	105	Germany	1,2	1,3	1,2	96
Greece	0,4	0,4	0,5	117	Greece	1,2	1,0	1,0	96
Hungary	0,3	0,3	0,3	102	Hungary	0,8	1,0	1,0	94
Japan	9,6	9,8	10,2	104	Japan	1,3	1,2	1,2	97
Latvia	na	0,1	0,0	67	Latvia	na	2,2	1,5	70
Lithuania	na	0,1	0,1	115	Lithuania	na	2,9	2,6	89
Macedonia	na	0,0	0,0	138	Macedonia	na	1,3	1,6	125
Malta	na	na	na	na	Malta	na	na	na	na
Poland	1,7	1,4	1,4	103	Poland	2,0	1,9	1,9	100
Portugal	0,1	0,2	0,3	144	Portugal	1,6	1,1	1,1	95
Romania	0,1	0,2	0,3	134	Romania	1,4	2,0	2,3	115
Slovakia	na	0,1	0,2	132	Slovakia	na	1,0	1,2	124
Slovenia	na	0,1	0,1	126	Slovenia	na	1,4	1,4	97
Spain	1,1	1,8	2,2	122	Spain	0,9	0,9	0,9	102
Turkey	0,1	0,2	0,4	182	Turkey	0,9	0,7	0,7	101
United-Kingdom	5,6	5,5	5,3	95	United-Kingdom	0,7	0,7	0,7	100
USA	30,3	26,9	22,7	84	USA	0,9	0,8	0,7	93
Yugoslavia	0,4	0,2	0,2	114	Yugoslavia	1,6	1,6	1,6	104
World	100,0	100,0	100,0	100					

Sources: ISI data, OST treatments.

••• World share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• When the specialisation index is higher than 1,2 (strong specialisation), all the data are written with the red colour. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written with the blue colour. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

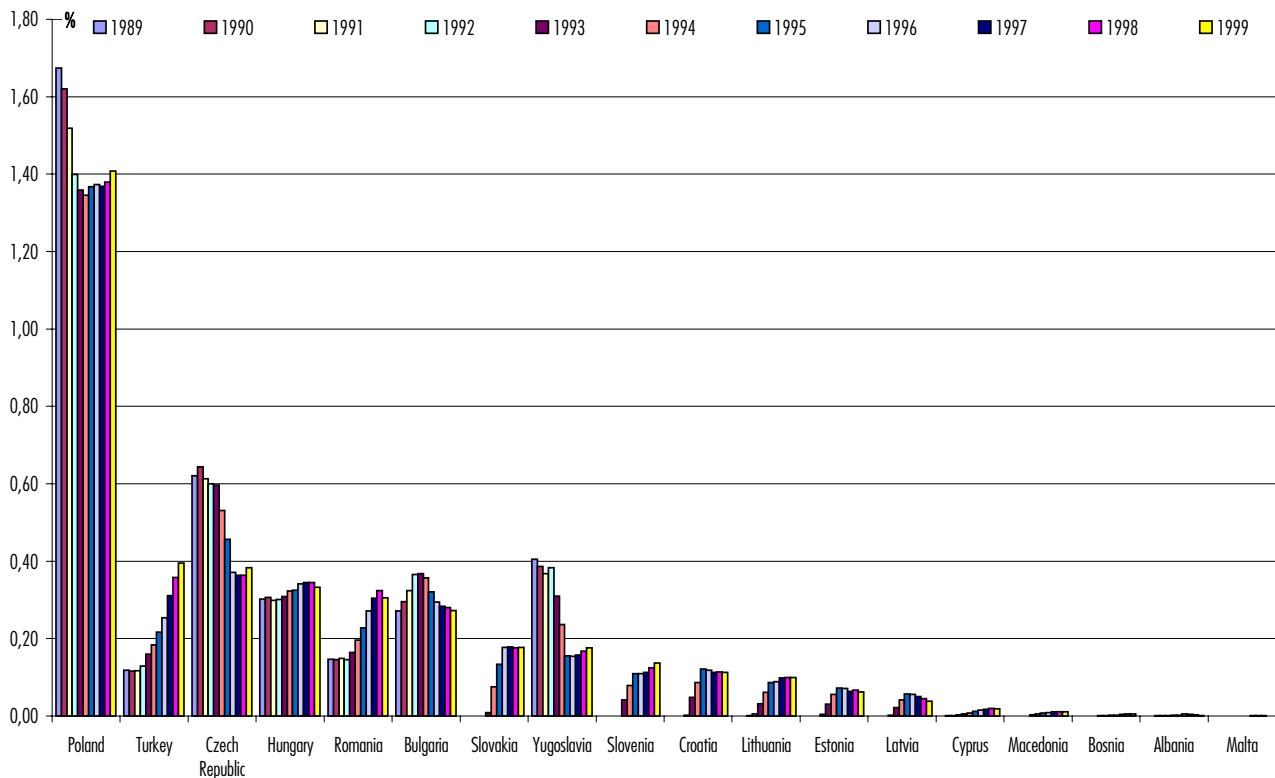
••• na: not available.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

➤ *How to read these tables? In these two tables, we distinguish the world share of the considered countries in physics in 1989, 1995, and 1999. The evolution between 1995 and 1999 is measured with the base 100 indicator. In addition, we provide the specialisation index and its evolution for the same years.*

For example, Poland represents nearly 1,7% of the world scientific literature in physics in 1989; but 1,4% in 1995 and 1999. Then the decrease between 1989 and 1995 stops during the second analysed period. Poland is particularly specialised in physics with a specialisation index close to 1,9 and relatively stable during the two considered periods.

Figure 12. World share (%) in the scientific literature of the CEECs (physics) evolution between 1989 and 1999 - (ranking established for 1999)



Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

Poland (WS=1,4%), Turkey (WS=0,4%), Czech Republic (WS=0,4%), Hungary (WS=0,3%), and Romania (WS=0,3%) appear at the first five positions in the CEECs zone in physics regarding the world share indicator.

Despite a decrease in physics during the first years of the 1990's, Poland maintains its prevailing position in the CEECs zone. Turkey and Romania particularly increase their participation in the world scientific literature in Physics from 1989.

All the CEECs except for Albania, Hungary, Malta and Turkey appear to be specialised in physics. Between 1995 and 1999, Czech Republic, Yugoslavia, Slovakia, Romania, Slovakia and Turkey increase their specialisation in physics.

6. World share and specialisation index of the selected countries regarding the World - earth and Space Sciences

Table 13. World share (%) in the scientific literature and scientific specialisation index of the selected countries - evolution between 1989 and 1999 - earth and space Sciences

World share in the scientific literature					Specialisation Index earth and space sciences				
Country	1989	1995	1999	1999 (base 100=1995)	Country	1989	1995	1999	1999 (base 100=1995)
Albania	na	na	na	na	Albania	na	na	na	na
Bosnia	na	na	na	na	Bosnia	na	na	na	na
Bulgaria	0,1	0,1	0,1	79	Bulgaria	0,5	0,8	0,7	92
Croatia	na	0,1	0,1	67	Croatia	na	1,1	0,8	72
Cyprus	na	na	na	na	Cyprus	na	na	na	na
Czech Republic	0,4	0,4	0,3	77	Czech Republic	0,7	1,0	0,9	93
Estonia	na	0,1	0,1	86	Estonia	na	2,7	1,8	67
France	4,6	5,1	5,9	116	France	1,0	1,0	1,1	112
Germany	4,5	5,2	6,0	116	Germany	0,7	0,8	0,9	107
Greece	0,5	0,6	0,6	101	Greece	1,7	1,5	1,2	83
Hungary	0,1	0,2	0,2	102	Hungary	0,4	0,6	0,6	93
Japan	3,2	3,7	4,2	113	Japan	0,4	0,5	0,5	106
Latvia	na	0,0	0,0	81	Latvia	na	0,8	0,7	81
Lithuania	na	0,0	0,0	107	Lithuania	na	0,5	0,4	81
Macedonia	na	na	na	na	Macedonia	na	na	na	na
Malta	na	na	na	na	Malta	na	na	na	na
Poland	0,4	0,6	0,6	98	Poland	0,5	0,8	0,8	95
Portugal	0,1	0,1	0,2	167	Portugal	0,7	0,9	1,0	109
Romania	0,0	0,1	0,1	104	Romania	0,2	0,4	0,4	89
Slovakia	na	0,1	0,1	119	Slovakia	na	0,6	0,6	112
Slovenia	na	0,0	0,0	102	Slovenia	na	0,6	0,5	80
Spain	1,0	1,9	2,5	132	Spain	0,8	0,9	1,0	110
Turkey	0,2	0,3	0,4	164	Turkey	1,4	0,8	0,8	91
United-Kingdom	7,6	8,4	8,3	99	United-Kingdom	0,9	1,0	1,0	105
USA	40,7	37,7	35,1	93	USA	1,1	1,1	1,1	103
Yugoslavia	0,2	0,1	0,1	72	Yugoslavia	0,8	0,9	0,6	66
World	100,0	100,0	100,0	100					

Sources: ISI data, OST treatments.

••• World share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• When the specialisation index is higher than 1,2 (strong specialisation), all the data are written with the red colour. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written with the blue colour. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

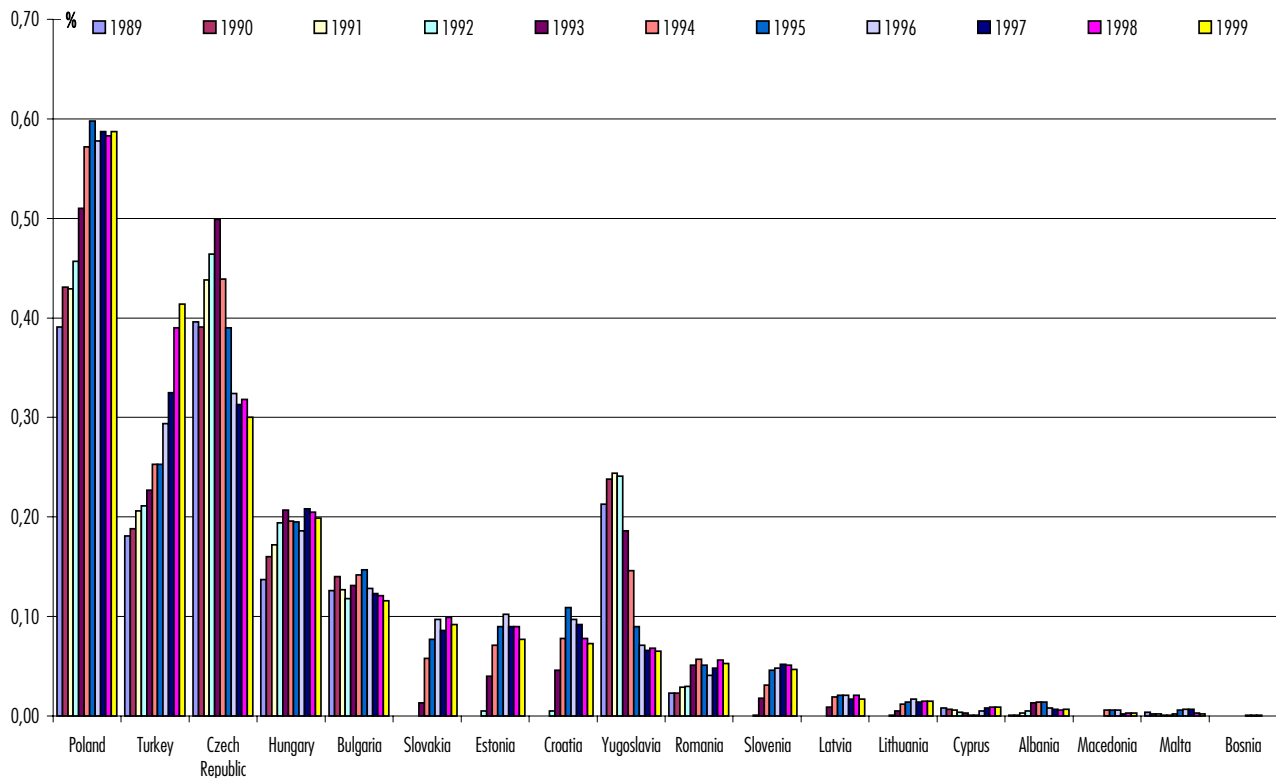
••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• na: not available.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

➤ *How to read these tables? In these two tables, we distinguish the world share of the considered countries in earth and space sciences in 1989, 1995, and 1999. The evolution between 1995 and 1999 is measured with the base 100 indicator. In addition, we provide the specialisation index and its evolution for the same years. For example, Poland represents nearly 0,4% of the world scientific literature in physics in 1989; but 0,6% in 1995 and 1999. Then Poland particularly increases its world share in this field between 1989 and 1995, but only maintains its position after 1995. Poland is particularly despecialised in earth and space sciences with a specialisation index close to 0,8 and relatively stable during the second considered period.*

Figure 13. World share (%) in the scientific literature of the CEECs (earth and space sciences) - evolution between 1989 and 1999 - (ranking established for 1999)



Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

Regarding the world share (WS) indicator, Poland (WS=0,6%), Turkey (WS=0,4%), Czech Republic (WS=0,3%), Hungary (WS=0,2%), and Bulgaria (WS=0,1%) appear at the first five positions in the CEECs zone in space and earth sciences.

We do not observe any overall tendency. Meanwhile, between 1989 and 1999, Turkey and Poland have a strong reinforcement of their presence in the world scientific literature in the field of earth and space sciences.

Slovakia appears as the only CEEC which has a world share higher than 0,1% all fields combined and reinforces its specialisation in earth and space sciences. Meanwhile, there is no other CEEC specialised in this field.

7. World share and specialisation index of the selected countries regarding the World - engineering and technology

Table 14. World share (%) in the scientific literature and scientific specialisation index of the selected countries - evolution between 1989 and 1999 - engineering and technology

World share in the scientific literature					Specialisation Index engineering and technology				
Country	1989	1995	1999	1999 (base 100=1995)	Country	1989	1995	1999	1999 (base 100=1995)
Albania	na	na	na	na	Albania	na	na	na	na
Bosnia	na	na	na	na	Bosnia	na	na	na	na
Bulgaria	0,2	0,2	0,2	88	Bulgaria	0,7	1,2	1,2	102
Croatia	na	0,1	0,1	92	Croatia	na	0,6	0,6	100
Cyprus	na	0,0	0,0	194	Cyprus	na	2,8	3,2	117
Czech Republic	0,5	0,4	0,3	69	Czech Republic	0,9	1,0	0,8	83
Estonia	na	0,0	0,1	222	Estonia	na	0,7	1,2	177
France	3,5	3,9	4,4	113	France	0,8	0,8	0,8	109
Germany	6,3	5,5	5,5	99	Germany	1,0	0,9	0,8	91
Greece	0,6	0,8	0,9	110	Greece	2,1	2,1	1,9	91
Hungary	0,3	0,2	0,3	105	Hungary	0,8	0,8	0,7	96
Japan	9,2	8,2	8,0	97	Japan	1,2	1,0	0,9	91
Latvia	na	0,0	0,0	150	Latvia	na	0,8	1,3	155
Lithuania	na	0,0	0,0	87	Lithuania	na	1,3	0,9	68
Macedonia	na	0,0	0,0	100	Macedonia	na	1,4	1,2	81
Malta	na	na	na	na	Malta	na	na	na	na
Poland	1,3	0,8	0,7	85	Poland	1,5	1,1	0,9	83
Portugal	0,1	0,2	0,4	163	Portugal	1,5	1,5	1,6	107
Romania	0,2	0,2	0,2	121	Romania	1,7	1,4	1,5	104
Slovakia	na	0,1	0,1	102	Slovakia	na	0,7	0,7	96
Slovenia	na	0,1	0,2	120	Slovenia	na	1,8	1,7	92
Spain	0,7	1,3	1,9	152	Spain	0,6	0,6	0,8	127
Turkey	0,3	0,5	0,8	163	Turkey	2,0	1,5	1,4	91
United-Kingdom	7,3	7,2	7,4	103	United-Kingdom	0,9	0,8	0,9	109
USA	38,8	35,1	29,8	85	USA	1,1	1,0	1,0	94
Yugoslavia	0,4	0,2	0,2	107	Yugoslavia	1,4	2,2	2,2	98
World	100,0	100,0	100,0	100					

Sources: ISI data, OST treatments.

••• World share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written with the red colour and bold character (blue colour when the ratio is negative).

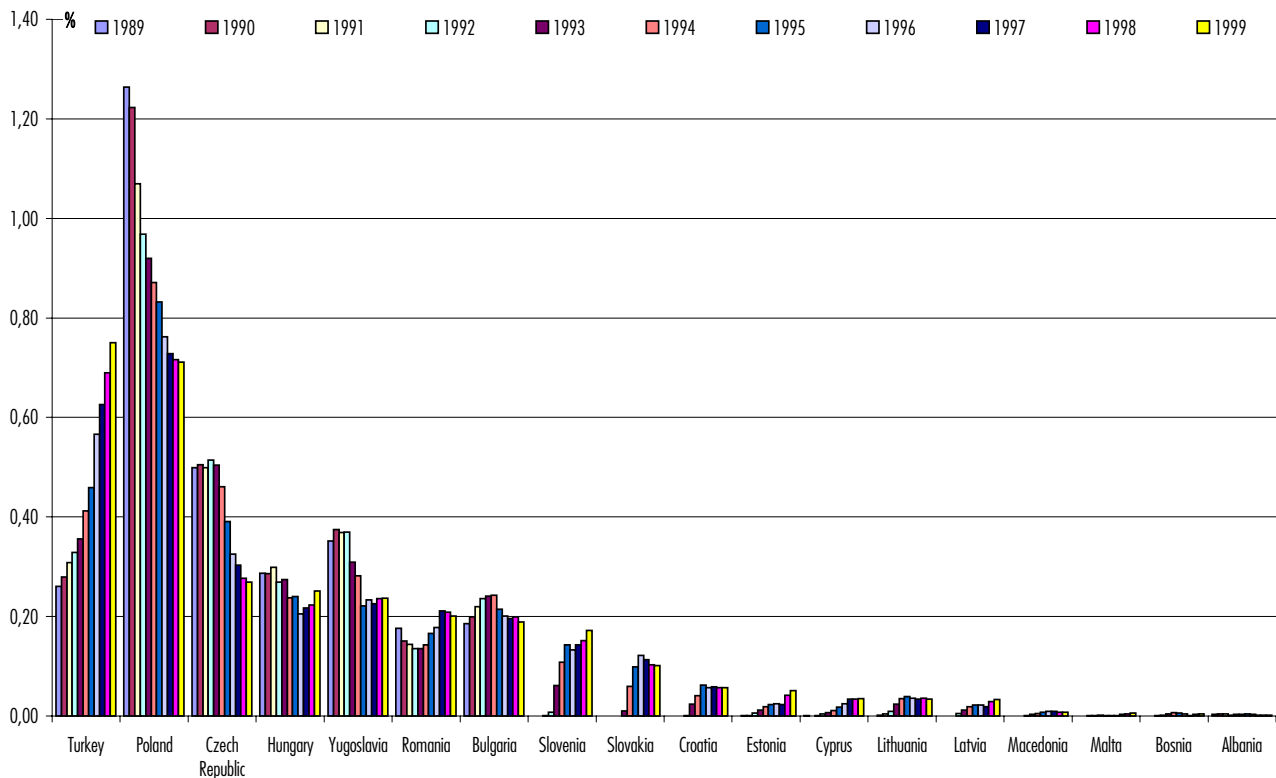
••• When the specialisation index is higher than 1,2 (strong specialisation), all the data are written with the red colour. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written with the blue colour. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• na: not available.

➤ *How to read these tables? In these two tables, we distinguish the world share of the considered countries in engineering and technology in 1989, 1995, and 1999. The evolution between 1995 and 1999 is measured with the base 100 indicator. In addition, we provide the specialisation index and its evolution for the same years. For example, Turkey represents nearly 0,3% of the world scientific literature in engineering and technology in 1989; but 0,5% in 1995 and nearly 0,8% in 1999. Then Turkey particularly increases its world share between 1989 and 1999 and then takes the first position in the CEECs zone in this field. Meanwhile Turkey, which is specialised in engineering and technology, regularly decreases its specialisation during the two considered periods.*

Figure 14. World share (%) in the scientific literature of the CEECs (engineering and technology) - evolution between 1989 and 1999 - (ranking established for 1999)



Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

Turkey (WS=0,8%), Poland (WS=0,7%), Czech Republic (WS=0,3%), Hungary (WS=0,3%), and Romania (WS=0,2%) appear at the first five positions in the CEECs zone in physics regarding the world share indicator.

In this field, we can observe that all the major countries decrease their world share except for Turkey, which particularly increases its world share and presents the higher world share among the CEECs in 1999.

Romania and Bulgaria are the only CEECs, which have a world share higher than 0,1% and reinforce their specialisation in engineering and technology.

8. World share and specialisation index of the selected countries regarding the World - mathematics

Table 15. World share (%) in the scientific literature and scientific specialisation index of the selected countries - evolution between 1989 and 1999 - mathematics

World share in the scientific literature					Specialisation Index				
Country	1989	1995	1999	1999 (base 100=1995)	Country	1989	1995	1999	1999 (base 100=1995)
Albania	na	na	na	na	Albania	na	na	na	na
Bosnia	na	na	na	na	Bosnia	na	na	na	na
Bulgaria	0,4	0,3	0,3	84	Bulgaria	1,5	1,8	1,7	98
Croatia	na	0,1	0,2	134	Croatia	na	1,4	2,0	143
Cyprus	0,0	0,0	0,0	253	Cyprus	0,6	2,5	3,9	156
Czech Republic	0,8	0,6	0,5	90	Czech Republic	1,3	1,5	1,6	108
Estonia	na	0,0	0,1	270	Estonia	na	0,7	1,4	215
France	6,0	7,1	7,9	111	France	1,3	1,4	1,5	108
Germany	7,2	7,0	6,9	98	Germany	1,2	1,1	1,0	90
Greece	0,6	0,6	0,7	119	Greece	2,0	1,5	1,5	97
Hungary	1,0	0,9	0,8	91	Hungary	2,7	2,7	2,3	83
Japan	4,9	4,3	4,5	106	Japan	0,6	0,5	0,5	99
Latvia	na	0,0	0,0	88	Latvia	na	1,0	0,9	91
Lithuania	na	0,1	0,1	150	Lithuania	na	1,7	1,9	117
Macedonia	na	0,0	0,0	163	Macedonia	na	na	na	na
Malta	na	na	na	na	Malta	1,4	0,5	2,0	411
Poland	1,9	1,5	1,4	95	Poland	2,2	2,0	1,9	92
Portugal	0,2	0,3	0,3	119	Portugal	2,0	1,7	1,3	78
Romania	0,4	0,4	0,4	123	Romania	3,8	3,1	3,2	106
Slovakia	na	0,2	0,3	111	Slovakia	na	1,7	1,8	104
Slovenia	na	0,2	0,2	106	Slovenia	na	2,7	2,2	82
Spain	1,6	2,2	3,1	139	Spain	1,2	1,1	1,3	116
Turkey	0,2	0,2	0,4	182	Turkey	1,2	0,7	0,7	101
United-Kingdom	5,3	5,3	5,2	99	United-Kingdom	0,6	0,6	0,6	104
USA	36,1	32,5	27,4	84	USA	1,0	1,0	0,9	93
Yugoslavia	0,5	0,2	0,3	124	Yugoslavia	1,7	2,1	2,4	113
World	100,0	100,0	100,0	100					

Sources: ISI data, OST treatments.

••• World share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

••• When the specialisation index is higher than 1,2 (strong specialisation), all the data are written with the red colour. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written with the blue colour. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written with the red colour and bold character (blue colour when the ratio is negative).

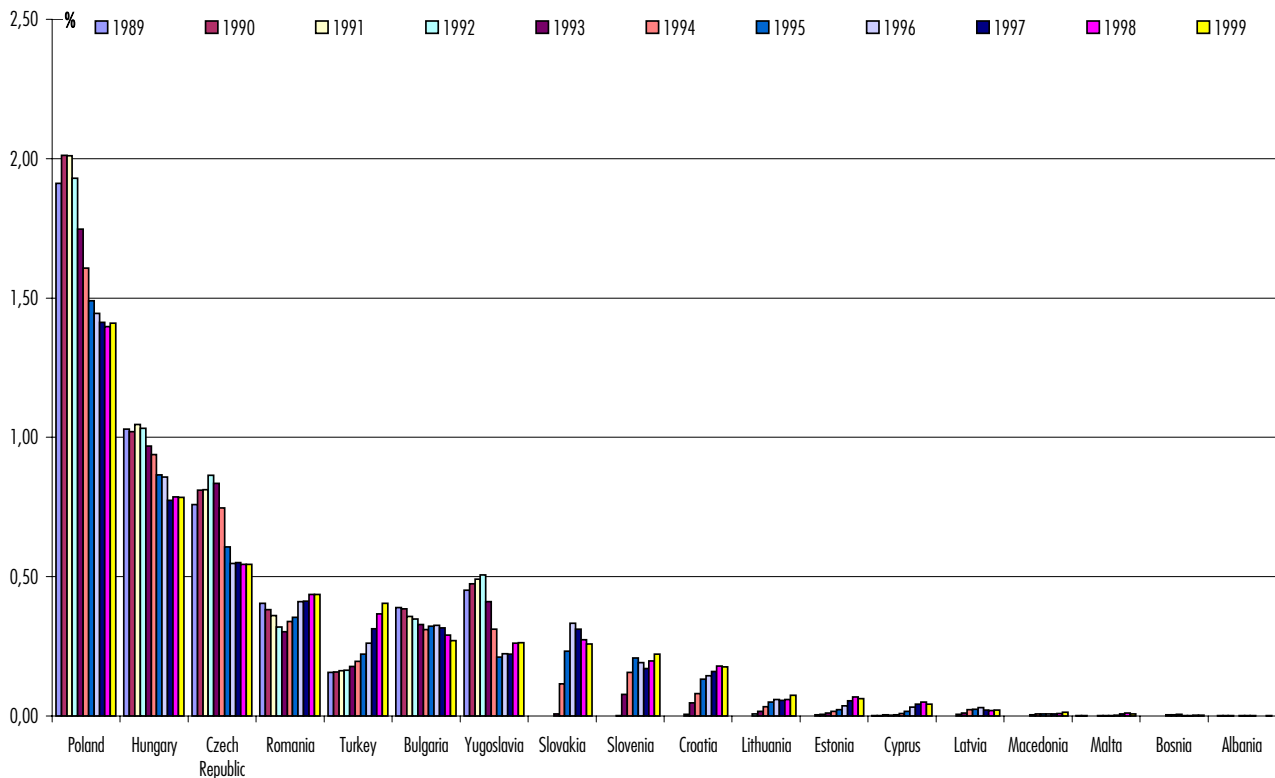
••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• na: not available.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

➤ *How to read these tables? In these two tables, we distinguish the world share of the considered countries in mathematics in 1989, 1995, and 1999. The evolution between 1995 and 1999 is measured with the base 100 indicator. In addition, we provide the specialisation index and its evolution for the same years. For example, Poland represents nearly 1,9% of the world scientific literature in mathematics in 1989, but 1,5% in 1995 and nearly 1,4% in 1999. Then Poland decreases its world share between 1989 and 1999 but preserves its first position in the CEECs zone in this field. Poland, which is specialised in mathematics, regularly decreases its specialisation during the two considered periods.*

Figure 15. World share (%) in the scientific literature of the CEECs (mathematics) evolution between 1989 and 1999 - (ranking established for 1999)



Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in the research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

Poland (WS=1,4%), Hungary (WS=0,8%), Czech Republic (WS=0,5%), Romania (WS=0,4%), and Turkey (WS=0,4%) appear at the first five positions in the CEECs zone in physics regarding the world share indicator.

In this field, we can observe that all the major countries decrease their world share between 1989 and 1999 except for Turkey and Romania, which particularly increase their world share between 1995 and 1999.

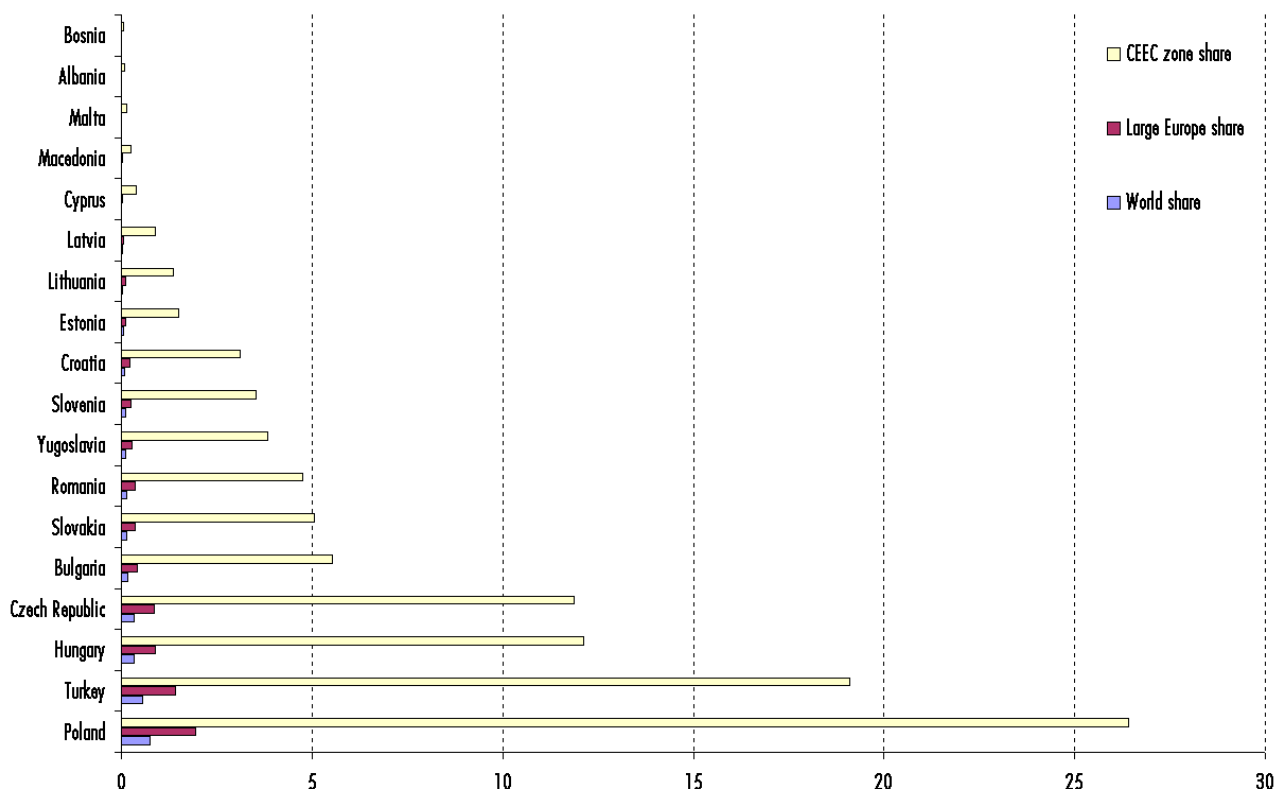
All the CEECs appear to be specialised in mathematics, except for Turkey.

III. Comparison of the share in the scientific literature of Central and Eastern European countries in the CEECs zone per discipline -1999

In this report, we consider indicators worldwide in the world dimension. We provide an additional dimension when including other levels of analysis by distinguishing the position of the CEECs zone.

Poland represents 0,46% of the world scientific literature, but nearly 26% of scientific publication of the CEECs zone. In physics, Poland represents more than 35% of the scientific publications of the CEECs zone. Turkey represents 43% of the medical research scientific production of the CEECs zone (see the following figure).

Figure 16. Share (%) of each Central and Eastern European country in the world scientific literature, in the Large Europe scientific literature and in the CEECs zone scientific literature - all fields combined - 1999 (ranking established for the year 1999)



Sources: ISI data, OST treatments.

●●● In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in research. That is why we provide data in the case of the countries which have a world share higher than 0,1%, only to give an overview concerning the presence of the considered countries in the SCI database. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

This figure illustrates the advantage to distinguish third analysis levels: the World, the wider Europe and the CEECs zone. It also gives an overall idea of the dimension of commented data in each of those three dimensions. In the following tables and figures, we only give an overview of the share of the considered countries in the CEECs zone.

Table 16. Share in the scientific literature (% in 1999) of each CEEC in the CEECs zone - per discipline - (ranking established by world share 'all fields combined')

Share of each CEEC in the scientific publication of the CEEC zone

	Fundamental biology	Medical research	Applied biology and ecology	Chemistry	Physics	Earth & space sciences	Engineering & technology	Mathematics	All fields combined
Bulgaria	6,2	2,8	7,3	6,1	6,9	5,6	6,1	5,4	5,5
Czech Republic	16,8	7,8	21,2	13,1	9,7	14,5	8,6	10,9	11,9
Cyprus	0,4	0,2	0,4	0,1	0,5	0,4	1,1	0,9	0,4
Estonia	1,9	1,2	3,5	0,7	1,6	3,7	1,6	1,2	1,5
Hungary	17,8	12,2	12,3	12,3	8,5	9,6	8,1	15,7	12,1
Latvia	0,8	0,2	0,6	1,5	1,0	0,8	1,0	0,4	0,9
Lithuania	1,4	0,4	1,1	1,6	2,5	0,7	1,1	1,5	1,4
Malta	0,2	0,4	0,1	0,0	0,0	0,1	0,2	0,2	0,1
Poland	24,2	15,7	26,2	31,1	35,7	28,3	22,9	28,2	26,4
Romania	1,3	1,0	1,1	7,1	7,7	2,5	6,5	8,7	4,8
Slovenia	3,8	3,1	3,6	3,1	3,5	2,3	5,5	4,4	3,5
Slovakia	8,3	3,9	4,2	5,6	4,5	4,4	3,3	5,2	5,1
Turkey	11,8	43,4	12,3	10,9	10,0	20,0	24,1	8,1	19,1
Albania	0,0	0,1	0,2	0,1	0,0	0,3	0,1	0,0	0,1
Bosnia	0,0	0,1	0,0	0,0	0,1	0,0	0,1	0,1	0,1
Croatia	2,6	4,1	2,2	3,2	2,9	3,5	1,8	3,5	3,1
Macedonia	0,1	0,2	0,2	0,3	0,3	0,1	0,3	0,3	0,3
Yugoslavia	2,4	3,2	3,5	3,1	4,5	3,1	7,6	5,3	3,8

Sources: ISI data, OST treatments.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted. Lastly, the measure of scientific production must incorporate the Human and Financial resources invested in research. The particularly concerned countries are the following: Estonia, Lithuania, Latvia, Cyprus, Macedonia, Malta, Albania, and Bosnia.

••• When the share of the countries in the considered discipline is higher than its share all fields combined, we write the number in red color and in boldface character; if not the character are written in blue color and normal character.

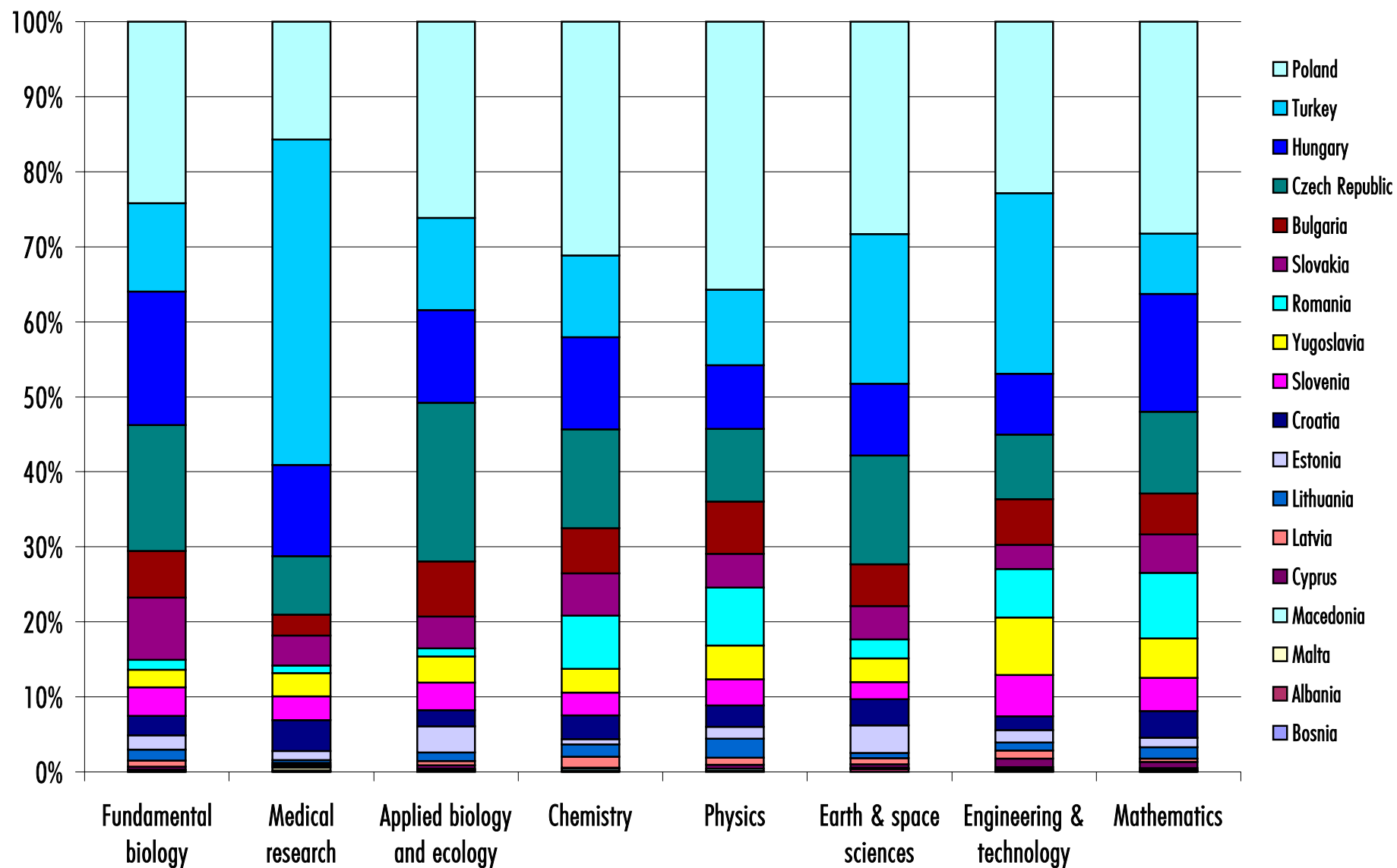
➤ *How to read this table? In 1999, Bulgaria represents nearly 5,5% of the CEECs zone scientific literature. At the field level, Bulgaria does better than its average all disciplines combined in the majority of the disciplines except for medical research (2,8%) and mathematics (5,4%).*

In 1999, Poland appears as the more active country in the CEECs zone with 26,4% of the scientific production of the zone. Turkey, Hungary, Czech Republic follow with a share close to respectively 19,1%, 12,1% and 11,9%. The first five CEECs countries nearly represent 70% of the scientific publication of the zone all fields combined. In 1999, Poland represents 24,2% of the scientific production of the CEECs zone in the field of fundamental biology. Meanwhile, this share is lower than its share all fields combined. Turkey occupies a strong position in medical research (43,3% of the scientific production of the CEECs zone).

The following figure summarises the share per discipline in the scientific literature in 1999 of each Central and Eastern European Country in the CEECs zone. We observe that in each discipline the first four countries realise more than 60% of the scientific production of the zone. We also observe that the four first countries realise more than 80% in medical research and more than 70% in fundamental research, applied biology and ecology and earth and space sciences.

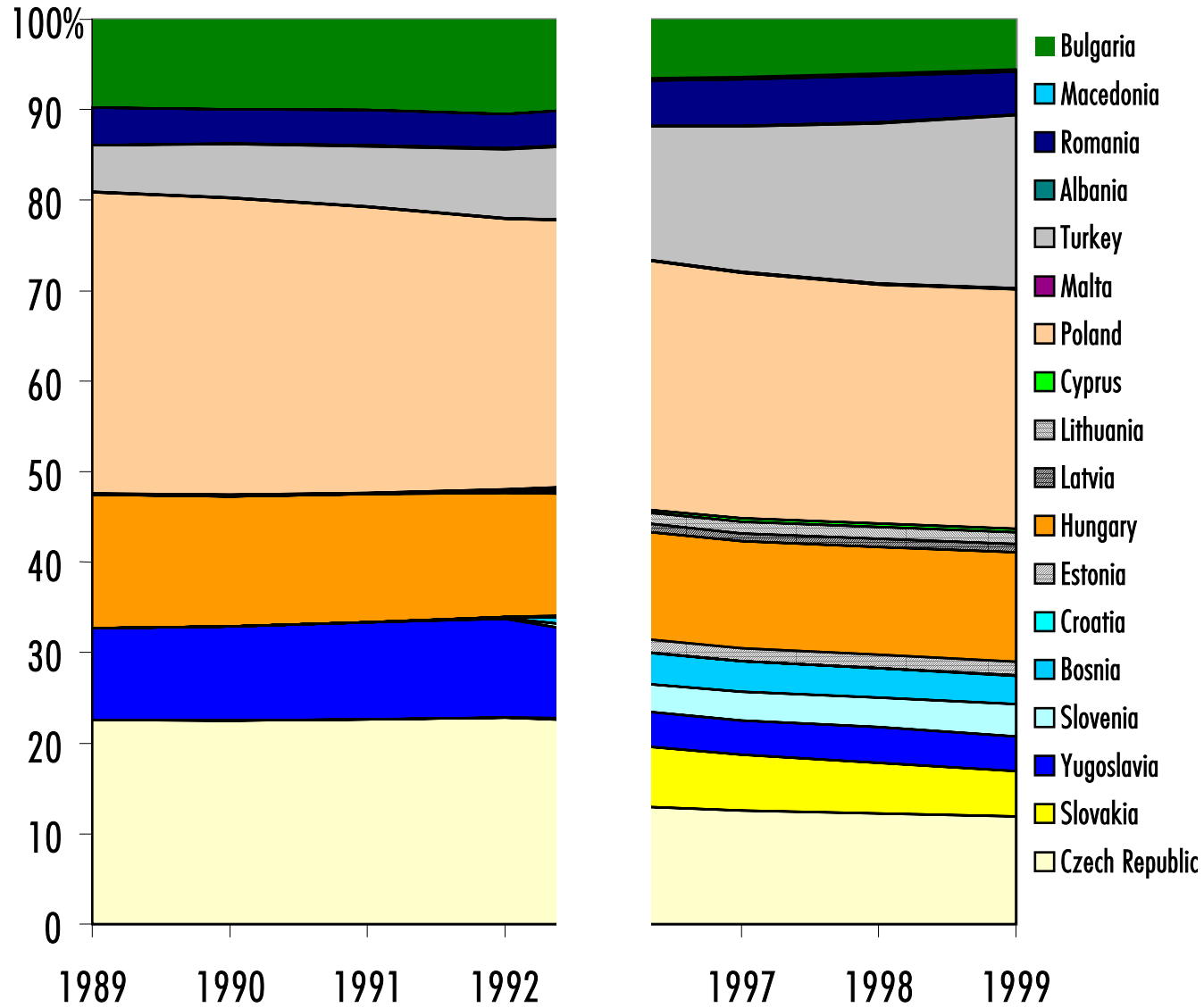
Through the time, we observe in figure 18 that: Bulgaria and Poland decrease their share in scientific literature of the CEECs zone; Turkey particularly increases its share in scientific literature of the CEECs zone; Hungary and Romania maintain their positions; Ex-Yugoslavia which now concerns Yugoslavia, Croatia, Macedonia, Bosnia maintains its position; The decreasing weight of Slovakia plus Czech Republic in comparison with Ex-Czechoslovakia.

Figure 17. Share (%) of the CEECs in the scientific literature of the CEECs zone - per discipline - 1999 (Top down ranking: All fields combined 1999)



Sources: ISI data, OST treatments.

Figure 18. Share (%) of the CEECs in the scientific literature of the CEECs zone - all fields combined - Evolution between 1989 and 1992 and between 1996 and 1999



Sources: ISI data, OST treatments.

Part B. International scientific co-publications

Part B.I. International scientific co-publication at the zone level - discipline level - 1995 - 1999

In this part, we consider the international scientific co-publication activity at the zone level. We call zone, the geographical area, which appears comparable (see annex for the considered classification).

For our purpose, we are interested in the level of co-operative activities, as expressed by the number of co-publications (co-signed articles). Quite obviously, other forms of exchange, less directly accessible to the strictly bibliometric techniques such as the mobility of students and researchers, can also be studied.

Several methods for counting publications can be used in the field of bibliometrics. Generally, they all converge on the same conclusions. Nonetheless, particular types of set-ups could easily be encountered whereby this convergence is missing. An explanation of each of the calculation methods available, complete with its specific advantages and flaws, is indeed vital.

Determining the number of co-publications does presume a series of methodological choices. The first of these choices pertains to the type of counting technique.

In order to preserve an overall consistency and additive properties, the indicators presented in the body of this study are based on the same principle of fraction-based counting, as have publications: the sum of the bilateral links existing between authors for a given document is thus unitary, with each bilateral link being divided into two coupled relations.

The set of indicators published in this study are then calculated using the principle of "fraction-based counting" adapted to the level of macro-analysis, whether this level pertains to documents (each document is ascribed an equal unitary weight, to be split among the authors) or to journals (a journal's contribution spread across several fields of specialisation is to be split up on a fractional basis among these fields).

As an example, for a Country X/Country X article (two authors both with Country X addresses), Country X's publication count comes to 1: ascribed entirely to an internal Country X/Country X co-publication count. The same reasoning applies to the zones. **We have explicitly excluded this case in this study.** In other words, all "intra-zone" and "intra-national" collaborations are excluded from this study. For example, the EU involves at least one intra-EU address and one extra-EU address: the EU explicitly excludes all intra-national and intra-EU co-publications. The effect of the relation inside the EU area and inside all considered zones is then neutralised.

On the other hand, for a Country X/Country Y article, Country X's publication count would stand at 1/2: ascribed entirely to the co-publication count with Country Y (which would thus be increased by 1/2).

For a three-author article (Country X/Country Y/Country Z), for example, Country X's publication count would be 1/3, with an even split occurring between the co-publication count with Country Y (with 1/3) and the co-publication count with Country Z (with 1/3). Any interpretation of the absolute co-publication numbers must consider this breakdown in terms of "exchange fractions".

Co-publications are both symmetrical and additive: for example, a comparison can be drawn between the sum of a given zone's external co-publications with its total number of co-publications (which is called "internationalisation ratio") or with its total number of whole publications.

Table 17. World share (%) of international scientific co-publication in the World – all fields combined - 1995 and 1999

World share (%) of international scientific co-publications in the World from 1995							World share (%) of international scientific co-publications in the World from 1999						
	EU candidates	Other CEEC	USA	Japan	Russia	EU		EU candidates	Other CEEC	USA	Japan	Russia	EU
With ASEAN	0,1	0,0	0,5	2,2	0,0	0,7	With ASEAN	0,1	0,1	0,6	2,0	0,0	0,6
Australia / New Zealand	0,8	3,7	4,3	3,1	1,1	4,9	Australia / New Zealand	1,1	3,4	4,5	3,5	1,1	5,1
Brazil	0,2	0,1	1,6	0,6	0,6	1,8	Brazil	0,5	0,8	1,8	0,6	1,1	2,0
Canada	3,9	4,2	10,8	4,6	2,7	6,2	Canada	3,1	2,5	9,7	4,0	2,4	5,5
China	0,3	0,1	2,7	5,3	0,4	2,5	China	0,5	0,7	3,3	7,1	0,6	2,9
EFTA	3,0	2,6	3,9	1,8	2,4	8,0	EFTA	2,8	1,8	3,7	1,8	2,7	8,2
EU	55,4	44,9	44,2	25,0	47,6	-	EU	57,7	48,2	45,0	26,1	53,3	-
EU candidates	-	9,3	3,9	2,8	7,5	9,5	EU candidates	-	12,3	3,7	3,4	5,4	9,7
India	0,3	0,1	1,9	1,7	0,5	1,7	India	0,4	0,3	1,7	1,8	0,3	1,6
Israel	0,9	0,6	4,0	0,6	1,6	1,9	Israel	0,8	0,9	3,2	0,5	1,5	1,8
Japan	2,8	2,1	8,2	-	2,7	4,4	Japan	3,8	3,1	8,2	-	4,2	4,8
Near and middle East	0,3	0,4	0,6	0,2	0,0	0,7	Near and middle East	0,5	0,0	0,5	0,2	0,1	0,6
NIC	0,3	1,2	4,3	4,4	0,7	0,8	NIC	0,4	0,9	4,9	5,1	1,0	1,1
Other Africa	0,1	0,0	0,9	0,4	0,0	2,4	Other Africa	0,1	0,0	0,7	0,4	0,1	2,1
Other Asia	0,2	0,0	0,3	0,5	0,1	0,5	Other Asia	0,2	0,0	0,2	0,5	0,1	0,4
Other CEEC	0,8	-	0,4	0,2	0,3	0,6	Other CEEC	0,8	-	0,3	0,2	0,2	0,5
Other Far East	0,1	0,0	0,0	0,1	0,1	0,2	Other Far East	0,0	0,1	0,0	0,2	0,1	0,2
Other ISC	2,8	0,9	0,3	0,4	11,5	1,2	Other ISC	3,0	1,3	0,5	0,6	6,5	1,5
Other Latin America	0,8	0,1	3,3	0,6	1,0	3,2	Other Latin America	1,0	0,8	3,6	0,7	1,2	3,7
Other Oceania	0,0	0,0	0,1	0,1	0,0	0,1	Other Oceania	0,0	0,0	0,0	0,0	0,0	0,0
Other Southern mediterranean	0,3	0,1	0,7	0,6	0,1	1,7	Other Southern mediterranean	0,4	0,2	0,6	0,6	0,1	1,9
Russia	5,5	2,9	2,6	1,9	-	6,0	Russia	4,0	2,6	2,6	2,8	-	6,6
Southern Africa	0,3	0,3	0,6	0,2	0,3	0,8	Southern Africa	0,2	0,4	0,6	0,2	0,2	0,8
USA	20,6	26,4	-	42,8	18,5	40,2	USA	18,8	19,5	-	37,6	18,0	38,1

Sources: ISI data, OST treatments.

••• Note: see annex for a definition of zones. The EU candidate countries: 13 EU candidate countries engaged in the process of enlargement of the European Union: Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia and Turkey. The other Central and Eastern European countries than the EU candidate countries: Albania, Croatia, Bosnia, Macedonia and Yugoslavia. EFTA: Island, Liechtenstein, Norway and Switzerland.

➤ *How to read these tables? For each zone, the columns give the distribution of total international scientific co-publications between the considered zone and the other zones.*

➤ *For example, in 1995, the EU represents more than 55% of the external scientific co-publications of the EU candidate countries and nearly 45% of the international scientific co-publications of the other CEECs. The USA count for more than 20% of the Candidate countries international scientific copublication.*

Between 1995 and 1999, North America and Europe maintain particularly strong relations. Europe carries out 54,4% of its international co-publications with North America and 58,6% of its international co-publications with Europe.

In 1995, the most important scientific partner of the EU candidate countries are the EU (55,4%), the USA (20,6%), Russia, (5,5%), Canada (4,2%) and EFTA (3,0%).

The analysis between 1995 and 1999 of the World share in the international scientific literature (see table 20), indicates the increasing weight of the EU (+4%), Japan (+36%), other ISC (+7%), and the decreasing weight of the USA (-9%), Canada (-21%), Russia (-27%), EFTA (-7%), in the international scientific publication of the EU candidate countries.

Then, in 1999, the most important scientific partner of the EU candidate countries aggregate continues to be the EU (nearly 58%), which is followed by the USA (nearly 19%), Russia and Japan (around 4%).

For the other CEECs zone, the most important scientific partners in 1995 are respectively the EU (nearly 45%), the USA (26,4%), the EU candidate countries aggregate (9,3%), Canada (4,2%) and Australia - New Zealand (3,7%).

The analysis between 1995 and 1999 of the world share in the international scientific literature (see table 20), indicates the increasing weight of the EU (+7%), Japan (+48%) and the EU candidate countries (+32%), and the decreasing weight of the USA (-26%), the EU candidate countries (-1%), Russia (-27%), EFTA (-7%), in the international scientific publication of the other CEECs area.

Finally, for the other CEECs area, the most important scientific partner in 1999 is still the EU (48,2%), which is followed by the USA (19,5%), the EU candidate countries (12,3%), Australia-New Zealand (3,4%) and Japan (3,1%).

To conclude, from another point of view, we also observe the increasing weight of the EU candidate countries in the international scientific co-publication of the other CEECs (+32%), Japan (+21%), and the EU (+2%), as well as the decreasing weight of the other CEECs in the international scientific co-publication of the EU (-5%), the USA (-25%), and Russia (-33%).

Table 18. Evolution between 1995 and 1999 of the share (%) of international scientific co-publication in the World – all fields combined

Evolution between 1995 and 1999 of the World share of international scientific co-publications in the World from

	EU candidates	Other CEEC	USA	Japan	Russia	EU
ASEAN	100	na	120	91	na	86
Australia / New Zealand	138	92	105	113	100	104
Brazil	250	800	113	100	183	111
Canada	79	60	90	87	89	89
China	167	700	122	134	150	116
EFTA	93	69	95	100	113	103
EU	104	107	102	104	112	-
EU candidates	-	132	95	121	72	102
India	133	300	89	106	60	94
Israel	89	150	80	83	94	95
Japan	136	148	100	na	156	109
Near and middle East	167	0	83	100	na	86
NIC	133	75	114	116	143	138
Other Africa	100	0	78	100	na	88
Other Asia	100	0	67	100	100	80
Other CEEC	100	-	75	100	67	83
Other Far East	0	na	na	200	100	100
Other ISC	107	144	167	150	57	125
Other Latin America	125	800	109	117	120	116
Other Southern mediterranean	133	200	86	100	100	112
Russia	73	90	100	147	-	110
Southern Africa	67	133	100	100	67	100
USA	91	74	-	88	97	95

Sources: ISI data, OST treatments.

••• The EU candidate countries: 13 Candidate countries engaged in the process of enlargement of the European Union: Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia and Turkey.

••• The other Central and Eastern European countries than the EU candidate countries: Albania, Croatia, Bosnia, Macedonia and Yugoslavia.

••• EFTA: Island, Liechtenstein, Norway and Switzerland.

••• The CEECs zone is divided into the EU candidate countries aggregate and the other CEECs aggregate and into the South-East European countries (Albania, Bulgaria, Bosnia, Croatia, Cyprus, Malta, Macedonia, Romania, Slovenia, Turkey and Yugoslavia) and the Central European countries (Estonia, Hungary, Latvia, Lithuania, Poland, Czech Republic and Slovakia).

••• *How to read this table? This table presents the results of base 100 ratio calculations which provide a dynamic perspective of the evolution between 1989 and 1999: when the indicator is higher than 100, it means that the cooperation degree between the two considered zones is higher in 1999 than in 1989. Respectively, when the indicator is lower than 100, it means that the cooperation degree between the two zones considered is lower in 1999 than in 1995. Those "base 100 indicators" are simply calculated as follows: the 1999's data are divided by the 1995's data and 100 have multiplied this ratio.*

I. The first ten scientific partners of the selected zones - 1989 - 1995 - 1999 - all fields combined

We now make a zoom on the first scientific partners of the EU candidate countries, the other CEECs and the EU considered as a whole, between 1989 and 1995.

Firstly, we concentrate on the all fields combined (table 22).

Then we present the first scientific partners by scientific discipline at the zone level.

In the EU candidate countries case, the overall range of the first scientific partners is stable between 1989 and 1999. We can observe that the EU and Japan reinforce their presence in the EU candidate countries international scientific publications. The EU is the first scientific partner of the EU candidate countries and nearly 58% of the international scientific copublications of the EU candidate countries aggregate concern the EU. Japan goes from the sixth position in 1989 (1,9%) to the fourth position (3,8%) in 1999. The USA maintains its weight in the EU candidate countries international scientific collaboration (around 19%). Russia stays the third scientific partner of the EU candidate countries but goes from 14,7% of the EU candidate countries international scientific co-publication to 4,0%. Nevertheless, this evolution must be attenuated by the increasing weight of the countries of the Independent States Community, which represent 3,0% of the international scientific publication of the EU candidate countries. Canada goes from the fourth to the fifth position.

For the other CEECs area, we observe that the progression of the EU candidate countries (from 8,0% to 12,3% between 1989 and 1999) in the international scientific co-operation of the other CEECs area. The EU candidate countries are then the third scientific partner of the CEECs area, behind the EU (48,2%) and the USA (19,5%). In terms of evolution, the EU increases its weight in the international scientific of the other CEECs from 42,7% to 48,2% i.e. nearly + 13%. At the same time, the USA goes from 28,5% to 19,5% i.e. nearly - 31% between 1989 and 1999.

We can observe that all these evolutions seem to highlight first, the US and the European attraction according to their respective weight in the international scientific literature and, second, the importance of the geographical proximity and complexity of the relationship between the EU candidate countries and the other CEECs. Of course, some other explanations can highlight those evolutions: the cultural links, the colonial past, etc. These evolutions are also detailed by disciplinary fields (8 disciplines).

Table 19. The first ten scientific partners of the EU with the other zones - 1989, 1995 and 1999 - All fields combined

World share (%) of international scientific co-publications in the World of the EU

1989	fundamental biology	medical research	applied biology and ecology	chemistry	physics	earth and space sciences	engineering and technology	mathematics	All fields combined
With	1 USA 50,3	1 USA 46,5	1 USA 31,9	1 USA 34,1	1 USA 44,6	1 USA 49,6	1 USA 43,9	1 USA 52,7	1 USA 45,2
	2 EFTA 10,3	2 EFTA 12,6	2 Canada 8,3	2 EU candidates 16,3	2 EFTA 10,4	2 Canada 8,1	2 EU candidates 10,4	2 Canada 10,1	2 EFTA 8,9
	3 Canada 7,5	3 Canada 6,2	3 Australia/N.Zealand 8,2	3 EFTA 7,3	3 EU candidates 9,9	3 Australia/N.Zealand 6,1	3 Canada 8,3	3 EU candidates 8,5	3 EU candidates 8,3
	4 EU candidates 7,3	4 Other Africa 5,9	4 Other Africa 7,3	4 Canada 6,8	4 Russia 6,0	4 EFTA 5,8	4 China 4,5	4 Australia/N.Zealand 4,2	4 Canada 7,0
	5 Japan 4,7	5 EU candidates 5,5	5 EU candidates 6,5	5 Russia 4,6	5 Australia/N.Zealand 5,5	5 EU candidates 4,2	5 Japan 4,4	5 EFTA 3,4	5 Australia/N.Zealand 4,2
	6 Australia/N.Zealand 4,2	6 Australia/N.Zealand 4,3	6 Other Latin America 6,2	6 Japan 4,1	6 Japan 4,3	6 Russia 4,1	6 EFTA 4,2	6 Israel 3,4	6 Japan 3,9
	7 Russia 2,3	7 Japan 3,7	7 EFTA 5,8	7 Other Latin America 3,8	7 Israel 2,7	7 Other Latin America 4,0	7 Australia/N.Zealand 3,9	7 Japan 3,2	7 Russia 3,0
	8 Israel 2,2	8 Other Latin America 1,8	8 Other Southern med. 4,3	8 Australia/N.Zealand 3,7	8 Other Latin America 2,6	8 Japan 2,9	8 Other Southern med. 3,4	8 Brazil 2,3	8 Other Africa 2,7
	9 Other Latin America 2,0	9 Israel 1,7	9 India 3,2	9 Other Southern med. 3,6	9 India 2,6	9 India 2,1	9 India 2,6	9 China 2,3	9 Other Latin America 2,7
	10 Other Africa 1,9	10 Other Southern med. 1,6	10 Japan 3,2	10 India 3,1	10 China 2,1	10 Other Africa 2,0	10 Near and middle East 2,2	10 Other Latin America 1,9	10 Israel 2,2

World share (%) of international scientific co-publications in the World of the EU

1995	fundamental biology	medical research	applied biology and ecology	chemistry	physics	earth and space sciences	engineering and technology	mathematics	All fields combined
With	1 USA 48,3	1 USA 46,8	1 USA 29,0	1 USA 27,8	1 Other CEEC 33,4	1 USA 45,5	1 USA 38,7	1 USA 42,3	1 USA 40,2
	2 EFTA 10,1	2 EFTA 11,8	2 Australia/N.Zealand 9,1	2 EU candidates 17,9	2 Near and middle East 13,8	2 Canada 7,8	2 EU candidates 11,6	2 EU candidates 12,0	2 EU candidates 9,5
	3 EU candidates 7,1	3 Australia/N.Zealand 6,0	3 Other Africa 8,4	3 Russia 7,9	3 Canada 12,9	3 EFTA 6,0	3 Canada 6,8	3 Canada 7,9	3 EFTA 8,0
	4 Canada 6,9	4 Canada 5,9	4 Canada 8,1	4 EFTA 6,5	4 EFTA 7,4	4 Australia/N.Zealand 6,0	4 China 6,1	4 Russia 5,5	4 Canada 6,2
	5 Japan 5,2	5 Other Africa 5,5	5 EU candidates 7,5	5 Canada 5,5	5 Israel 5,2	5 Russia 5,9	5 Russia 4,9	5 Australia/N.Zealand 4,9	5 Russia 6,0
	6 Australia/N.Zealand 5,0	6 EU candidates 5,0	6 Other Latin America 6,5	6 Japan 5,0	6 Brazil 4,8	6 EU candidates 5,5	6 EFTA 4,8	6 China 3,7	6 Australia/N.Zealand 4,9
	7 Russia 3,5	7 Japan 3,9	7 EFTA 6,2	7 Other Southern med. 4,1	7 EU candidates 3,1	7 Other Latin America 4,3	7 Australia/N.Zealand 4,7	7 EFTA 3,6	7 Japan 4,4
	8 Other Latin America 2,7	8 Other Latin America 2,4	8 Japan 3,5	8 Australia/N.Zealand 3,9	8 Other Latin America 2,9	8 Japan 2,7	8 Japan 4,1	8 Israel 3,2	8 Other Latin America 3,2
	9 Israel 1,9	9 China 1,7	9 ASEAN 2,7	9 Other Latin America 3,9	9 Other ISC 2,8	9 China 2,6	9 Other Latin America 2,4	9 Japan 3,1	9 China 2,5
	10 Other Africa 1,8	10 Brazil 1,5	10 Other Southern med. 2,7	10 China 2,9	10 Australia/N.Zealand 2,5	10 Brazil 2,2	10 Other Southern med. 2,3	10 Other Latin America 2,5	10 Other Africa 2,4

World share (%) of international scientific co-publications in the World of the EU

1999	fundamental biology	medical research	applied biology and ecology	chemistry	physics	earth and space sciences	engineering and technology	mathematics	All fields combined
With	1 USA 46,3	1 USA 47,0	1 USA 27,9	1 USA 25,4	1 USA 30,2	1 USA 43,3	1 USA 35,9	1 USA 37,4	1 USA 38,1
	2 EFTA 9,6	2 EFTA 11,7	2 Australia/N.Zealand 9,3	2 EU candidates 17,7	2 Russia 15,5	2 EFTA 7,4	2 EU candidates 10,5	2 EU candidates 11,6	2 EU candidates 9,7
	3 EU candidates 7,6	3 Canada 6,1	3 Other Africa 7,8	3 Russia 8,8	3 EU candidates 12,9	3 Australia/N.Zealand 6,6	3 Canada 6,5	3 Russia 6,7	3 EFTA 8,2
	4 Canada 6,3	4 Australia/N.Zealand 6,0	4 EU candidates 7,8	4 EFTA 7,0	4 EFTA 7,1	4 Canada 6,6	4 EFTA 6,1	4 Canada 5,9	4 Russia 6,6
	5 Japan 5,7	5 EU candidates 5,7	5 EFTA 7,4	5 Japan 5,9	5 Japan 5,8	5 Russia 6,2	5 China 5,8	5 Australia/N.Zealand 5,5	5 Canada 5,5
	6 Australia/N.Zealand 5,3	6 Other Africa 4,4	6 Canada 7,2	6 Other Latin America 4,7	6 Other ISC 3,5	6 EU candidates 6,0	6 Australia/N.Zealand 5,5	6 China 5,5	6 Australia/N.Zealand 5,1
	7 Russia 3,9	7 Japan 4,1	7 Other Latin America 7,1	7 Other Southern med. 4,5	7 Canada 3,4	7 Other Latin America 5,2	7 Russia 4,9	7 EFTA 3,8	7 Japan 4,8
	8 Other Latin America 3,1	8 Other Latin America 2,6	8 Japan 3,5	8 Canada 4,3	8 Other Latin America 3,3	8 Japan 3,2	8 Japan 4,7	8 Other Latin America 3,2	8 Other Latin America 3,7
	9 Other Africa 1,8	9 China 1,6	9 Brazil 3,3	9 China 3,7	9 China 3,3	9 China 2,7	9 Other Latin America 3,2	9 Israel 3,1	9 China 2,9
	10 Israel 1,8	10 Brazil 1,4	10 China 2,9	10 Australia/N.Zealand 3,6	10 Australia/N.Zealand 2,5	10 Brazil 2,2	10 Other Southern med. 2,5	10 Other ISC 2,9	10 Other Africa 2,1

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

In the EU case, we can observe that the progression of the EU candidate countries in the international scientific cooperation of the EU from rank 3 (8,3%) to rank 2 (9,7%) i.e. nearly +17%, as well as Russia from rank 7 (3,0%) to rank 4 (6,6%) i.e. + 120%. EFTA relatively maintains its position. In addition, the scientific co-operation appears more squandering in the EU case than in the cases of the EU candidate countries and the other CEECs.

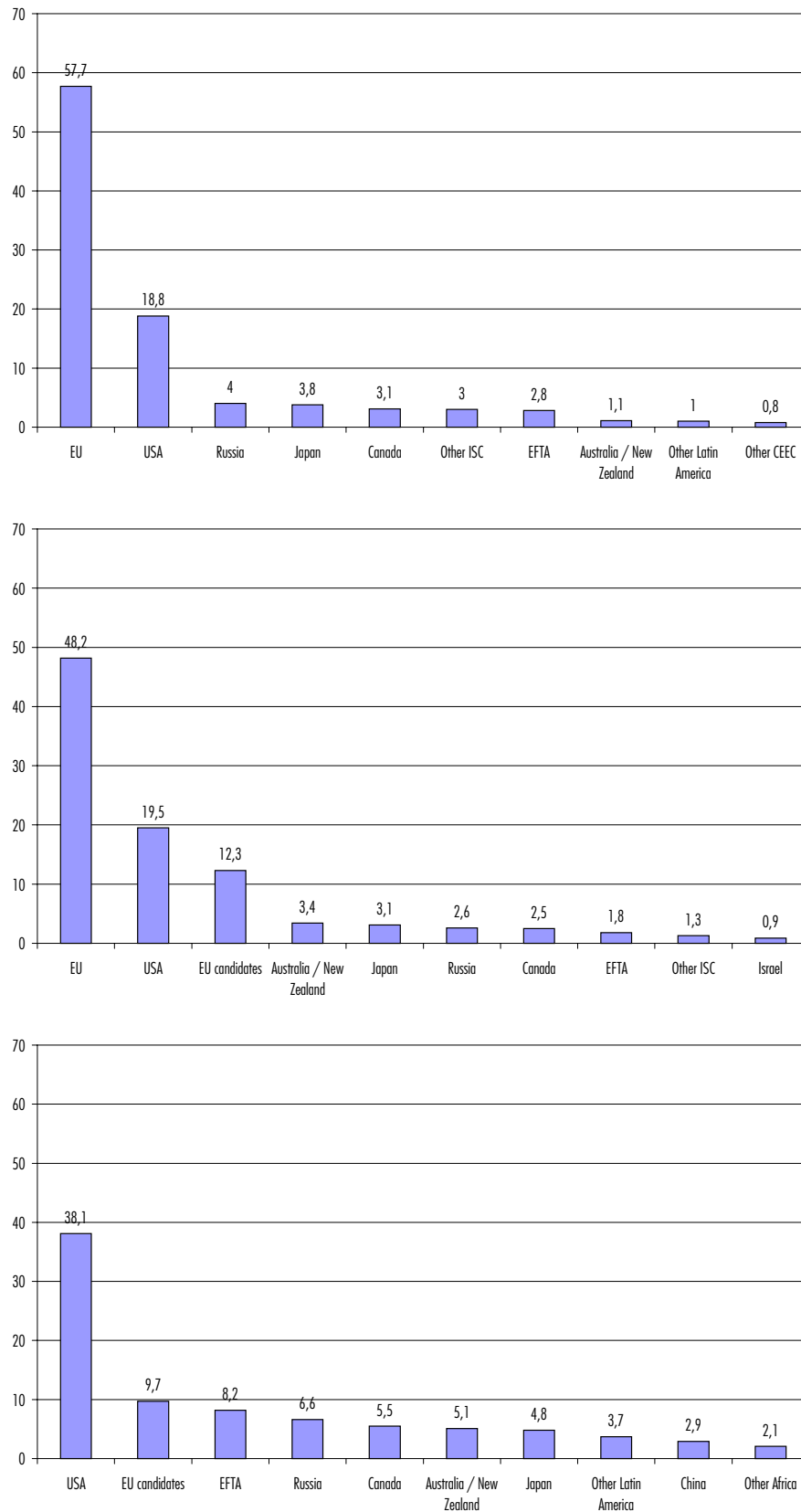
Table 20. The first ten scientific partners by zone of the EU candidate countries and the other CEECs - 1989, 1995 and 1999 - All fields combined

		World share (%) of international scientific co-publications in the World from		1989
		EU candidates	Other CEEC	
With	1 EU	52,6	1 EU	42,7
	2 USA	18,9	2 USA	28,5
	3 Russia	14,7	3 Russia	8,5
	4 Canada	4,3	4 EU candidates	8,0
	5 EFTA	2,1	5 EFTA	4,3
	6 Japan	1,9	6 Canada	3,9
	7 Other CEEC	1,2	7 Japan	1,2
	8 Other Latin America	0,7	8 Australia / New Zealand	0,6
	9 Other Southern mediterranean	0,7	9 China	0,5
	10 Australia / New Zealand	0,6	10 Other Latin America	0,4
		World share (%) of international scientific co-publications in the World from		1995
		EU candidates	Other CEEC	
With	1 EU	55,4	1 EU	44,9
	2 USA	20,6	2 USA	26,4
	3 Russia	5,5	3 EU candidates	9,3
	4 Canada	3,9	4 Canada	4,2
	5 EFTA	3,0	5 Australia / New Zealand	3,7
	6 Other ISC	2,8	6 Russia	2,9
	7 Japan	2,8	7 EFTA	2,6
	8 Israel	0,9	8 Japan	2,1
	9 Australia / New Zealand	0,8	9 NIC	1,2
	10 Other Latin America	0,8	10 Other ISC	0,9
		World share (%) of international scientific co-publications in the World from		1999
		EU candidates	Other CEEC	
With	1 EU	57,7	1 EU	48,2
	2 USA	18,8	2 USA	19,5
	3 Russia	4,0	3 EU candidates	12,3
	4 Japan	3,8	4 Australia / New Zealand	3,4
	5 Canada	3,1	5 Japan	3,1
	6 Other ISC	3,0	6 Russia	2,6
	7 EFTA	2,8	7 Canada	2,5
	8 Australia / New Zealand	1,1	8 EFTA	1,8
	9 Other Latin America	1,0	9 Other ISC	1,3
	10 Other CEEC	0,8	10 Israel	0,9

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

Figure 19. The first ten scientific partners by zone of the EU candidate countries aggregate (1), the other CEECs aggregate (2) and the EU (2) - 1999 - All fields combined



Sources: ISI data, OST treatments.

Note: see annex for a complete definition of zones.

**II. The first ten scientific partners of the selected zone
- 1989 - 1995 - 1999 - per discipline**

Table 21. The first ten scientific partners by zone of the EU candidate countries and the other CEECs - 1989, 1995 and 1999 - fundamental biology

		World share (%) of international scientific co-publications in the World from		1989
		EU candidates	Other CEEC	
With	1 EU	52,8	1 EU	58,8
	2 USA	22,1	2 USA	18,3
	3 Russia	14,9	3 Russia	6,9
	4 Canada	2,6	4 Canada	6,7
	5 Japan	2,1	5 EU candidates	5,9
	6 EFTA	1,6	6 EFTA	1,2
	7 Australia / New Zealand	0,9	7 Australia / New Zealand	0,6
	8 Other Latin America	0,8	8 Near and middle East	0,6
	9 Other CEEC	0,6	9 Israel	0,4
	10 Brazil	0,5	10 Japan	0,3
		World share (%) of international scientific co-publications in the World from		1995
		EU candidates	Other CEEC	
With	1 EU	54,5	1 EU	50,7
	2 USA	25,8	2 USA	28,9
	3 Russia	4,5	3 EU candidates	7,1
	4 EFTA	3,1	4 Canada	7,0
	5 Canada	3,0	5 Israel	1,7
	6 Japan	3,0	6 EFTA	1,5
	7 Other ISC	1,2	7 Russia	1,3
	8 Other Latin America	1,1	8 Japan	1,1
	9 Australia / New Zealand	1,0	9 Australia / New Zealand	0,4
	10 Israel	0,9	10 Other Asia	0,1
		World share (%) of international scientific co-publications in the World from		1999
		EU candidates	Other CEEC	
With	1 EU	58,6	1 EU	59,5
	2 USA	24,6	2 USA	26,0
	3 Japan	3,6	3 EU candidates	6,9
	4 EFTA	2,7	4 Canada	3,4
	5 Canada	2,6	5 NIC	0,8
	6 Russia	2,3	6 Other Latin America	0,7
	7 Australia / New Zealand	1,0	7 EFTA	0,6
	8 Other Latin America	0,9	8 Israel	0,5
	9 Israel	0,8	9 Japan	0,5
	10 Other ISC	0,7	10 Russia	0,5

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

In fundamental biology (table 23), the scientific relationship between the EU candidate countries aggregation and the other zone is stable between 1989 and 1999. Meanwhile, we can observe that Japan reinforces its presence in the international scientific publication of the EU candidate countries (Japan goes from the fifth position in 1989 and the sixth position in 1995 to the third position in 1999).

The scientific relationships between the other CEECs and the other zones is also very stable, except for the case of the relationship with Canada. In fact, the other CEECs aggregate reinforces its relation with the EU and decreases its relation with Canada.

At the same time (see table 21), the EU candidate countries aggregate reinforces its position in the EU international scientific publication in term of rank (4 to 3) and in term of share (7,3% in 1989 to 7,6% in 1999).

Table 22. The first ten scientific partners by zone of the EU candidate countries, the other CEECs - 1989, 1995 and 1999 - medical research

		World share (%) of international scientific co-publications in the World from		1989
		EU candidates	Other CEEC	
With	1 EU	60,2	1 EU	43,8
	2 USA	19,4	2 USA	34
	3 Russia	8,9	3 Russia	8,5
	4 Japan	2,7	4 EU candidates	5,3
	5 Canada	2,4	5 Canada	1,9
	6 EFTA	2,3	6 Japan	1,7
	7 Other CEEC	0,8	7 EFTA	1,6
	8 Australia / New Zealand	0,7	8 Other Latin America	1,2
	9 Other Far East	0,5	9 NIC	0,7
	10 Other Latin America	0,4	10 Other Africa	0,4
		World share (%) of international scientific co-publications in the World from		1995
		EU candidates	Other CEEC	
With	1 EU	56,8	1 EU	44
	2 USA	26,7	2 USA	31,9
	3 Japan	3,6	3 Japan	6,8
	4 EFTA	3,1	4 EU candidates	6,4
	5 Canada	2,9	5 Canada	3,4
	6 Russia	1,8	6 Near and middle East	2,3
	7 Other ISC	0,8	7 EFTA	1,7
	8 Other CEEC	0,8	8 Australia / New Zealand	1,5
	9 Australia / New Zealand	0,7	9 Other ISC	0,6
	10 Israel	0,5	10 Russia	0,6
		World share (%) of international scientific co-publications in the World from		1999
		EU candidates	Other CEEC	
With	1 EU	59,1	1 EU	46,8
	2 USA	25,9	2 USA	29,1
	3 Japan	3,5	3 EU candidates	7,8
	4 EFTA	3,1	4 Japan	6,2
	5 Canada	2,1	5 EFTA	4,6
	6 Israel	1	6 Australia / New Zealand	2,6
	7 Australia / New Zealand	0,9	7 Canada	1
	8 Other CEEC	0,8	8 Israel	0,6
	9 Other ISC	0,7	9 Other Latin America	0,3
	10 Near and middle East	0,7	10 NIC	0,3

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

In medical research (table 24), the evolutions between 1989 and 1999 of the international scientific relationship between the EU candidate countries and the other zones are relatively stable and characterised only by the decreasing weight of Russia in the international scientific relationship of the EU candidate countries. We can also note the increasing weight of the USA in the international scientific co-operation of the EU candidate countries (from 19,4% to nearly 26%). In the case of the other CEECs, the evolutions shows the decrease of the international scientific co-operation with Canada.

We do not observe any other major evolution at this level of analysis, both in terms of rank and world share in the EU international scientific co-operation (see table 21).

Table 23. The first ten scientific partners by zone of the EU candidate countries and the other CEECs - 1989, 1995 and 1999 - applied biology and ecology

		World share (%) of international scientific co-publications in the World from		1989
		EU candidates	Other CEEC	
With	1 EU	51	1 EU	48,2
	2 USA	16,6	2 USA	35,2
	3 Russia	10,7	3 Canada	5,9
	4 Canada	6,9	4 EU candidates	4,9
	5 Australia / New Zealand	2,2	5 Russia	3
	6 EFTA	2,1	6 Australia / New Zealand	1,6
	7 Other Latin America	2,0	7 Other Latin America	0,7
	8 Other Southern mediterranean	1,5	8 Other Southern mediterranean	0,5
	9 Japan	1,3	9 EFTA	0
	10 Other Asia	1,2	10 Southern Africa	0
		World share (%) of international scientific co-publications in the World from		1995
		EU candidates	Other CEEC	
With	1 EU	54,9	1 EU	49
	2 USA	19,3	2 USA	24,8
	3 Canada	4,4	3 EU candidates	10,8
	4 Russia	3,8	4 Canada	9,1
	5 EFTA	3,7	5 Australia / New Zealand	5,5
	6 Japan	2,4	6 NIC	0,6
	7 Israel	1,8	7 Israel	0,2
	8 Other Latin America	1,6	8 EFTA	0
	9 Australia / New Zealand	1,5	9 Southern Africa	0
	10 Other Asia	1,2	10 ASEAN	0
		World share (%) of international scientific co-publications in the World from		1999
		EU candidates	Other CEEC	
With	1 EU	58,3	1 EU	46,9
	2 USA	16,3	2 USA	24,4
	3 Canada	4,3	3 EU candidates	16,8
	4 Japan	4,3	4 Canada	6,3
	5 EFTA	4,1	5 Brazil	2,5
	6 Russia	2,5	6 China	1,3
	7 Israel	2,0	7 Other Latin America	1
	8 Other ISC	1,3	8 Russia	0,5
	9 Australia / New Zealand	1,2	9 Other ISC	0,4
	10 Other Latin America	1,1	10 EFTA	0

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

In applied biology and ecology (table 25), the scientific relationship between the EU candidate countries and the other zones is stable between 1989 and 1999. The EU, the USA, and Canada appear as the first three scientific partners of the EU candidate countries. We can observe that Russia decreases its relationship with the EU candidate countries and Japan reinforces its presence in the international scientific publication of the EU candidate countries. Japan goes from the ninth position in 1989 (1,3% of the international scientific co-operation of the EU candidate countries) to the sixth position in 1995 (2,4%) and the fourth position in 1999 (4,3%).

The scientific relationships between the other CEECs and the other zones are also very stable with the EU and the USA even if the world share of the international scientific co-publication of the EU candidate countries with the USA decreases from 35,2% (in 1989) to 24,4% (in 1999).

In addition, the other CEECs aggregate reinforces its relation with the EU candidate countries aggregate and decreases its relation with Canada.

At the same time (see table 21), the EU candidate countries aggregate reinforces its position in the international scientific publication of the EU, both in term of rank (5 to 4) and in term of world share (6,5% in 1989 to 7,8% in 1999). The other CEECs area does not appear in the first ten scientific partners of the EU in the field of the applied biology and ecology.

In chemistry (table 26), the scientific relationships between the EU candidate countries and the other zones are stable between 1989 and 1999. The EU, the USA, and Russia appear as the first three scientific partners of the EU candidate countries. We can also observe that Russia decreases its relationships in terms of rank and world share with the EU candidate countries. Japan reinforces its presence in the international scientific publication of the EU candidate countries. Japan goes from the seventh position (1,6% of the international scientific co-operation of the EU candidate countries) in 1989 to the fourth position (4,4%) in 1999.

The scientific relationship between the other CEECs and the EU, the USA and the EU candidate countries evolves between 1989 and 1999 as follows: the EU particularly reinforces its participation in the scientific co-operation of this zone (from 37% in 1989 to 43,2% in 1999). The USA go from the second position (30%) in 1989 to the third position (16,6%) in 1999. And the EU candidate countries aggregate goes from the third position (12,7%) in 1989 to the second position (23,4%) in 1999.

During the same period of time (see table 21), the EU decreases its international scientific collaboration with the USA (from 35,1% in 1989 to 25,4% in 1999). The EU also maintains its international scientific relationships with the EU candidate countries. The EU candidate countries aggregate preserves its second position in the top ten of scientific partners of the EU with a participation close to 18% of the European international scientific publication in the field of chemistry.

Table 24. The first ten scientific partners by zone of the EU candidate countries and the other CEECs - 1989, 1995 and 1999 - chemistry

		World share (%) of international scientific co-publications in the World from		1989
		EU candidates	Other CEEC	
With	1 EU	57	1 EU	37
	2 Russia	19	2 USA	30
	3 USA	11,9	3 EU candidates	12,7
	4 Canada	3,7	4 Russia	10,1
	5 Other CEEC	2	5 EFTA	5,8
	6 EFTA	1,8	6 Canada	1,8
	7 Japan	1,6	7 Australia / New Zealand	0,8
	8 Other Southern mediterranean	1	8 China	0,8
	9 India	0,6	9 Other Latin America	0,6
	10 Other Latin America	0,3	10 Israel	0,4
		World share (%) of international scientific co-publications in the World from		1995
		EU candidates	Other CEEC	
With	1 EU	56,7	1 EU	39,1
	2 USA	17,3	2 USA	30
	3 Russia	7,7	3 EU candidates	17,8
	4 Other ISC	3,5	4 NIC	2,7
	5 Canada	3,1	5 EFTA	2,4
	6 EFTA	2,8	6 Russia	2,2
	7 Japan	2,6	7 Other ISC	1,9
	8 Other CEEC	1,5	8 Canada	1,6
	9 Other Southern mediterranean	0,6	9 Japan	1,3
	10 Israel	0,6	10 Southern Africa	0,4
		World share (%) of international scientific co-publications in the World from		1999
		EU candidates	Other CEEC	
With	1 EU	61,4	1 EU	43,2
	2 USA	12,8	2 EU candidates	23,4
	3 Russia	4,7	3 USA	16,6
	4 Japan	4,4	4 Russia	3,6
	5 Other ISC	4	5 Other ISC	2,3
	6 EFTA	3,1	6 Japan	2,1
	7 Canada	2,4	7 NIC	2
	8 Other CEEC	1,5	8 Canada	1,4
	9 Australia / New Zealand	0,9	9 EFTA	1,3
	10 Other Latin America	0,9	10 Australia / New Zealand	1

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

In physics (table 27), the scientific relationship between the EU candidate countries aggregate and the other zones evolves between 1989 and 1999 as follows: the EU stays the first scientific partner of the EU candidate (59% of the international scientific co-publication of the EU candidate countries). Russia progressively decreases its relationship in terms of rank and world share with the EU candidate countries but this evolution contrasts with the increasing relationship with the other Independent States Community (which appears in 1999 as the fourth privileged scientific partner of the EU candidate countries). The USA are the second scientific partner of the EU candidate countries but the weight of the USA in the EU candidate countries international scientific relationship is decreasing across the time (from 15,3% in 1989 to 14% in 1999).

Table 25. The first ten scientific partners by zone of the EU candidate countries and the other CEECs - 1989, 1995 and 1999 - physics

		World share (%) of international scientific co-publications in the World from		1989
		EU candidates	Other CEEC	
With	1 EU	54,2	1 EU	43,4
	2 Russia	18,9	2 USA	21,8
	3 USA	15,3	3 Russia	11,9
	4 EFTA	3,4	4 EFTA	7,5
	5 Canada	2,3	5 EU candidates	5,5
	6 Japan	1,4	6 Canada	5
	7 Other CEEC	1,2	7 Australia / New Zealand	0,9
	8 Other Southern mediterranean	0,8	8 Southern Africa	0,7
	9 Other Latin America	0,6	9 Israel	0,6
	10 China	0,5	10 Japan	0,6
		World share (%) of international scientific co-publications in the World from		1995
		EU candidates	Other CEEC	
With	1 Russia	40,3	1 Russia	47,4
	2 Other CEEC	33,4	2 Israel	7,3
	3 Israel	10,1	3 Brazil	6,7
	4 Brazil	5,0	4 Near and middle East	5,7
	5 Australia / New Zealand	2,9	5 Japan	4,9
	6 Japan	2,4	6 Canada	4,7
	7 Near and middle East	1,3	7 India	4,5
	8 EFTA	1,2	8 EFTA	3,9
	9 Canada	0,7	9 EU candidates	3,7
	10 Other Southern mediterranean	0,6	10 USA	2,4
		World share (%) of international scientific co-publications in the World from		1999
		EU candidates	Other CEEC	
With	1 EU	59	1 EU	56,3
	2 USA	14	2 USA	13,2
	3 Russia	6	3 EU candidates	8,3
	4 Other ISC	5,8	4 Japan	3,6
	5 Japan	4,2	5 Australia / New Zealand	3,1
	6 EFTA	3,0	6 Russia	2,9
	7 Canada	2,1	7 Other ISC	2,5
	8 Other Latin America	1,2	8 Southern Africa	1,7
	9 Israel	0,9	9 EFTA	1,6
	10 Australia / New Zealand	0,8	10 Brazil	1,4

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

The scientific relationship between the other CEECs and the EU, the USA, Russia and the EU candidate countries evolves between 1989 and 1999. The EU particularly reinforces its participation in the scientific co-operation of this zone (from 43,4% in 1989 to 56,3% in 1999). The USA are the second scientific partner of the other CEECs area in physics but the weight of the USA in the EU candidate countries international scientific relationship decreases across the time (from 21,8% in 1989 to 13,2% in 1999). The same happens with Russia, which goes from 11,9% to 2,9%. Finally, the EU candidate countries aggregate goes from the fifth position (5,5%) in 1989 to the third position (8,3%) in 1999.

During the same period of time (see table 21), the EU decreases its international scientific collaboration with the USA (from 44,6% in 1989 to 30,2% in 1999). On the other hand, the EU reinforces its international scientific relationship in the field of physics with the EU candidate countries (from 9,9% in 1989 to 12,9% in 1999 i.e. +30%), and with Russia (6% in 1989 to 15,5% in 1999).

In earth and space sciences (table 28), the scientific relationship between the EU candidate countries and the other zones is stable between 1989 and 1999: the EU stays the first scientific partner of the EU candidate countries (nearly 55% of the EU candidate countries international scientific co-publication). The USA are the second scientific partner and the weight

of the USA in the international scientific relationship of the EU candidate countries is stable across the time. Russia progressively decreases its relationship with the EU candidate countries, not in terms of rank but in terms of world share (from 15,2% in 1989 to 6% in 1999). The same happens to Canada.

Table 26. The first ten scientific partners by zone of the EU candidate countries and the other CEECs - 1989, 1995 and 1999 - earth and space sciences

		World share (%) of international scientific co-publications in the World from		1989
		EU candidates	Other CEEC	
With	1 EU	47	1 EU	56,3
	2 USA	19,2	2 USA	16,4
	3 Russia	15,2	3 EU candidates	14,6
	4 Canada	6,3	4 EFTA	9,2
	5 EFTA	3,0	5 Japan	2,1
	6 Other CEEC	2,0	6 Canada	1,3
	7 Other Latin America	1,6	7 China	0,1
	8 Other Southern mediterranean	1,5	8 Southern Africa	0
	9 Japan	1,0	9 ASEAN	0
	10 China	0,8	10 Australia / New Zealand	0
		World share (%) of international scientific co-publications in the World from		1995
		EU candidates	Other CEEC	
With	1 EU	52,4	1 EU	60,3
	2 USA	21,7	2 USA	12,1
	3 Russia	7,7	3 EFTA	11,5
	4 Canada	5,0	4 EU candidates	6,5
	5 Japan	2,5	5 Russia	4,2
	6 EFTA	2,3	6 Canada	2
	7 Other Latin America	2,2	7 NIC	0,9
	8 Other ISC	1,3	8 Other Southern mediterranean	0,7
	9 Australia / New Zealand	0,9	9 China	0,5
	10 Israel	0,8	10 Southern Africa	0,4
		World share (%) of international scientific co-publications in the World from		1999
		EU candidates	Other CEEC	
With	1 EU	55,2	1 EU	66,5
	2 USA	20,3	2 USA	10,3
	3 Russia	6	3 EU candidates	8,7
	4 Canada	3,2	4 Russia	3,8
	5 EFTA	3,1	5 Other ISC	3,5
	6 Japan	2,7	6 Australia / New Zealand	2,1
	7 Australia / New Zealand	1,7	7 Canada	1,8
	8 Other ISC	1,5	8 Other Latin America	0,9
	9 Other Latin America	1,3	9 EFTA	0,8
	10 China	0,9	10 Brazil	0,4

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

The scientific relationship between the other CEECs and the EU, the USA, Russia and the EU candidate countries evolves between 1989 and 1999 as follows: the EU particularly reinforces its participation in the scientific co-operation of this zone (from 56,3% in 1989 to 66,5% in 1999). The USA are the second scientific partner of the other CEECs area in physics but the weight of the USA in the international scientific relationship of the other CEECs area is decreasing across the time (from 16,4% in 1989 to 10,3% in 1999). The same happens with EFTA, which goes from 9,2% to 0,8%. The EU candidate countries aggregate appears as the third scientific partner of the other CEECs (8,7% of the international scientific co-publication of the other CEECs area in 1999).

During the same period of time (see table 21), the EU decreases its international scientific collaboration with the USA (from 49,6% in 1989 to 43,3% in 1999) and with Canada (nearly -23% between 1989 and 1999). On the other hand, the

EU reinforces its international scientific relationship in the field of physics with Australia – New Zealand, EFTA, Russia, the EU candidate countries, other Latin America, Japan, and China.

In engineering and technology (table 29), the scientific relationship between the EU candidate countries and the other zones is stable between 1989 and 1999: the EU stays the first EU candidate countries scientific partner (nearly 55% of the EU candidate countries international scientific co-publication). The USA are the second scientific partner and the weight of the USA in the international scientific relationship of the EU candidate countries is stable across the time. Russia progressively decreases its relationship in terms of rank and of world share with the EU candidate countries (from 8,5% in 1989 to 2,7% in 1999). Canada appears as the third scientific partner of the EU candidate countries international scientific publication.

The scientific relationship between the other CEECs and the EU, the USA, Russia and the EU candidate countries evolve between 1989 and 1999. The EU particularly reinforces its participation in the scientific co-operation of this zone (from 28,9% in 1989 to 37,6% in 1999). The USA are the second scientific partner of the other CEECs area in engineering and technology but the weight of the USA in the international scientific relationship of the other CEECs area is decreasing across the time (from rank 1 with 46,1% in 1989 to rank 2 with 20,6% in 1999). The EU candidate countries area appears as the third scientific partner of the other CEECs (with an increasing weight in the international scientific co-publication of the other CEECs area between 1989 and 1999).

During the same period of time, the EU decreases its international scientific collaboration with the USA (from 43,0% in 1989 to 35,9% in 1999) and with Canada (nearly -22% between 1989 and 1999). On the other hand, the EU maintains its international scientific relationship in the field of engineering and technology with the EU candidate countries (10,5% in 1999), and reinforces its international scientific co-publication with most of the other zones.

Table 27. The first ten scientific partners by zone of the EU candidate countries and the other CEECs - 1989, 1995 and 1999 - engineering and technology

		World share (%) of international scientific co-publications in the World from		1989
		EU candidates	Other CEEC	
With	1 EU	52,2	1 USA	46,1
	2 USA	22,5	2 EU	28,9
	3 Russia	8,5	3 EU candidates	11,2
	4 Canada	6,3	4 Canada	4
	5 Japan	2,0	5 Russia	3,2
	6 EFTA	1,5	6 Japan	2,8
	7 Other CEEC	1,5	7 Other Southern mediterranean	1,6
	8 Near and middle East	1,2	8 Other Africa	0,7
	9 Other Far East	0,8	9 Other Latin America	0,5
	10 Other Southern mediterranean	0,7	10 China	0,5
		World share (%) of international scientific co-publications in the World from		1995
		EU candidates	Other CEEC	
With	1 EU	51,1	1 EU	38,5
	2 USA	22,6	2 USA	30,8
	3 Canada	6,2	3 EU candidates	7,8
	4 Japan	4,4	4 Canada	6,6
	5 Russia	4,1	5 Russia	5,7
	6 Other ISC	2,6	6 Australia / New Zealand	5,1
	7 EFTA	2,2	7 EFTA	1,8
	8 Australia / New Zealand	1,4	8 Japan	1,6
	9 Israel	0,8	9 Other ISC	0,9
	10 Other CEEC	0,7	10 NIC	0,6
		World share (%) of international scientific co-publications in the World from		1999
		EU candidates	Other CEEC	
With	1 EU	53,5	1 EU	37,6
	2 USA	21,9	2 USA	20,6
	3 Canada	5,2	3 EU candidates	14,6
	4 Japan	3,6	4 Russia	6,9
	5 Russia	2,7	5 Australia / New Zealand	5,6
	6 Other ISC	2,4	6 Canada	5,1
	7 EFTA	1,7	7 Japan	2,6
	8 China	1,5	8 EFTA	1,4
	9 Australia / New Zealand	1,4	9 China	1,3
	10 Other CEEC	1,3	10 Other Latin America	1,2

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

In mathematics (table 30), the scientific relationship between the EU candidate countries and the other zones evolves between 1989 and 1999 as follows: the EU stays the first scientific partner of the EU candidate countries and increases its collaboration with the EU candidate countries (from 37,1% in 1989 to 47,7 % in 1999). The USA are the second scientific partner but the weight of the USA in the international scientific publication of the EU candidate countries aggregate decreases across the time (from 34,9% in 1989 to 26,3% in 1999). Canada appears as the third scientific partner. Russia progressively decreases its relationship in terms of rank and of world share with the EU candidate countries (from 4,4% in 1989 to 3,4% in 1999), but particularly increases its weight in the international scientific co-publication of EU candidate countries.

Table 28. The first ten scientific partners by zone of the EU candidate countries and the other CEECs - 1989,

		World share (%) of international scientific co-publications in the World from		1989
		EU candidates	Other CEEC	
With	1 EU	37,1	1 USA	44
	2 USA	34,9	2 EU	30,6
	3 Canada	12,0	3 Japan	8,2
	4 Russia	4,4	4 Canada	6,3
	5 Japan	3,2	5 EU candidates	5,8
	6 Israel	2,3	6 Russia	3,4
	7 Australia / New Zealand	1,3	7 China	1,5
	8 Other Latin America	1,2	8 Southern Africa	0,2
	9 EFTA	0,9	9 EFTA	0
	10 India	0,9	10 ASEAN	0

1995 and 1999 - mathematics				
		World share (%) of international scientific co-publications in the World from		1995
		EU candidates	Other CEEC	
With	1 EU	47,5	1 EU	37,1
	2 USA	27,9	2 Australia / New Zealand	26,8
	3 Canada	9,2	3 USA	17,4
	4 Israel	2,1	4 Canada	8,7
	5 Australia / New Zealand	1,8	5 Japan	3,3
	6 Other ISC	1,8	6 EU candidates	2,8
	7 Japan	1,8	7 EFTA	1,2
	8 Russia	1,8	8 Russia	0,9
	9 EFTA	1,4	9 India	0,7
	10 Other Latin America	0,7	10 NIC	0,5

		World share (%) of international scientific co-publications in the World from		1999
		EU candidates	Other CEEC	
With	1 EU	47,7	1 EU	32,6
	2 USA	26,3	2 USA	20,1
	3 Canada	7,1	3 Australia / New Zealand	14
	4 Russia	3,4	4 EU candidates	9,8
	5 Other ISC	1,9	5 Japan	5,6
	6 Japan	1,9	6 Canada	5,4
	7 Australia / New Zealand	1,8	7 Israel	2,5
	8 China	1,6	8 EFTA	2
	9 Other Latin America	1,4	9 India	1,8
	10 EFTA	1,2	10 China	1,6

Sources: ISI data, OST treatments.

Note: See annex for a complete definition of zones.

The scientific relationship between the other CEECs and the EU, the USA, and the EU candidate countries evolves between 1989 and 1999 as follows: the EU slowly reinforces its participation in the scientific co-operation of this zone (from 28,9% in 1989 to 32,6% in 1999 with a top in 1995 close to 37%). The USA are the second scientific partner of the other CEECs area in mathematics but the weight of the USA in the other CEECs area international scientific relationship decreases across the time (from rank 1 with 44% in 1989 to rank 2 with 20,1% in 1999 but with a gap in 1995 close to 17,4%). The EU candidate countries area appears as the fourth scientific partner of the other CEECs (with an increasing weight in the international scientific co-publication of the other CEECs area between 1989 and 1999 from 5,8% in 1989 to 9,8% in 1999). During the same period of time (see table 21), the EU decreases its international scientific collaboration with the USA (from 52,7% in 1989 to 37,4% in 1999 i.e. nearly - 29%) and with Canada (from 10,5% to 5,9% i.e. nearly - 44% between 1989 and 1999). In 1999, Russia stands as the second scientific partner of the EU (6,7%) behind the EU candidate countries (11,6%).

Part B.II.

**International scientific collaborations of each Central and Eastern European countries -
1999**

**I. International scientific collaboration of each Central and Eastern European Country
- All fields combined - 1999**

In the following section, we present, for the year 1999, the international scientific collaborations of each of the CEECs, which have a world share of scientific publication higher than 0,1% - all fields combined, with all the EU members states, the EU as a whole, the USA, Japan, and all the CEECs.

In the case of co-publications between the CEECs, we have chosen to only retain data that are higher than 0,5 (see methodological annex).

Table 29. International co-publication of some CEECs with the rest of the European countries, the Triad, and the other CEECs - all fields combined - 1999

	International co-publication of some CEECs								all fields combined		1999
	Bulgaria	Croatia	Czech Republic	Hungary	Poland	Romania	Slovakia	Slovenia	Turkey	Yugoslavia	
With Austria	2,5	5,9	3,3	3,5	1,1	0,8	7,3	6,2	0,9	1,0	
Belgium	3,6	0,9	2,2	2,5	2,1	4,9	2,2	1,3	0,9	1,1	
Denmark	0,8	2,6	0,8	1,1	1,0	0,4	1,3	0,7	1,0	0,1	
Finland	1,2	0,7	1,0	3,0	1,3	1,2	1,8	1,2	0,9	0,3	
France	10,1	4,2	9,6	7,3	9,9	16,6	7,1	5,6	4,3	7,3	
Germany	22,0	22,8	18,5	14,9	15,6	15,4	14,8	13,4	8,3	9,8	
Greece	3,1	0,3	0,5	0,4	0,3	1,4	0,9	1,1	0,3	2,2	
Ireland	0,1	0,2	0,1	0,2	0,1	0,2			0,1	0,3	
Italy	6,2	5,8	4,3	4,0	5,0	8,6	4,7	7,3	2,6	3,0	
Luxemburg								0,1			
Netherlands	1,7	1,9	2,7	3,3	2,5	2,7	1,4	4,1	1,4	0,7	
Portugal	0,4	0,4	0,2	0,5	0,2	0,5	0,3	0,4		0,4	
Spain	4,7	1,1	2,1	1,9	2,3	3,2	1,1	1,5	1,1	2,7	
Sweden	1,7	1,4	2,0	2,4	2,9	1,5	2,0	1,9	0,7	1,2	
United Kingdom	7,2	5,4	7,1	8,8	7,3	6,7	7,9	8,9	18,7	6,9	
EU	65,3	53,6	54,4	53,8	51,6	64,1	52,8	53,7	41,2	37,0	
USA	10,4	16,9	14,2	22,5	18,6	12,9	12,8	13,5	33,0	21,2	
Japan	4,3	0,7	4,0	4,8	3,4	3,4	4,0	1,2	3,2	5,9	
Albania											
Bosnia										1,1	
Bulgaria	-		0,5			0,6				0,7	
Croatia		-						5,9			
Cyprus											
Czech Republic	1,2	0,7	-	1,0	1,0	0,7	10,9	0,8		2,1	
Estonia											
Hungary	0,8	2,1	1,0	-	0,6	2,4	1,2	2,7	0,5	4,0	
Latvia											
Lithuania											
Macedonia		2,4						1,0		3,0	
Malta											
Poland	1,5	0,5	2,0	1,1	-	0,7	3,8	1,1	0,5	0,9	
Romania	0,5	0,7		1,0		-				1,0	
Slovakia		0,8	4,7	0,5	0,8		-	0,8		0,5	
Slovenia		7,0		0,6				-		0,7	
Turkey									-		
Yugoslavia				0,7				0,5		-	
Other	14,6	13,1	17,8	12,8	22,8	13,9	13,0	17,5	20,0	20,8	
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

Sources: ISI data, OST treatments.

Note: we only retain in the second part of this table (e.g. in the case of the co-publications between the CEECs data which are higher than 0,5. That is why the total in columns is not equal by 100.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted.

➤ *How to read this table? For each country, the columns give the distribution of the total international scientific co-publications in 1999 between the considered country and the other countries.*

For example, in 1999, 65,3% of the international scientific publication of Bulgaria imply a EU country all fields combined. Germany appears as the first scientific partner of Bulgaria in terms of scientific co-publication (22% of the international scientific publication of Bulgaria implies Germany). The USA represent 10,4% of the Bulgarian international scientific publication. Poland (1,5%) and Czech Republic (1,2%) are the first two scientific partners of Bulgaria among the CEECs.

II. International scientific collaboration of some CEECs - per discipline - 1999

Table 30. International co-publication of some CEECs with the EU countries, the Triad, and the CEECs - fundamental biology - 1999

International co-publication of some CEECs		fundamental biology								1999
	Bulgaria	Croatia	Czech Republic	Hungary	Poland	Romania	Slovakia	Slovenia	Turkey	Yugoslavia
With Austria	0,4	5,9	4,3	1,5	0,7		4,3	6,6	0,5	
Belgium	0,4	3,7	1,2	1,7	1,6	4,0	2,2	2,0	1,1	0,4
Denmark	1,2		1,5	0,9	1,5	2,1	3,3	1,2	2,1	1,9
Finland	1,8		1,1	3,7	2,1	0,1	2,1	5,0	1,7	1,7
France	10,6	2,1	10,4	6,2	7,2	18,8	8,5	9,8	3,4	5,2
Germany	26,7	36,8	16,9	12,5	12,9	16,8	8,9	12,6	12,6	4,3
Greece	2,7		0,6	0,1		1,1	0,4		0,1	3,3
Ireland				0,6	0,1		0,1			
Italy	4,7	3,1	4,1	4,2	5,6	8,2	3,5	3,8	2,9	6,1
Luxemburg										
Netherlands	2,4	2,9	3,1	4,4	3,8	5,0	1,4	4,5	3,6	4,7
Portugal			0,3	0,5	0,1	0,6	0,6		0,1	
Spain	3,4	2,4	1,4	2,6	0,8	0,6	1,6	0,3	1,6	8,9
Sweden	0,8	1,3	1,9	2,8	5,4	1,5	4,0	3,9	1,2	1,4
United Kingdom	8,4	6,0	8,3	12,0	7,9	8,9	11,0	11,8	19,4	13,1
EU	63,5	64,2	55,1	53,7	49,7	67,7	51,9	61,5	50,3	51,0
USA	17,8	19,4	18,3	29,1	27,4	8,7	22,3	15,3	34,4	40,3
Japan	2,0	0,9	3,7	4,6	4,3	2,9	2,9	1,4	2,3	
Albania										
Bosnia										1,4
Bulgaria	-								0,9	
Croatia		-						4,9		
Cyprus										
Czech Republic	1,0	0,8	-	1,1	0,6	1,2	11,8			2,8
Estonia										
Hungary	1,2		1,4	-	0,7	8,2	1,1	1,7		
Latvia										
Lithuania										
Macedonia										
Malta										
Poland		1,6	0,7	0,7	-	1,0		0,6	0,6	
Romania				0,9		-				
Slovakia			5,9				-	0,5		
Slovenia		6,7						-		
Turkey	0,9								-	
Yugoslavia										-
Other	12,8	6,2	14,0	8,5	16,6	9,9	9,4	13,3	11,1	4,1
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Sources: ISI data, OST treatments.

Note: we only retain in the second part of this table (e.g. in the case of the co-publications between the CEECs data which are higher than 0,5. That is why the total in columns is not equal by 100.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted.

➤ *How to read this table? For each country, the columns give the distribution of the total international scientific co-publications in 1999 between the considered country and the other countries. For example, in 1999, 63,3% of the Bulgarian international scientific publication in fundamental biology imply a EU country. Germany appears as the first scientific partner of Bulgaria in terms of scientific co-publication (26,7% of the international scientific publication of Bulgaria implies Germany). The USA represent 17,8% of the Bulgarian international scientific publication. Hungary (1,2%) and Czech Republic (1,0%) are the first two scientific partners of Bulgaria among the CEECs.*

Table 31. International co-publication of some CEECs with the European countries, the Triad, and the other CEECs - medical research - 1999

		International co-publication of some CEECs									1999
		Bulgaria	Croatia	Czech Republic	Hungary	Poland	Romania	Slovakia	Slovenia	Turkey	
With	Austria	1,6	8,1	4,3	3,9	1,0	0,2	7,4	8,7	2,0	
	Belgium	0,8	1,6	2,8	3,1	1,4	4,3	3,2	0,3	1,3	2,2
	Denmark	2,3	0,2	1,9	2,0	0,8		0,3	1,1	1,8	
	Finland	5,9	0,1	1,7	3,9	1,3	0,1	0,8	1,5	1,1	0,1
	France	6,1	2,9	7,6	3,7	6,0	15,2	3,7	2,4	5,4	0,8
	Germany	23,6	16,2	15,8	14,0	21,7	18,4	11,2	7,2	8,6	9,5
	Greece	3,4	0,2	0,4	0,6	0,2	0,6	0,2			2,8
	Ireland		0,1	0,2							
	Italy	6,8	6,5	4,0	3,6	9,2	13,7	2,8	6,3	3,4	4,3
	Luxemburg										
	Netherlands	8,3	2,7	3,3	2,6	5,1	4,1	1,3	3,4	2,1	1,1
	Portugal		0,5		0,1	0,1		0,3			
	Spain	3,2		0,8	1,1	1,2	3,9	0,8	1,6	0,4	3,3
	Sweden		0,2	2,5	2,8	3,8	1,4	3,6	2,5	1,2	0,6
	United Kingdom	13,5	10,8	9,9	11,3	8,4	12,3	9,3	13,5	14,1	12,7
	EU	75,5	50,1	55,2	52,7	60,2	74,2	44,9	48,5	41,4	37,4
	USA	13,3	27,7	20,6	28,1	24,4	16,3	15,8	24,1	40,7	29,8
	Japan	4,1		1,7	4,6	3,2	1,5	1,5	2,4	5,9	16,1
	Albania										
	Bosnia		1,4								1,5
Bulgaria	-						0,7				
Croatia		-					1,5	10,3		0,6	
Cyprus											
Czech Republic	0,5		-	0,5	0,6	1,1	18,1	0,7			
Estonia											
Hungary	0,9	0,6	0,7	-	0,5	2,9	1,2		0,7	4,0	
Latvia											
Lithuania											
Macedonia								0,7		1,1	
Malta											
Poland			1,0	0,6	-	0,6	2,6				
Romania				0,5		-					
Slovakia	1,5	2,0	9,1		0,7		-	4,2			
Slovenia		7,7					2,3	-			
Turkey				0,5					-	0,5	
Yugoslavia				0,7						-	
Other	3,2	9,9	11,1	10,9	9,9	3,3	11,4	8,7	10,6	9,0	
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

Sources: ISI data, OST treatments.

Note: we only retain in the second part of this table (e.g. in the case of the co-publications between the CEECs data which are higher than 0,5. That is why the total in columns is not equal by 100.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted.

➤ *How to read this table? For each country, the columns give the distribution of the total international scientific co-publications in 1999 between the considered country and the other countries. For example, in 1999, 75,5% of the Bulgarian international scientific publication in the field of medical research imply a EU country. Germany appears as the first scientific partner of Bulgaria in terms of scientific co-publication (23,6% of the international scientific publication of Bulgaria implies Germany). The USA represent 13,6% of the Bulgarian international scientific publication. Slovakia (1,5%), Hungary (0,9%) are the first two scientific partners of Bulgaria among the CEECs.*

Table 32. International co-publication of some CEECs with the European countries, the Triad, and the other CEECs - applied biology and ecology - 1999

		International co-publication of some CEECs								applied biology and ecology		1999
		Bulgaria	Croatia	Czech Republic	Hungary	Poland	Romania	Slovakia	Slovenia	Turkey	Yugoslavia	
With	Austria	5,1	11,8	2,9	1,5	1,0	2,1	7,9	10,3	0,3		
	Belgium	5,4		5,7	1,6	2,4		2,6	2,5	1,1		
	Denmark	0,2		1,0	1,9	1,4		0,6	1,4	0,1		
	Finland	0,6		0,9	3,1	0,5	1,3	5,0	0,4	1,2		
	France	6,2	4,0	6,2	8,5	6,0	9,2	2,6	5,4	2,8	5,9	
	Germany	11,0	14,4	12,2	15,4	16,5	8,4	20,3	17,6	9,2	3,0	
	Greece	1,8		0,1			4,7	1,0				
	Ireland				0,4	0,4						
	Italy	2,4	6,0	4,8	2,9	5,3	4,2	5,3	5,0	2,3	4,2	
	Luxemburg											
	Netherlands	4,4	5,1	3,3	4,3	3,5	17,3	1,2	7,4	1,6		
	Portugal	1,3			0,3							
	Spain	3,0	6,6	0,9	3,7	2,2	0,6	0,6		1,6	2,0	
	Sweden	2,6	1,4	2,7	1,3	3,1	10,2	2,7	1,4	1,6	3,4	
	United Kingdom	14,4	6,3	10,0	13,8	8,9		8,1	12,4	23,1	22,5	
	EU	58,4	55,6	50,7	58,7	51,2	58,0	57,9	63,8	44,9	41,0	
	USA	6,0	24,7	12,6	17,2	19,6	18,0	10,5	16,4	24,9	20,5	
	Japan	6,1		4,0	3,8	4,9	2,9	6,5		5,2		
	Albania											
	Bosnia										2,5	
Bulgaria	-	0,7	1,4			0,7	1,5		0,7	5,4		
Croatia		-					1,5	3,7		1,2		
Cyprus												
Czech Republic	3,8		-	0,7	1,9	0,5	7,9	2,8	0,6			
Estonia												
Hungary		0,7	0,5	-		5,4	1,9			5,1		
Latvia												
Lithuania												
Macedonia								2,1				
Malta										5,1		
Poland			2,3		-		2,5					
Romania				0,9		-		0,7				
Slovakia	1,4	4,6	2,6	0,9	0,7	0,5	-	0,6		0,8		
Slovenia		7,5	0,6			1,4		-	2,5			
Turkey	1,0					1,4		5,7	-			
Yugoslavia	1,4	1,0		0,7						-		
Other	21,2	4,4	24,9	16,7	20,8	11,0	9,0	3,9	20,5	18,1		
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0		

Sources: ISI data, OST treatments.

Note: we only retain in the second part of this table (e.g. in the case of the co-publications between the CEECs data which are higher than 0,5. That is why the total in columns is not equal by 100.

••• In the methodological annex, we insist on the limitations and biases introduced into bibliometric statistics. That suggests extreme caution in interpreting the results, especially when analysing small data sets. The interpretation of indicators cannot be carried out independently of the methodological approaches adopted.

➤ *How to read this table? For each country, the columns give the distribution of the total international scientific co-publications in 1999 between the considered country and the other countries.*

For example, in 1999, 58,4% of the Bulgarian international scientific publication in the field of biology and ecology imply a EU country. United-Kingdom appears as the first scientific partner of Bulgaria in terms of scientific co-publication (14,4% of the international scientific publication of Bulgaria implies the U.-K.). The USA and Japan represent each nearly 6% of the Bulgarian international scientific publication. Czech Republic (3,8%), Slovakia (1,4%) and Yugoslavia (1,4%) are the first three scientific partners of Bulgaria among the CEECs.

Table 33. International co-publication of some CEECs with the European countries, the Triad, and the other CEECs - chemistry - 1999

International co-publication of some CEECs		chemistry								1999
	Bulgaria	Croatia	Czech Republic	Hungary	Poland	Romania	Slovakia	Slovenia	Turkey	Yugoslavia
With Austria	1,0	5,3	2,9	2,9	1,0	1,0	6,8	6,8	1,1	1,0
Belgium	4,2	0,1	2,6	3,1	1,9	4,5	1,4	1,6	0,7	0,9
Denmark	0,4		0,6	0,9	1,2	0,1	0,3			
Finland	1,5		0,7	4,9	1,7	0,7	1,4		0,7	
France	15,8	4,1	9,9	6,5	10,3	22,2	8,1	8,6	3,4	5,8
Germany	25,2	22,2	21,9	16,4	14,5	14,0	21,2	17,2	15,2	4,4
Greece	1,4	0,5	0,7	0,5	0,3	1,1	0,5	0,3	0,9	1,5
Ireland	0,1		0,2	0,2					0,1	
Italy	4,4	8,2	3,6	6,0	4,4	4,4	3,8	7,1	3,4	3,3
Luxemburg										
Netherlands	0,7	2,1	2,3	2,6	2,3	2,0	2,1	6,2	1,3	
Portugal			0,1	1,1	0,2	0,9				1,0
Spain	8,7	1,2	4,3	2,3	2,8	3,0	0,9	5,6	0,7	2,2
Sweden	3,1	1,7	2,0	2,4	3,1	1,4	1,4	2,2		1,3
United Kingdom	5,5	3,2	6,9	7,3	7,0	5,0	6,3	6,4	20,7	4,5
EU	72,0	48,6	58,7	57,1	50,7	60,3	54,2	62,0	48,2	25,9
USA	7,1	13,5	10,9	13,0	13,8	7,4	9,0	7,7	22,7	16,8
Japan	3,9	1,0	4,4	6,4	3,8	3,0	5,3	0,8	3,9	3,6
Albania										
Bosnia										0,6
Bulgaria	-	1,1	1,0	0,6	0,7	1,1				0,7
Croatia		-		1,0		0,6		8,0	0,7	
Cyprus										
Czech Republic	2,0	0,8	-	0,6	1,2		10,8	1,2		4,6
Estonia										
Hungary	1,1	4,9	0,6	-	0,8	3,2	1,7	1,4	0,5	11,8
Latvia										
Lithuania					0,6					
Macedonia		10,2						3,7	0,6	4,0
Malta										
Poland	2,9		2,4	1,8	-	0,6	6,8	2,7	1,5	1,2
Romania	1,1	1,4		1,6		-		0,8		3,6
Slovakia			5,2	0,9	1,7		-			
Slovenia		8,3						-		2,5
Turkey		1,4							-	
Yugoslavia			0,7	1,9		1,2		1,9		-
Other	8,9	8,0	14,7	14,1	25,6	21,6	12,0	9,4	21,1	24,2
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Sources: ISI data, OST treatments.

Note: we only retain in the second part of this table (e.g. in the case of the co-publications between the CEECs data which are higher than 0,5. That is why the total in columns is not equal by 100.

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➤ *How to read this table?* For each country, the columns give the distribution of the total international scientific co-publications in 1999 between the considered country and the other countries. For example, in 1999, 72,0% of the Bulgarian international scientific publication in the field of chemistry implies a EU country. Germany appears as the first scientific partner of Bulgaria in terms of scientific co-publication (25,2% of the international scientific publication of Bulgaria implies Germany). The USA represent 7,1% of the Bulgarian international scientific publication. Poland (2,9%) and Czech Republic (2,0%) are the first two scientific partners of Bulgaria among the CEECs.

Table 34. International co-publication of some CEECs with the European countries, the Triad, and the other CEECs - physics - 1999

International co-publication of some CEECs		physics								1999
	Bulgaria	Croatia	Czech Republic	Hungary	Poland	Romania	Slovakia	Slovenia	Turkey	Yugoslavia
With Austria	3,9	4,3	2,8	5,0	1,4	0,9	10,3	2,5	0,2	2,4
Belgium	3,1	0,1	1,5	2,4	2,8	4,9	1,9	0,2	0,5	2,0
Denmark	1,1	1,9	0,6	1,2	1,0	0,2	1,6	0,1		0,1
Finland	0,1	2,4	0,7	2,2	0,8	1,0	1,7	0,7	0,8	
France	7,6	7,0	11,5	10,9	12,1	14,2	7,8	4,7	3,5	7,8
Germany	25,5	30,2	20,6	22,0	17,7	19,3	14,9	12,3	5,0	22,6
Greece	5,5		0,5	0,6	0,5	0,4	1,5	3,9	0,4	1,3
Ireland	0,1		0,2	0,1	0,3	0,3			0,4	
Italy	9,6	8,4	4,2	3,1	4,5	10,8	6,4	7,3	4,4	0,6
Luxembourg										
Netherlands	0,7	0,7	2,0	2,3	1,2	1,8	1,1	3,5	0,7	
Portugal	0,6		0,1	0,6	0,3	0,5	0,2	1,8	0,1	0,1
Spain	3,1	1,1	1,7	1,2	2,2	3,5	1,1	0,4	0,9	4,2
Sweden	1,2	0,1	0,9	3,5	1,9	1,8	1,3	1,4	0,9	2,0
United Kingdom	4,4	5,0	6,1	7,2	7,0	5,3	7,6	7,3	13,7	4,2
EU	66,5	61,2	53,4	62,3	53,7	64,9	57,4	46,1	31,5	47,3
USA	8,5	11,1	9,0	15,4	14,7	10,1	8,1	15,0	32,7	15,7
Japan	5,7	1,1	5,8	5,7	3,2	5,2	4,6	1,1	1,7	6,7
Albania										
Bosnia										0,6
Bulgaria	-					0,8				0,8
Croatia		-		0,7				4,4		
Cyprus									0,7	
Czech Republic			-		1,1	0,9	7,5	1,0		1,6
Estonia										
Hungary		2,8		-		1,1	0,5	2,3		0,8
Latvia										
Lithuania										
Macedonia										2,8
Malta										
Poland	1,2		3,2	1,2	-	0,7	5,1	1,8		2,2
Romania	0,8	1,1	0,6	0,8		-		1,0		
Slovakia			3,3		0,8		-			0,8
Slovenia		5,5		0,7				-		
Turkey									-	
Yugoslavia										-
Other	16,0	16,1	22,9	12,0	25,4	15,1	16,3	27,1	32,8	20,1
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Sources: ISI data, OST treatments.

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➤ *How to read this table? For each country, the columns give the distribution of total international scientific co-publications in 1999 between the considered country and the other countries.*

For example, in 1999, 66,5% of the Bulgarian international scientific publication in the field of physics implies a EU country. Germany appears as the first scientific partner of Bulgaria in terms of scientific co-publication (25,5% of the international scientific publication of Bulgaria implies Germany). The USA represent 8,5% of the Bulgarian international scientific publication. Poland (1,2%) and Romania (0,2%) are the first two scientific partners of Bulgaria among the CEECs.

Table 35. International co-publication of some CEECs with the European countries, the Triad and the other CEECs - earth and space sciences - 1999

International co-publication of some CEECs		earth and space sciences								1999	
		Bulgaria	Croatia	Czech Republic	Hungary	Poland	Romania	Slovakia	Slovenia	Turkey	Yugoslavia
With	Austria	3,2	10,0	2,3	4,4	1,4	2,0	4,9	8,7	0,7	
	Belgium	4,0	1,7	1,6	1,9	0,7	3,2		1,2	0,6	
	Denmark	0,2	0,1	0,3	0,1	0,7	4,3	1,0	8,7	2,4	
	Finland	0,5	2,2	0,5	1,8	0,7		2,9		1,2	
	France	13,6	2,3	9,1	7,5	10,7	20,0	11,7	2,3	14,3	36,4
	Germany	12,8	34,5	16,2	11,1	14,5	15,2	14,0	13,9	5,4	3,7
	Greece	0,5	1,4	0,5	0,2		5,3	2,5		0,1	4,2
	Ireland			0,1	0,1		0,7				
	Italy	5,4	0,9	5,2	2,6	2,2	3,4	7,1	38,0	2,0	10,0
	Luxemburg										
	Netherlands		0,1	4,4	3,0	2,8	7,6	0,1	0,4	0,5	0,1
	Portugal	0,1	2,8	0,4							
	Spain	7,2	0,5	1,2	4,3	2,3	0,4	0,4	0,5	2,3	1,0
	Sweden	0,9	2,9	2,1	0,4	3,7	1,5	0,3	0,4	0,6	0,1
	United Kingdom	8,0	1,5	6,1	8,4	8,6	9,5	7,5	3,2	22,8	8,0
	EU	56,4	60,9	50,0	45,8	48,3	73,1	52,4	77,3	52,9	63,5
	USA	9,5	9,6	17,9	20,6	24,8	5,4	8,9	13,7	27,1	11,7
	Japan	1,3	0,1	2,4	2,3	3,1	2,2	1,4		1,8	
	Albania										
	Bosnia										
	Bulgaria	-		1,3		0,9		1,0			
	Croatia		-	1,2				0,5	1,4		0,9
	Cyprus										
	Czech Republic	3,6	10,6	-	3,9	0,8		4,3			
	Estonia	0,7				0,5					
	Hungary			2,8	-	0,8	1,1	1,9	3,0		1,9
	Latvia										
	Lithuania										
	Macedonia										2,8
	Malta										
	Poland	4,2		1,4	2,0	-	2,4	1,8	1,7		
	Romania						-			0,7	
	Slovakia	0,9	1,5	1,4	0,9		0,6	-			
	Slovenia		1,4		0,5				-		
	Turkey	0,6	0,5				2,2			-	3,8
	Yugoslavia		1,4							0,9	-
	Other	22,5	13,9	21,2	23,1	19,8	12,8	27,3	2,7	15,5	15,2
	Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Sources: ISI data, OST treatments.

Note: we only retain in the second part of this table (e.g. in the case of the co-publications between the CEECs data which are higher than 0,5. That is why the total in columns is not equal by 100.

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➤ *How to read this table? For each country, the columns give the distribution of the total international scientific co-publications in 1999 between the considered country and the other countries.*

For example, in 1999, 56,4% of the Bulgarian international scientific publication in the field of earth and space science imply a EU country. France appears as the first scientific partner of Bulgaria in terms of scientific co-publication (13,6% of the international scientific publication of Bulgaria implies France). The USA represent 9,5% of the Bulgarian international scientific publication. Poland (4,2%) and Czech Republic (3,6%) are the first two scientific partners of Bulgaria among the CEECs.

Table 36. International co-publication of some CEECs with the European countries, the Triad, and the other CEECs - engineering and technology - 1999

International co-publication of each CEEC		engineering and technology									1999
		Bulgaria	Croatia	Czech Republic	Hungary	Poland	Romania	Slovakia	Slovenia	Turkey	Yugoslavia
With	Austria	1,8	7,9	4,0	7,0	1,0	0,8	13,5	10,4	0,8	0,8
	Belgium	8,2		2,4	4,1	2,7	4,7	4,3	3,4	0,8	
	Denmark	1,0		0,1	0,8	0,6		1,8	0,1	0,7	
	Finland	2,9		1,2	1,2	1,4	4,0	1,5	0,8	0,4	1,2
	France	7,0	3,1	8,9	9,8	9,4	9,6	7,0	4,0	1,2	2,8
	Germany	18,5	15,4	20,2	10,2	10,6	10,7	13,6	14,1	4,3	10,6
	Greece	2,4		0,7	0,5	0,5	3,4	0,9	0,8	0,3	3,2
	Ireland	0,7	3,0		0,4	0,1				0,1	
	Italy	3,8	2,8	4,6	3,3	6,1	10,9	5,4	5,5	0,1	2,4
	Luxembourg								0,5		
	Netherlands	2,6	3,0	2,8	6,6	2,7	3,6	1,8	1,6	0,6	1,2
	Portugal	0,5	3,0		0,4	0,4	0,2	1,8			1,2
	Spain	0,8		1,7	1,0	1,5	4,2		0,9	0,7	0,2
	Sweden	1,0	1,0	2,5	3,5	3,3	1,1	0,3	1,1	0,2	1,2
	United Kingdom	14,5	0,4	5,4	4,9	9,0	13,0	3,3	11,7	22,9	3,8
	EU	65,7	39,6	54,5	53,7	49,3	66,2	55,2	54,9	33,1	28,6
	USA	6,1	18,9	15,2	22,4	16,0	19,1	9,1	11,3	40,8	21,5
	Japan	7,0		6,2	5,1	2,7	2,1	4,3	2,6	2,0	3,9
	Albania										
	Bosnia								2,8		1,8
	Bulgaria	-			0,8	0,5					
	Croatia		-					1,8	10,1		
	Cyprus								0,9	1,1	
	Czech Republic			-	1,3	0,6	1,4	9,2			0,6
	Estonia		0,8								0,8
	Hungary	1,5	1,5	1,5	-	0,6	0,8		1,6	0,9	3,4
	Latvia										
	Lithuania										
	Macedonia								0,6		7,3
	Malta										
	Poland	1,7		1,2	1,0	-		3,6			
	Romania		1,5	1,1	0,6		-				1,2
	Slovakia		3,0	2,9		0,6		-			0,5
	Slovenia		21,9		0,6				-		0,6
	Turkey		0,5		1,2		0,8			-	
	Yugoslavia				1,4		0,7	0,8	0,8		-
	Other	17,5	12,0	16,7	11,6	29,6	8,2	15,5	14,0	21,5	29,8
	Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Sources: ISI data, OST treatments.

Note: we only retain in the second part of this table (e.g. in the case of the co-publications between the CEECs data which are higher than 0,5. That is why the total in columns is not equal by 100.

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➤ *How to read this table? For each country, the columns give the distribution of total international scientific co-publications in 1999 between the considered country and the other countries.*

For example, in 1999, 65,7% of the Bulgarian international scientific publication in the field of engineering and technology implies a EU country. Germany appears as the first scientific partner of Bulgaria in terms of scientific co-publication (18,5% of the international scientific publication of Bulgaria implies Germany). Japan and the USA respectively represent 7,0% and 6,1% of the Bulgarian international scientific publication. Poland (1,7%) and Hungary (1,5%) are the first two scientific partners of Bulgaria among the CEECs.

Table 37. International co-publication of some CEECs with the European countries, the Triad, and the other CEECs - mathematics - 1999

International co-publication of some CEECs		-								mathematics		1999
		Bulgaria	Croatia	Czech Republic	Hungary	Poland	Romania	Slovakia	Slovenia	Turkey	Yugoslavia	
With	Austria	3,1	1,8	2,0	4,2	1,0	0,2	6,0	2,3	0,7	0,7	
	Belgium	5,0		1,0	1,6	1,8	7,9	5,3		1,8	1,3	
	Denmark		21,3		0,4			1,0		1,6		
	Finland	0,3		2,6		1,3	1,3		0,6			
	France	6,4	4,3	7,7	8,0	8,8	17,4	3,4	2,3	3,1	7,7	
	Germany	10,4	4,1	16,7	11,3	10,9	12,1	9,9	11,9	6,2		
	Greece	3,7	0,6		0,8	0,3	1,7	1,5		0,2	1,3	
	Ireland						0,6		0,3		2,7	
	Italy	8,1	1,2	5,7	3,6	5,1	9,3	7,0	6,7	0,3		
	Luxemburg											
	Netherlands	1,3		2,2	3,4	3,2	0,6		3,0	1,2		
	Portugal	1,0		0,5	0,4		0,2					
	Spain	4,8		3,0	0,1	5,3	3,7	2,9		2,7	0,7	
	Sweden	2,4	5,5	2,9	0,1	1,5			0,3			
	United Kingdom	3,5	4,3	3,7	4,6	3,5	4,7	5,2	4,5	16,8	4,0	
	EU	50,0	43,1	48,0	38,5	42,7	59,7	42,2	31,9	34,6	18,4	
	USA	19,8	14,4	18,5	33,5	25,5	22,9	17,1	7,5	29,7	23,5	
	Japan	3,7	0,9	1,3	2,0	1,5	2,4	4,6			9,4	
	Albania											
	Bosnia										2,0	
	Bulgaria	-								1,0	2,0	
	Croatia		-									
	Cyprus											
	Czech Republic			-	1,4	1,0		16,3			6,0	
	Estonia							1,0				
	Hungary	1,0	1,8	2,2	-	0,9	2,9	1,5	13,3	1,7	1,8	
	Latvia											
	Lithuania											
	Macedonia											
	Malta										2,0	
	Poland	0,7	1,8	2,3	1,2	-	0,7	2,9		1,6	2,0	
	Romania		0,6		1,7		-				1,0	
	Slovakia			6,1		0,5		-	1,5		1,8	
	Slovenia				3,1			1,5	-			
	Turkey	1,0			0,6					-		
	Yugoslavia	1,0		1,6				1,3			-	
	Other	22,2	37,1	19,7	16,5	26,6	10,4	11,3	45,5	31,1	30,1	
	Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	

Sources: ISI data, OST treatments.

Note: we only retain in the second part of this table (e.g. in the case of the co-publications between the CEECs data which are higher than 0,5. That is why the total in columns is not equal by 100.

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➤ *How to read this table? For each country, the columns give the distribution of total international scientific co-publications in 1999 between the considered country and the other countries.*

For example, in 1999, 50% of the Bulgarian international scientific publications in the field of mathematics imply an EU country. Germany appears as the first scientific partner of Bulgaria in terms of scientific co-publication (10,4% of the international scientific publication of Bulgaria implies Germany). The USA represent 19,8% of the Bulgarian international scientific publication. Hungary (1%), Turkey (1,0%) and Yugoslavia (1,0%) are the first two scientific partners of Bulgaria among the CEECs.

To conclude this section, the first scientific partners of the CEECs with the Triad and the other CEECs (all fields combined) for the year 1999 are shown in the following table.

Table 38. The first scientific partner of some CEECs with the EU countries, the USA, Japan, and the other CEECs - all fields combined - 1999

The first scientific partners of the selected countries - All fields combined - 1999										
	Bulgaria		Croatia		Czech Republic		Hungary		Poland	
1	Germany	22,0	Germany	22,8	Germany	18,5	USA	22,5	USA	18,6
2	USA	10,4	USA	16,9	USA	14,2	Germany	14,9	Germany	15,6
3	France	10,1	Slovenia	7,0	France	9,6	United Kingdom	8,8	France	9,9
4	United Kingdom	7,2	Austria	5,9	United Kingdom	7,1	France	7,3	United Kingdom	7,3
5	Italy	6,2	Italy	5,8	Slovakia	4,7	Japan	4,8	Italy	5
6	Spain	4,7	United Kingdom	5,4	Italy	4,3	Italy	4,0	Japan	3,4
7	Japan	4,3	France	4,2	Japan	4,0	Austria	3,5	Sweden	2,9
8	Belgium	3,6	Denmark	2,6	Austria	3,3	Netherlands	3,3	Netherlands	2,5
9	Greece	3,1	Macedonia	2,4	Netherlands	2,7	Finland	3,0	Spain	2,3
	Romania		Slovakia		Slovenia		Turkey		Yugoslavia	
1	France	16,6	Germany	14,8	USA	13,5	USA	33,0	USA	21,2
2	Germany	15,4	USA	12,8	Germany	13,4	United Kingdom	18,7	Germany	9,8
3	USA	12,9	Czech Republic	10,9	United Kingdom	8,9	Germany	8,3	France	7,3
4	Italy	8,6	United Kingdom	7,9	Italy	7,3	France	4,3	United Kingdom	6,9
5	United Kingdom	6,7	Austria	7,3	Austria	6,2	Japan	3,2	Japan	5,9
6	Belgium	4,9	France	7,1	Croatia	5,9	Italy	2,6	Hungary	4,0
7	Japan	3,4	Italy	4,7	France	5,6	Netherlands	1,4	Italy	3,0
8	Spain	3,2	Japan	4,0	Netherlands	4,1	Spain	1,1	Macedonia	3,0
9	Netherlands	2,7	Poland	3,8	Hungary	2,7	Denmark	1,0	Spain	2,7

Sources: ISI data, OST treatments.

●●● We only zoom on the scientific co-operation between the CEECs and the EU countries, the USA, and Japan. Then we excluded Canada, Russia and the other CEI countries from the analysis, which is not without consequences on interpretations and rankings.

USA and Germany appear to be the two privileged scientific partners of the CEECs, which have a world share higher than 0,1% in the world scientific literature.

Meanwhile, according to their own scientific specialisation, the historical cultural links, the geographical or political proximities, the specialisation of the considered CEECs, France and United Kingdom also sometimes appear as privileged scientific partners of some CEECs.

Romania particularly collaborates with France for 16,6% of its collaboration. Concerning the scientific collaboration within the CEECs zone, Czech Republic particularly collaborates with Slovakia, which is its fifth scientific partner (with 4,7% of its international scientific publication). At the same time, Slovakia has relatively closely scientific links with Czech Republic, which is its third scientific partner (with nearly 11% of its international scientific co-publication). Slovenia particularly collaborates with Croatia (5,9% of its international co-publication) and with Hungary (2,7% of its international co-publication), and Yugoslavia is relatively close to Hungary, which is its sixth scientific partner (with 4,0% of its international scientific publication).

Part B.III.

The position of the Central and Eastern European Countries in the scientific co-publications of the United Kingdom, Germany, France, the USA, and Italy

In the following section, we are making a zoom, for each of the eight considered scientific disciplines, on the position of some CEECs⁴ in the scientific co-publications of the United Kingdom, Germany, France, and the USA.

Then, for the United Kingdom, Germany, France, the USA, and Italy, we provide:

- two tables (1995 and 1999) with the first scientific partner of these four countries among the CEECs (all fields combined and in each of the eight considered scientific disciplines);
- one figure representing the world share (all fields combined) of the scientific co-publication of each of these four countries with the CEECs (1995 and 1999);
- one figure for each of the eight scientific disciplines representing the world share of the scientific co-publication of each of these four countries with the CEECs (1999).

In the selected CEECs, we only retain the countries, which have a share higher than 0,1% in the world scientific literature (see part I).

⁴ We only retain the CEECs, which have a world share of scientific publication higher than 0,1% - all field combined.

I. The position of the Central and Eastern European Countries in United Kingdom's scientific co-publications

In 1995, Poland, Czech Republic and Turkey are the first three scientific partners among the CEECs of the United Kingdom all fields combined (with respectively 1% and 0,7% of the international co-publication of the United-Kingdom).

Table 39. World share (%) of United Kingdom's scientific co-publications with the CEECs - per discipline – 1995 and 1999

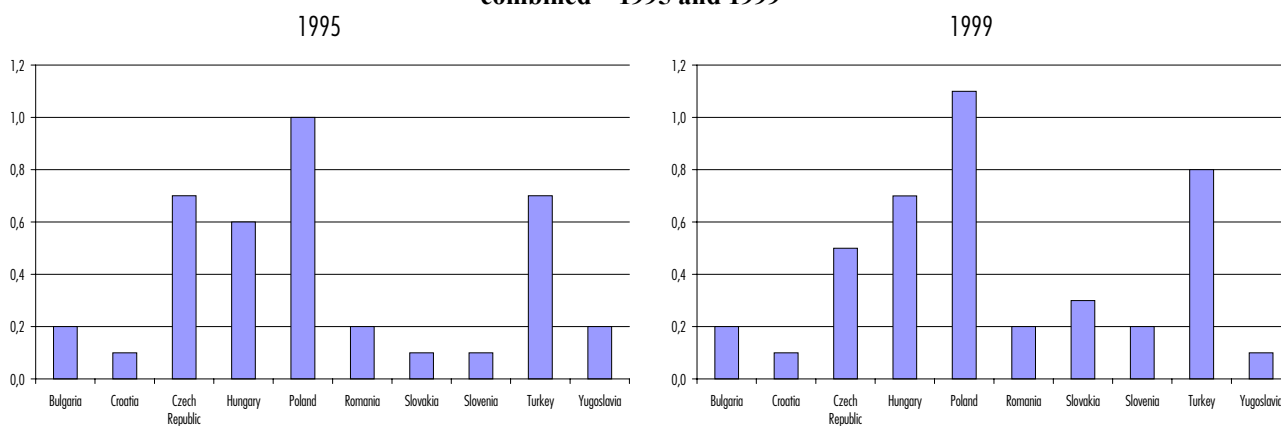
World share (%) of scientific co-publication of United-Kingdom with the CEECs - 1995																							
fundamental biology		medical research		applied biology & ecology		chemistry		physics		earth & space sciences		mathematics		All fields combined									
1	Czech Republic	0,7	1	Hungary	0,5	1	Czech Republic	0,9	1	Poland	4,4	1	Turkey	0,8	1	Turkey	1,7	1	Turkey	1,3	1	Poland	1,0
2	Hungary	0,7	2	Poland	0,4	2	Poland	0,6	2	Czech Republic	2,3	2	Poland	0,7	2	Poland	1,4	2	Czech Republic	1,2	2	Czech Republic	0,7
3	Poland	0,6	3	Turkey	0,4	3	Hungary	0,5	3	Turkey	1,8	3	Czech Republic	0,3	3	Romania	1,0	3	Poland	0,9	3	Turkey	0,7
4	Turkey	0,3	4	Czech Republic	0,3	4	Turkey	0,5	4	Hungary	1,6	4	Hungary	0,3	4	Czech Republic	0,8	4	Hungary	0,6	4	Hungary	0,6
5	Bulgaria	0,2	5	Croatia	0,1	5	Bulgaria	0,2	5	Estonia	0,6	5	Estonia	0,1	5	Yugoslavia	0,4	5	Yugoslavia	0,5	5	Bulgaria	0,2

World share (%) of scientific co-publication of Italy with the CEECs - 1999																							
fundamental biology		medical research		applied biology & ecology		chemistry		physics		earth & space sciences		mathematics		All fields combined									
1	Hungary	0,9	1	Hungary	0,6	1	Turkey	0,8	1	Poland	4,6	1	Turkey	0,8	1	Turkey	2,3	1	Turkey	1,1	1	Poland	1,1
2	Poland	0,6	2	Poland	0,5	2	Poland	0,7	2	Czech Republic	1,8	2	Turkey	0,8	2	Poland	1,2	2	Poland	1,0	2	Turkey	0,8
3	Czech Republic	0,5	3	Turkey	0,5	3	Czech Republic	0,6	3	Hungary	1,8	3	Czech Republic	0,3	3	Romania	0,7	3	Hungary	0,9	3	Hungary	0,7
4	Turkey	0,4	4	Czech Republic	0,3	4	Hungary	0,6	4	Turkey	1,8	4	Hungary	0,3	4	Bulgaria	0,5	4	Czech Republic	0,5	4	Czech Republic	0,5
5	Slovakia	0,3	5	Bulgaria	0,1	5	Bulgaria	0,3	5	Slovakia	0,9	5	Estonia	0,2	5	Czech Republic	0,4	5	Romania	0,5	5	Slovakia	0,3

Sources: ISI data, OST treatments.

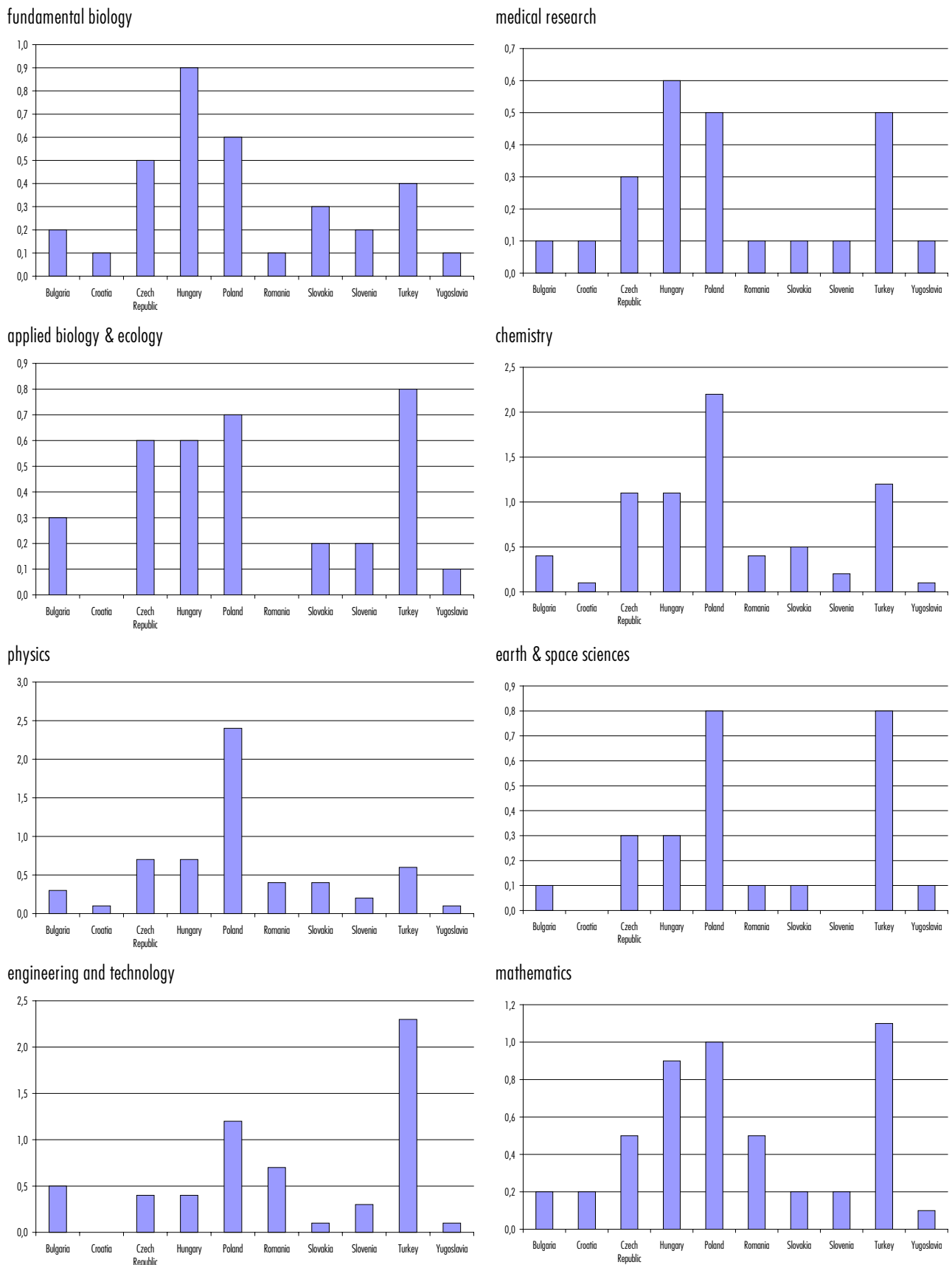
In 1999, Poland stays at the first position in the top five scientific partners among the CEECs of the United Kingdom, particularly in physics. Hungary is the first U.K. scientific partner in fundamental biology and medical research. Turkey is first in applied biology and ecology, earth and space sciences, and mathematics.

Figure 20. World share (%) of United Kingdom's scientific co-publications with the CEECs – all fields combined – 1995 and 1999



Sources: ISI data, OST treatments.

Figure 21. World share (%) of United Kingdom's scientific co-publications with the CEECs – per discipline – 1999



Sources: ISI data, OST treatments.

II. The position of the Central and Eastern European Countries in Germany's scientific co-publications

In 1995, Poland is the first scientific partner⁵ of Germany all fields combined (with nearly 2,8% of the international co-publications of Germany) and in all the considered disciplines. Czech Republic and Hungary take the second and the third positions. This ranking does not really change between 1995 and 1999. Meanwhile the presence of Poland in the international scientific co-publications of Germany decreases all fields combined and in all the considered disciplines except for medical research.

Table 40. World share (%) of Germany's scientific co-publications with the CEECs - per discipline - 1995 and 1999

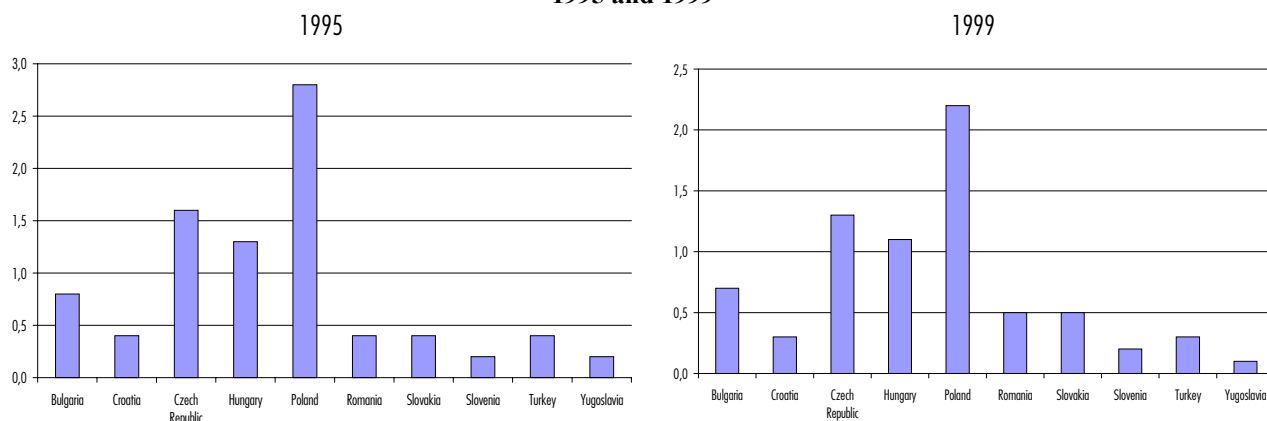
World share (%) of scientific co-publication of Germany with the CEECs - 1995												
	fundamental biology	medical research	applied biology & ecology	chemistry	physics	earth & space sciences	mathematics	All fields combined				
1	Poland 1,2	1 Poland 1,6	1 Poland 3,4	1 Poland 7,7	1 Poland 1,9	1 Poland 3,6	1 Poland 3,4	1 Poland 2,8				
2	Czech Republic 1,1	2 Hungary 1,1	2 Turkey 1,4	2 Czech Republic 4,9	2 Czech Republic 0,7	2 Czech Republic 2,2	2 Czech Republic 2,4	2 Czech Republic 1,6				
3	Hungary 1,1	3 Czech Republic 0,8	3 Czech Republic 1,3	3 Hungary 3,6	3 Bulgaria 0,4	3 Hungary 1,7	3 Hungary 1,7	3 Hungary 1,3				
4	Bulgaria 0,4	4 Turkey 0,3	4 Hungary 1,2	4 Bulgaria 2,8	4 Croatia 0,3	4 Bulgaria 1,0	4 Bulgaria 0,9	4 Bulgaria 0,8				
5	Croatia 0,3	5 Bulgaria 0,2	5 Estonia 0,4	5 Romania 1,5	5 Hungary 0,3	5 Slovakia 0,7	5 Romania 0,8	5 Croatia 0,4				

World share (%) of scientific co-publication of Italy with the CEECs - 1999												
	fundamental biology	medical research	applied biology & ecology	chemistry	physics	earth & space sciences	mathematics	All fields combined				
1	Czech Republic 1,1	1 Poland 1,7	1 Poland 2,0	1 Poland 6,8	1 Poland 1,4	1 Poland 1,7	1 Poland 2,4	1 Poland 2,2				
2	Poland 1,1	2 Hungary 1,0	2 Czech Republic 1,2	2 Czech Republic 4,0	2 Czech Republic 0,9	2 Czech Republic 1,6	2 Czech Republic 1,7	2 Czech Republic 1,3				
3	Hungary 1,0	3 Czech Republic 0,7	3 Hungary 1,1	3 Hungary 3,1	3 Hungary 0,4	3 Hungary 0,9	3 Hungary 1,7	3 Hungary 1,1				
4	Bulgaria 0,6	4 Turkey 0,4	4 Slovakia 0,7	4 Bulgaria 2,5	4 Bulgaria 0,3	4 Bulgaria 0,8	4 Romania 1,1	4 Bulgaria 0,7				
5	Croatia 0,4	5 Bulgaria 0,3	5 Estonia 0,5	5 Romania 1,6	5 Slovakia 0,3	5 Romania 0,7	5 Bulgaria 0,6	5 Romania 0,5				

Sources: ISI data, OST treatments.

In 1999, Czech Republic takes the first position⁶ in fundamental biology and is also Germany's second scientific partner all fields combined and particularly in medical research, applied biology and ecology and physics. Romania is in second position in chemistry and mathematics. Turkey is the second scientific partner of Germany in earth and space sciences.

Figure 22. World share (%) of Germany's scientific co-publications with the CEECs – all fields combined – 1995 and 1999

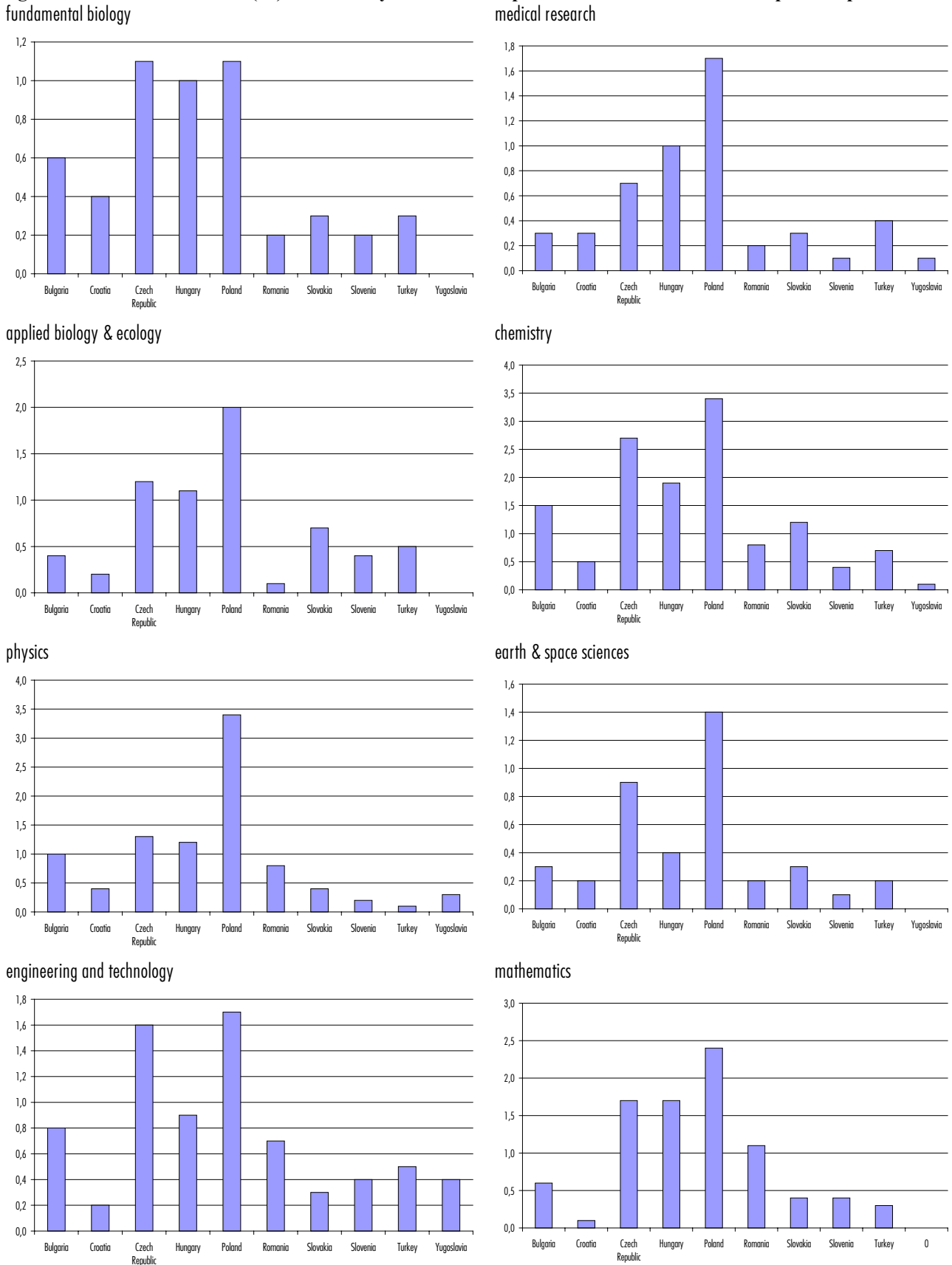


Sources: ISI data, OST treatments.

⁵ among the CEECs.

⁶ among the CEECs.

Figure 23. World share (%) of Germany's scientific co-publications with the CEECs – per discipline – 1999



Sources: ISI data, OST treatments.

III. The position of the Central and Eastern European Countries in France's scientific co-publications

In 1995, Poland is the first scientific partner⁷ of France all fields combined (with 2,1% of the international co-publications of France) and in all the considered scientific disciplines, except for fundamental biology, where Czech Republic replaces Poland. Czech Republic is the second scientific partner of France (with 1% of the international co-publications of France).

Table 41. World share (%) of France's scientific co-publications with the CEECs -per discipline -1995 and 1999

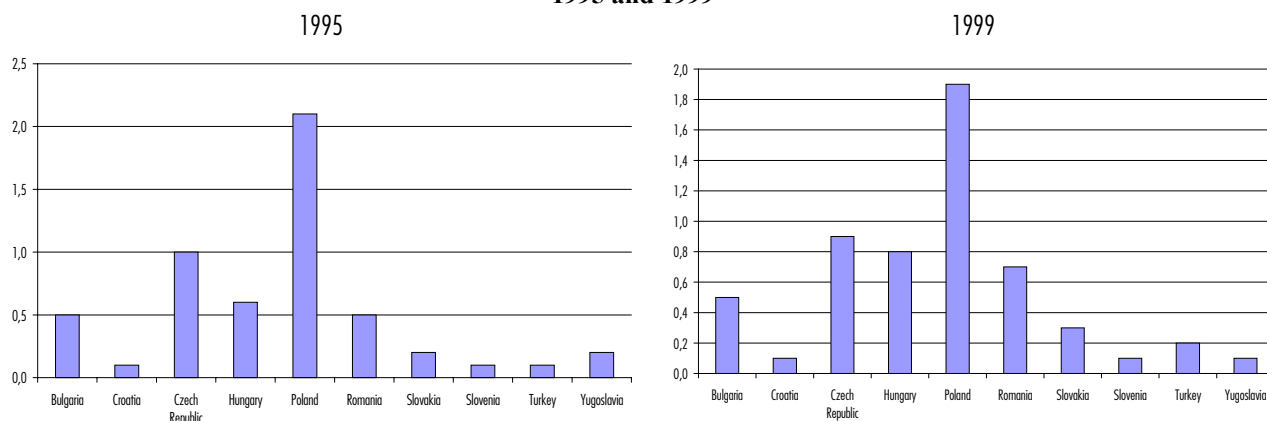
World share (%) of scientific co-publication of France with the CEECs - 1995																
	fundamental biology		medical research		applied biology & ecology		chemistry		physics		earth & space sciences		mathematics		All fields combined	
1	Czech Republic	1,1	1 Poland	0,8	1 Poland	1,6	1 Poland	6,9	1 Poland	1,6	1 Poland	3,5	1 Romania	2,2	1 Poland	2,1
2	Poland	0,9	2 Hungary	0,4	2 Czech Republic	0,8	2 Czech Republic	2,6	2 Czech Republic	0,9	2 Czech Republic	1,1	2 Poland	2,1	2 Czech Republic	1,0
3	Hungary	0,8	3 Czech Republic	0,3	3 Hungary	0,6	3 Bulgaria	1,9	3 Yugoslavia	0,4	3 Bulgaria	0,5	3 Hungary	0,9	3 Hungary	0,6
4	Bulgaria	0,3	4 Bulgaria	0,2	4 Albania	0,1	4 Romania	1,9	4 Bulgaria	0,3	4 Romania	0,5	4 Croatia	0,3	4 Bulgaria	0,5
5	Slovakia	0,3	5 Turkey	0,2	5 Bulgaria	0,1	5 Hungary	1,6	5 Hungary	0,2	5 Slovakia	0,2	5 Czech Republic	0,3	5 Romania	0,5

World share (%) of scientific co-publication of France with the CEECs - 1999																
	fundamental biology		medical research		applied biology & ecology		chemistry		physics		earth & space sciences		mathematics		All fields combined	
1	Czech Republic	0,9	1 Poland	0,7	1 Poland	0,9	1 Poland	6,9	1 Poland	1,2	1 Poland	1,8	1 Poland	2,2	1 Poland	1,9
2	Poland	0,8	2 Czech Republic	0,5	2 Czech Republic	0,8	2 Czech Republic	2,8	2 Czech Republic	0,6	2 Hungary	1,0	2 Romania	1,9	2 Czech Republic	0,9
3	Hungary	0,7	3 Hungary	0,4	3 Hungary	0,7	3 Romania	2,6	3 Turkey	0,6	3 Czech Republic	0,9	3 Hungary	1,4	3 Hungary	0,8
4	Slovakia	0,4	4 Turkey	0,4	4 Bulgaria	0,3	4 Hungary	2,0	4 Yugoslavia	0,4	4 Romania	0,8	4 Czech Republic	0,9	4 Romania	0,7
5	Bulgaria	0,3	5 Romania	0,3	5 Turkey	0,2	5 Bulgaria	1,7	5 Bulgaria	0,3	5 Bulgaria	0,4	5 Bulgaria	0,4	5 Bulgaria	0,5

Sources: ISI data, OST treatments.

In 1999, Poland stays at the first position in the top five of the scientific partner⁸ of France in all of the considered disciplines except for fundamental biology, where Czech Republic is at the first position, behind Poland. Czech Republic is also the second scientific partner of France all fields combined and particularly in medical research, applied biology and ecology, chemistry and physics.

Figure 24. World share (%) of France's scientific co-publications with the CEECs – all fields combined – 1995 and 1999

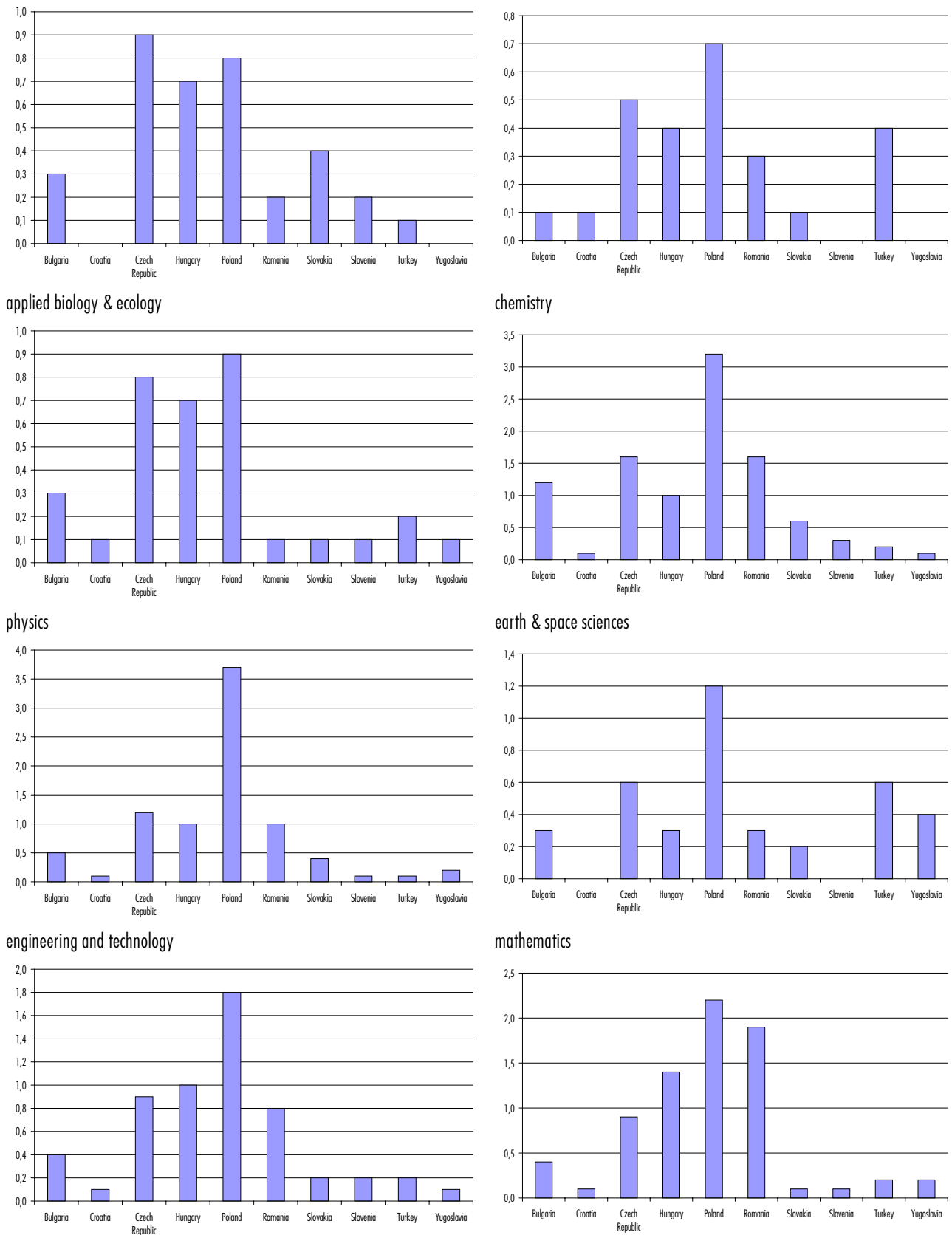


Sources: ISI data, OST treatments.

⁷ among the CEECs.

⁸ among the CEECs.

Figure 25. World share (%) of France's scientific co-publications with the CEECs – per discipline – 1999



Sources: ISI data, OST treatments.

IV. The position of the Central and Eastern European Countries in USA's scientific co-publications

In 1995, Poland is the first scientific partner of the USA all fields combined (with 1,3% of the international scientific co-publications of the USA). Hungary is the second scientific partner in fundamental biology, medical research, and mathematics.

Table 42. World share (%) of USA's scientific co-publications with the CEECs – all fields combined – 1995 and 1999

World share (%) of scientific co-publication of the USA with the CEECs - 1995

fundamental biology	medical research	applied biology & ecology	chemistry	physics	earth & space sciences	mathematics	All fields combined
1 Hungary 1,1	1 Hungary 0,7	1 Poland 1,0	1 Poland 5,1	1 Poland 0,9	1 Turkey 1,4	1 Hungary 2,4	1 Poland 1,3
2 Poland 1,0	2 Poland 0,6	2 Hungary 0,6	2 Hungary 2,4	2 Czech Republic 0,4	2 Poland 0,8	2 Poland 2,0	2 Hungary 0,9
3 Czech Republic 0,5	3 Turkey 0,5	3 Turkey 0,4	3 Czech Republic 1,5	3 Hungary 0,4	3 Hungary 0,7	3 Czech Republic 0,9	3 Czech Republic 0,5
4 Bulgaria 0,2	4 Czech Republic 0,3	4 Czech Republic 0,3	4 Turkey 1,1	4 Turkey 0,2	4 Czech Republic 0,5	4 Romania 0,7	4 Turkey 0,5
5 Turkey 0,2	5 Croatia 0,2	5 Bulgaria 0,1	5 Croatia 0,8	5 Bulgaria 0,1	5 Romania 0,4	5 Bulgaria 0,4	5 Bulgaria 0,2

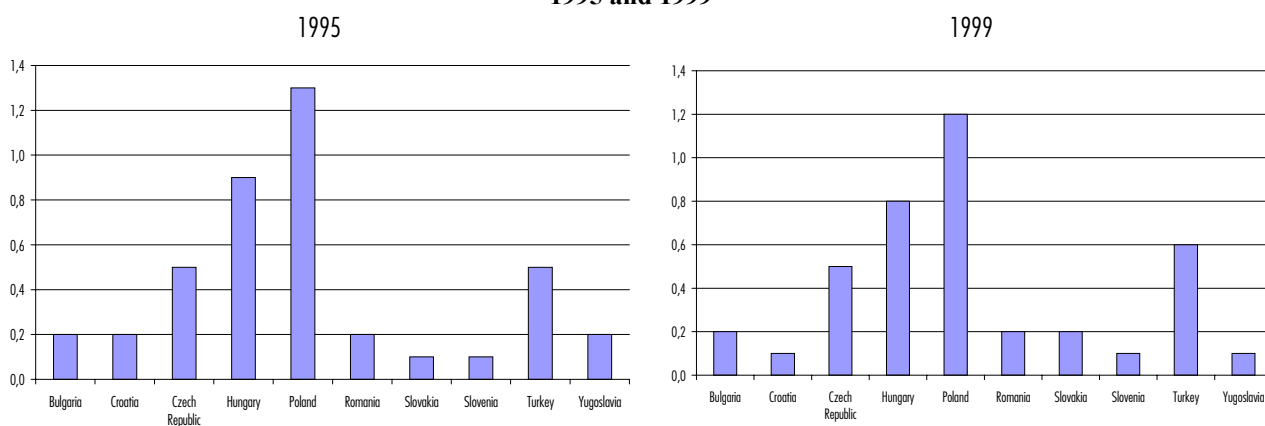
World share (%) of scientific co-publication of Italy with the CEECs - 1999

fundamental biology	medical research	applied biology & ecology	chemistry	physics	earth & space sciences	mathematics	All fields combined
1 Hungary 1,0	1 Hungary 0,6	1 Poland 0,8	1 Poland 4,2	1 Poland 1,0	1 Turkey 1,4	1 Poland 2,0	1 Poland 1,2
2 Poland 0,9	2 Poland 0,6	2 Turkey 0,5	2 Hungary 1,6	2 Czech Republic 0,4	2 Poland 0,8	2 Hungary 1,9	2 Hungary 0,8
3 Czech Republic 0,5	3 Turkey 0,6	3 Czech Republic 0,4	3 Czech Republic 1,3	3 Turkey 0,4	3 Hungary 0,6	3 Romania 0,8	3 Turkey 0,6
4 Slovakia 0,3	4 Czech Republic 0,3	4 Hungary 0,4	4 Turkey 1,3	4 Hungary 0,3	4 Czech Republic 0,4	4 Czech Republic 0,7	4 Czech Republic 0,5
5 Turkey 0,3	5 Croatia 0,1	5 Bulgaria 0,1	5 Romania 0,6	5 Bulgaria 0,1	5 Romania 0,4	5 Turkey 0,6	5 Bulgaria 0,2

Sources: ISI data, OST treatments.

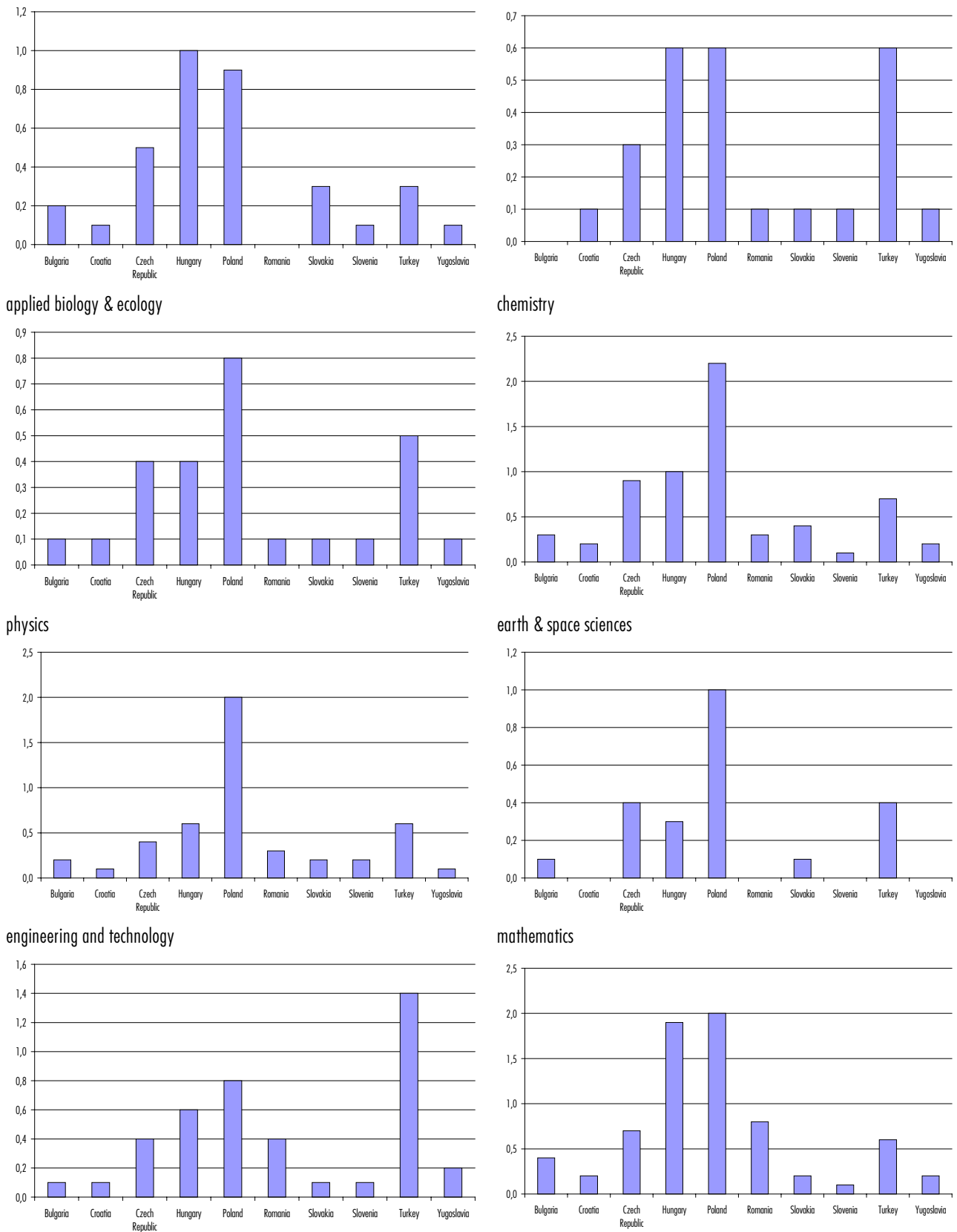
In 1999, Poland stays at the first position in the top five of the scientific partner of the USA. Hungary preserves its second position in fundamental biology, and medical research. Turkey is a privileged scientific partner in the CEECs in earth and space sciences.

Figure 26. World share (%) of USA's scientific co-publications with the CEECs – all fields combined – 1995 and 1999



Sources: ISI data, OST treatments.

Figure 27. World share (%) of USA's scientific co-publication with the CEECs – per discipline – 1999



Sources: ISI data, OST treatments.

V. The position of the Central and Eastern European Countries in Italy's scientific co-publications

In 1995, Poland is the first scientific partner of Italy all fields combined (with 2,2% of the international scientific co-publications of Italy). Czech Republic is the second scientific partner in applied biology and ecology, and in earth & space sciences.

Table 43. World share (%) of Italy's scientific co-publications with the CEECs – all fields combined – 1995 and 1999

World share (%) of scientific co-publication from Italy with the CEEC - 1995

Fundamental Biology	Medical research	Applied Biology & Ecology	Chemistry	Physics	Earth & Space Sciences	Engineering & Technology	Mathematics	All fields combined
1 Poland 1,9	Poland 1,6	Czech Republic 1,7	Poland 2,8	Poland 2,7	Czech Republic 0,8	Poland 3,0	Poland 4,2	Poland 2,2
2 Czech Republic 1,3	Czech Republic 0,4	Poland 1,2	Hungary 2,3	Romania 1,2	Hungary 0,6	Czech Republic 1,5	Czech Republic 2,7	Czech Republic 1,1
3 Hungary 0,9	Hungary 0,4	Hungary 1,1	Czech Republic 1,5	Czech Republic 1,1	Poland 0,6	Hungary 1,2	Hungary 1,7	Hungary 0,9
4 Bulgaria 0,4	Bulgaria 0,2	Albania 0,6	Bulgaria 0,8	Bulgaria 0,8	Slovenia 0,4	Romania 0,8	Bulgaria 1,6	Bulgaria 0,5
5 Croatia 0,2	Croatia 0,2	Yugoslavia 0,4	Slovakia 0,8	Hungary 0,5	Croatia 0,3	Croatia 0,7	Romania 1,1	Romania 0,5

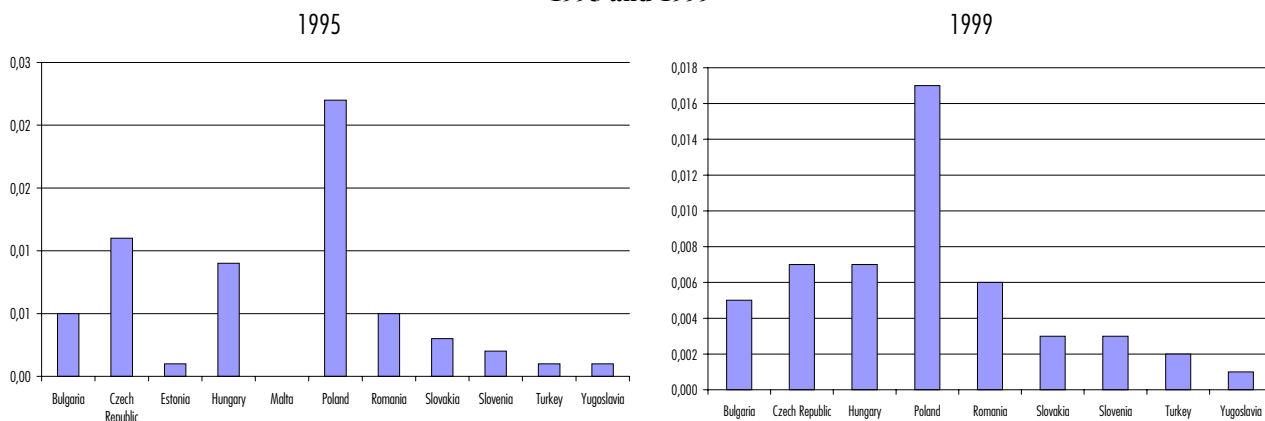
World share (%) of scientific co-publication from Italy with the CEEC - 1999

Fundamental Biology	Medical research	Applied Biology & Ecology	Chemistry	Physics	Earth & Space Sciences	Engineering & Technology	Mathematics	All fields combined
1 Poland 1,2	Poland 1,2	Poland 1,9	Poland 2,9	Poland 2,2	Czech Republic 0,7	Poland 1,8	Poland 2,2	Poland 1,7
2 Hungary 0,9	Hungary 0,4	Czech Republic 1,4	Hungary 1,9	Romania 1,2	Poland 0,5	Romania 1,3	Romania 1,7	Czech Republic 0,7
3 Czech Republic 0,7	Czech Republic 0,3	Hungary 0,6	Czech Republic 1,2	Bulgaria 1,0	Slovenia 0,5	Czech Republic 0,7	Czech Republic 1,1	Hungary 0,7
4 Bulgaria 0,3	Romania 0,3	Slovakia 0,5	Bulgaria 0,7	Czech Republic 0,7	Slovakia 0,3	Hungary 0,5	Hungary 1,1	Romania 0,6
5 Slovakia 0,3	Turkey 0,3	Turkey 0,4	Romania 0,7	Hungary 0,5	Bulgaria 0,2	Bulgaria 0,3	Bulgaria 0,9	Bulgaria 0,5

Sources: ISI data, OST treatments.

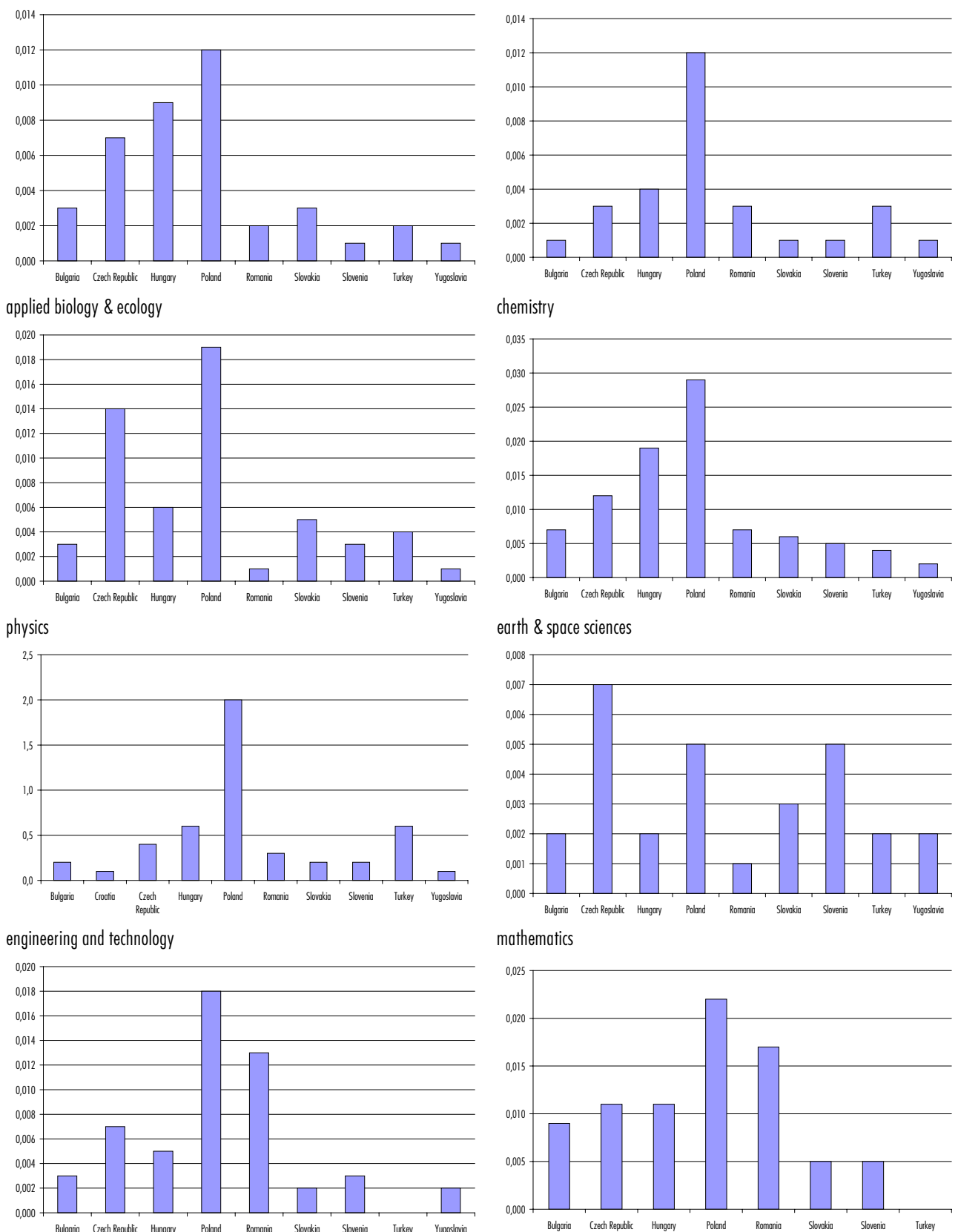
In 1999, Poland stays at the first position in the top five of the scientific partner of Italy. Czech Republic preserves its second position in a unique field: earth & space sciences.

Figure 28. World share (%) of Italy's scientific co-publications with the CEECs – all fields combined – 1995 and 1999



Sources: ISI data, OST treatments.

Figure 29. World share (%) of Italy's scientific co-publication with the CEECs – per discipline – 1999



Sources: ISI data, OST treatments.

Additional tables and figures

The "country files" for Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovenia, Slovakia, Turkey, and Yugoslavia

In this annex, we present data for each country and not per discipline. We can speak about "countries files".

These data, tables, and figures are not commented because the main conclusions are already given earlier.

In this case, the problems presented in the methodological annex remain. The limitations introduced into bibliometric statistics exist. Because of statistical limits and the "effects of the national journals", we provide data and "country files" only in the case of the countries, which have a world share around 0,1%.

In addition, we propose to retain the World and CEECs zone dimensions in the following tables and figures.

Finally the following "country files" illustrate:

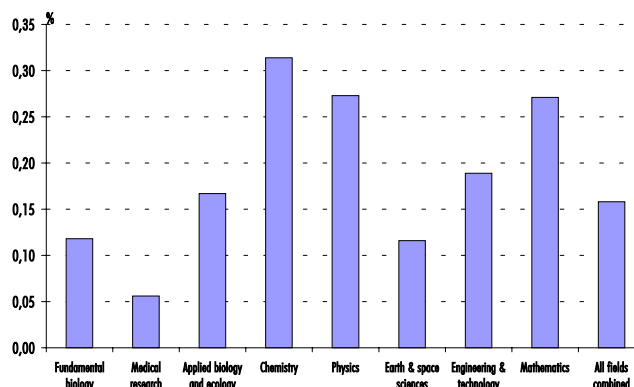
- The world share of the selected countries in 1999 (table and figure),
- The share of the country in the CEECs zone (table and figure),
- The specialisation indexes in the world scientific literature.

Table 44. Bulgaria. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

World share in the scientific literature

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,1	0,1	0,1	76	110
Medical research	0,1	0,1	0,1	94	97
Applied biology and Ecology	0,1	0,1	0,2	130	120
Chemistry	0,4	0,4	0,3	107	72
Physics	0,3	0,3	0,3	99	85
Earth and Space science	0,1	0,1	0,1	116	79
Engineering and Technology	0,2	0,2	0,2	98	88
Mathematics	0,4	0,3	0,3	90	84
All fields combined	0,3	0,2	0,2	71	86

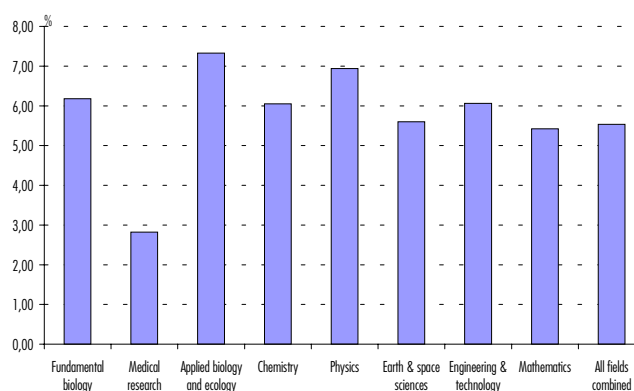
Share in the World scientific literature - 1999



Share in the CEECs's zone scientific literature

	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	7,2	6,1	6,2	85	101
Medical research	5,1	4,2	2,8	83	67
Applied biology and ecology	5,9	7,1	7,3	121	103
Chemistry	7,9	8,3	6,1	104	73
Physics	9,6	8,7	6,9	91	79
Earth & space sciences	7,7	7,0	5,6	91	80
Engineering & technology	7,5	7,3	6,1	97	83
Mathematics	6,8	6,7	5,4	99	81
All fields combined	10,1	7,1	5,5	71	78

Share in the scientific literature of the CEECs zone - 1999



Specialisation index (World)

Specialisation index

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,5	0,6	0,7	106	124
Mediical research	0,2	0,3	0,3	133	108
Applied biology and Ecology	0,4	0,8	1,0	183	135
Chemistry	1,6	2,4	2,1	150	88
Physics	1,3	1,8	1,7	139	95
Earth and Space science	0,5	0,8	0,7	162	90
Engineering and Technology	0,9	1,2	1,2	137	102
Mathematics	1,4	1,8	1,7	127	99

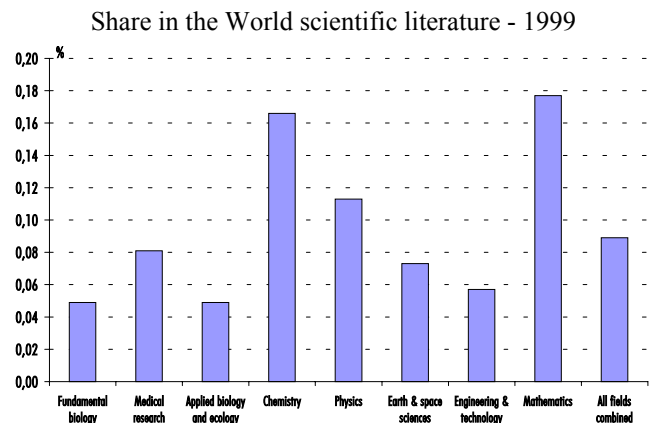
Sources: ISI data, OST treatments.

••• Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).

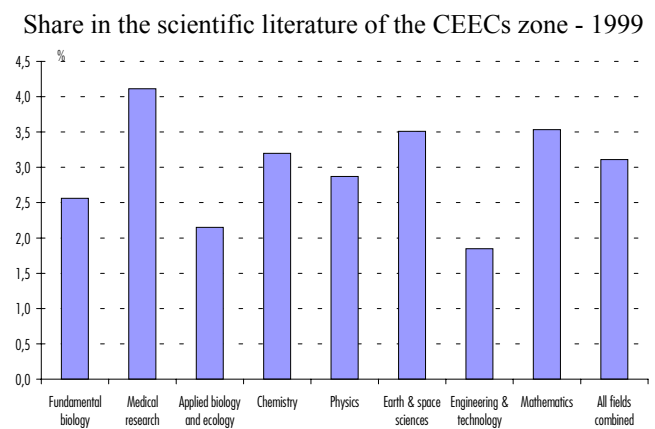
••• Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).

Table 45. Croatia. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

World share in the scientific literature			
Country	1995	1999	1999 base 100=1995
Fundamental biology	0,0	0,0	111
Medical research	0,1	0,1	96
Applied biology and Ecology	0,1	0,0	86
Chemistry	0,2	0,2	85
Physics	0,1	0,1	93
Earth and Space science	0,1	0,1	67
Engineering and Technology	0,1	0,1	92
Mathematics	0,1	0,2	134
All fields combined	0,1	0,1	94



Share in the CEECs's zone scientific literature			
	1995	1999	1999 base 100=1995
Fundamental biology	2,5	2,6	102
Medical research	6,1	4,1	67
Applied biology and ecology	2,9	2,2	73
Chemistry	3,7	3,2	86
Physics	3,3	2,9	87
Earth & space sciences	5,2	3,5	68
Engineering & technology	2,1	1,8	88
Mathematics	2,8	3,5	128
All fields combined	3,7	3,1	84



Specialisation index (World)

Specialisation index					
Country	1992	1995	1999	1995 base 100=1992	1999 base 100=1995
Fundamental biology	0,6	0,5	0,5	77	117
Mediical research	0,6	0,9	0,9	152	98
Applied biology and Ecology	4,4	0,6	0,5	14	83
Chemistry	0,9	2,1	2,0	224	96
Physics	0,7	1,3	1,3	173	100
Earth and Space science	1,7	1,1	0,9	69	76
Engineering and Technology	0,2	0,6	0,6	263	99
Mathematics	2,1	1,4	2,0	66	145

Sources: ISI data, OST treatments.

●●● Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).

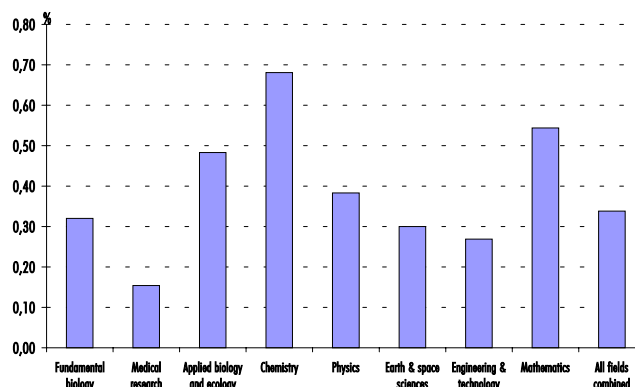
●●● Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).

Table 46. Czech Republic. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

World share in the scientific literature

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,6	0,4	0,3	63	86
Medical research	0,2	0,2	0,2	66	97
Applied biology and Ecology	0,5	0,5	0,5	100	106
Chemistry	1,4	0,9	0,7	65	72
Physics	0,6	0,5	0,4	75	84
Earth and Space science	0,4	0,4	0,3	89	77
Engineering and Technology	0,5	0,4	0,3	78	69
Mathematics	0,8	0,6	0,5	75	90
All fields combined	0,6	0,4	0,3	71	83

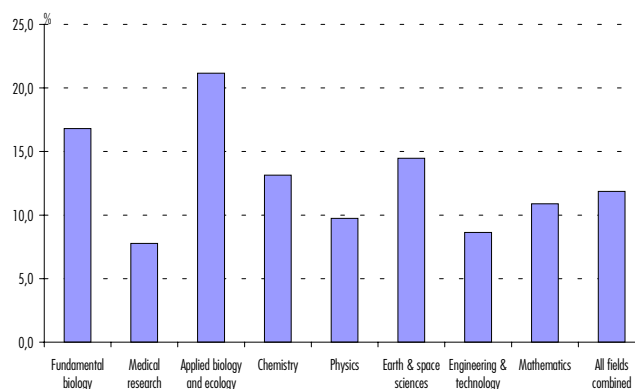
Share in the World scientific literature - 1999



Share in the CEECs's zone scientific literature

	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	30,2	21,3	16,8	70	79
Medical research	20,0	11,4	7,8	57	68
Applied biology and ecology	25,2	23,4	21,2	93	91
Chemistry	27,9	17,8	13,1	64	74
Physics	18,1	12,4	9,7	69	78
Earth & space sciences	26,5	18,5	14,5	70	78
Engineering & technology	17,1	13,2	8,6	78	65
Mathematics	15,5	12,7	10,9	82	86
All fields combined	22,6	15,8	11,9	70	75

Share in the scientific literature of the CEECs zone - 1999



Specialisation index (World)

Specialisation index

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	1,0	0,9	0,9	89	102
Medical research	0,4	0,4	0,4	93	111
Applied biology and Ecology	0,8	1,1	1,3	141	118
Chemistry	2,5	2,3	2,2	92	94
Physics	1,1	1,1	1,1	106	95
Earth and Space science	0,8	1,0	0,9	126	97
Engineering and Technology	0,9	1,0	0,8	111	85
Mathematics	1,4	1,5	1,6	106	107

Sources: ISI data, OST treatments.

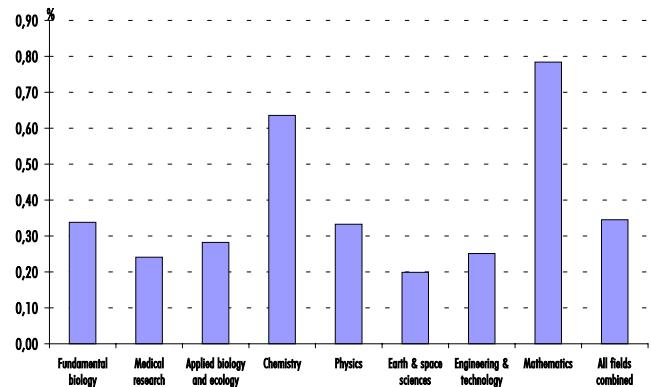
- Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).
- Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).
- For the year 1989 until 1993, Czech Republic shows the data for Ex-Czechoslovakia. Croatia, Bosnia, Macedonia statistically appears in 1990, 1991, 1992 (see annex). Before those years, Yugoslavia shows the data for those countries.

Table 47. Hungary. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

World share in the scientific literature

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,4	0,3	0,3	70	113
Medical research	0,2	0,2	0,2	87	133
Applied biology and Ecology	0,3	0,3	0,3	107	103
Chemistry	0,7	0,6	0,6	88	102
Physics	0,3	0,3	0,3	109	102
Earth and Space science	0,2	0,2	0,2	113	102
Engineering and Technology	0,3	0,2	0,3	80	105
Mathematics	1,0	0,9	0,8	83	91
All fields combined	0,4	0,3	0,3	87	109

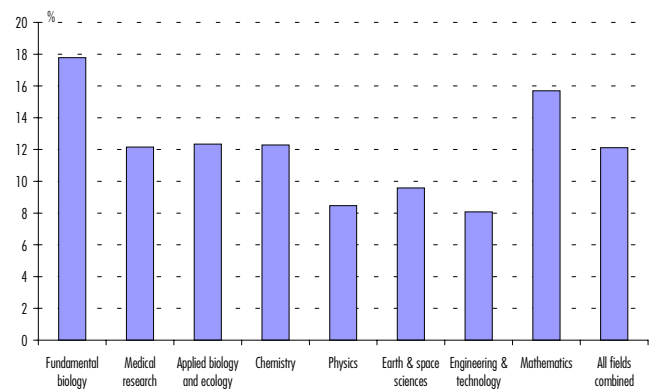
Share in the World scientific literature - 1999



Share in the CEECs's zone scientific literature

	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	21,7	17,1	17,8	79	104
Medical research	17,2	13,1	12,2	76	93
Applied biology and ecology	14,1	14,0	12,3	99	88
Chemistry	13,7	11,8	12,3	86	104
Physics	8,8	8,9	8,5	100	96
Earth & space sciences	10,4	9,3	9,6	89	104
Engineering & technology	10,2	8,2	8,1	80	99
Mathematics	19,9	18,1	15,7	91	87
All fields combined	14,2	12,3	12,1	86	99

Share in the scientific literature of the CEECs zone - 1999



Specialisation index (World)

Specialisation index

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	1,2	0,9	1,0	80	103
Medical research	0,6	0,6	0,7	101	116
Applied biology and Ecology	0,7	0,9	0,8	123	88
Chemistry	2,0	2,0	1,9	101	95
Physics	0,8	1,0	1,0	125	101
Earth and Space science	0,5	0,6	0,6	130	100
Engineering and Technology	0,8	0,8	0,7	92	88
Mathematics	2,9	2,7	2,4	95	86

Sources: ISI data, OST treatments.

●●● Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).

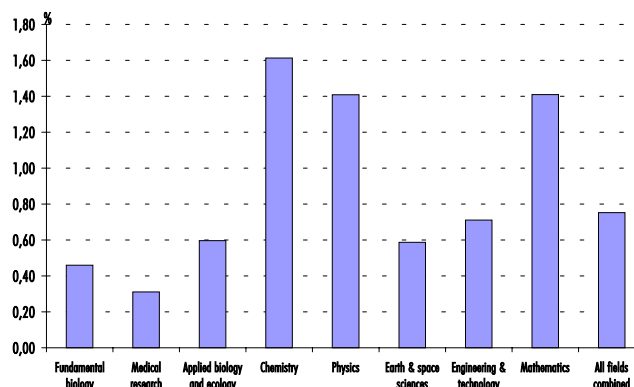
●●● Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).

Table 48. Poland. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

World share in the scientific literature

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,5	0,4	0,5	84	105
Medical research	0,3	0,2	0,3	89	131
Applied biology and Ecology	0,6	0,5	0,6	85	111
Chemistry	1,6	1,6	1,6	99	100
Physics	1,5	1,4	1,4	90	103
Earth and Space science	0,4	0,6	0,6	139	98
Engineering and Technology	1,1	0,8	0,7	78	85
Mathematics	2,0	1,5	1,4	74	95
All fields combined	0,8	0,7	0,8	90	103

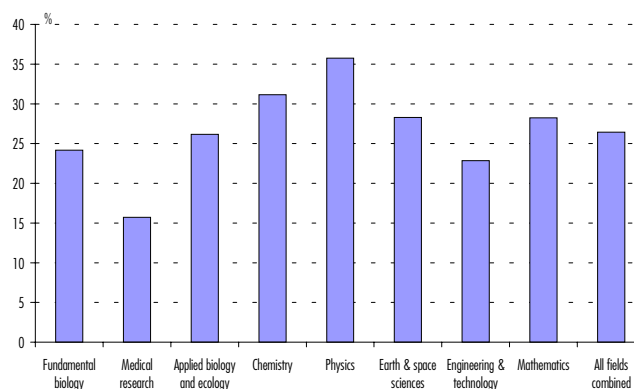
Share in the World scientific literature - 1999



Share in the CEECs's zone scientific literature

	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	26,6	25,0	24,2	94	97
Medical research	22,1	17,1	15,7	78	92
Applied biology and ecology	35,1	27,7	26,2	79	94
Chemistry	31,3	30,4	31,1	97	102
Physics	44,8	37,2	35,7	83	96
Earth & space sciences	25,9	28,4	28,3	109	100
Engineering & technology	36,6	28,2	22,9	77	81
Mathematics	38,3	31,2	28,2	81	90
All fields combined	31,6	28,3	26,4	90	93

Share in the scientific literature of the CEECs zone - 1999



Specialisation index (World)

Specialisation index

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,6	0,6	0,6	93	101
Medical research	0,3	0,3	0,4	98	125
Applied biology and Ecology	0,8	0,7	0,8	94	102
Chemistry	2,0	2,2	2,2	110	98
Physics	1,9	1,9	1,9	99	100
Earth and Space science	0,5	0,8	0,8	154	96
Engineering and Technology	1,3	1,1	1,0	86	85
Mathematics	2,5	2,0	1,9	82	93

Sources: ISI data, OST treatments.

••• Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).

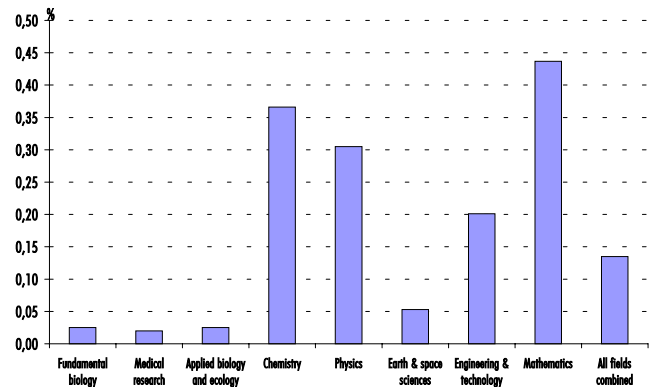
••• Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).

Table 49. Romania. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

World share in the scientific literature

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,0	0,0	0,0	86	104
Medical research	0,0	0,0	0,0	95	111
Applied biology and Ecology	0,0	0,0	0,0	123	156
Chemistry	0,3	0,4	0,4	113	103
Physics	0,1	0,2	0,3	153	134
Earth and Space science	0,0	0,1	0,1	176	104
Engineering and Technology	0,1	0,2	0,2	115	121
Mathematics	0,4	0,4	0,4	99	123
All fields combined	0,1	0,1	0,1	117	116

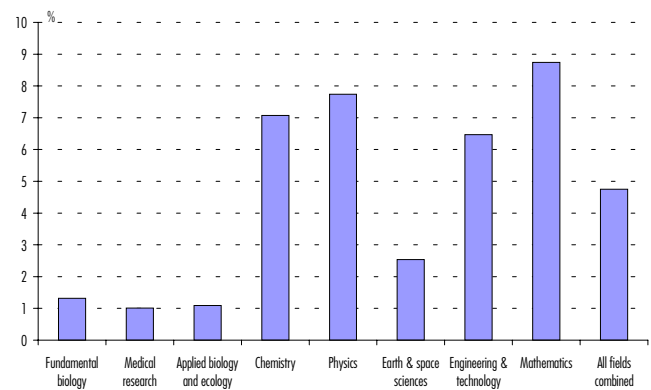
Share in the World scientific literature - 1999



Share in the CEECs's zone scientific literature

	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	1,4	1,4	1,3	97	97
Medical research	1,6	1,3	1,0	81	80
Applied biology and ecology	0,7	0,8	1,1	116	133
Chemistry	6,1	6,7	7,1	111	105
Physics	4,4	6,2	7,7	141	125
Earth & space sciences	1,7	2,4	2,5	140	105
Engineering & technology	4,9	5,6	6,5	114	115
Mathematics	6,9	7,4	8,7	108	118
All fields combined	3,9	4,5	4,8	117	105

Share in the scientific literature of the CEECs zone - 1999



Specialisation index (World)

Specialisation index

Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,3	0,2	0,2	73	85
Medical research	0,2	0,2	0,1	79	88
Applied biology and Ecology	0,1	0,1	0,2	107	122
Chemistry	3,2	3,1	2,8	96	93
Physics	1,5	2,0	2,2	130	115
Earth and Space science	0,3	0,4	0,4	151	88
Engineering and Technology	1,5	1,4	1,4	98	101
Mathematics	3,6	3,1	3,0	84	99

Sources: ISI data, OST treatments.

••• Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).

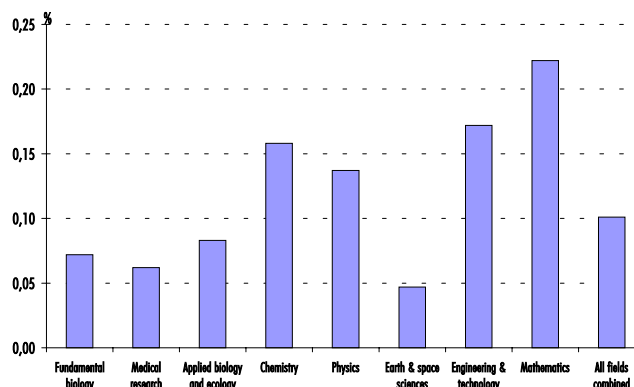
••• Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).

Table 50. Slovenia. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

World share in the scientific literature

Country	1995	1999	1999 base 100=1995
Fundamental biology	0,1	0,1	124
Medical research	0,0	0,1	159
Applied biology and Ecology	0,0	0,1	180
Chemistry	0,1	0,2	124
Physics	0,1	0,1	126
Earth and Space science	0,0	0,0	102
Engineering and Technology	0,1	0,2	120
Mathematics	0,2	0,2	106
All fields combined	0,1	0,1	129

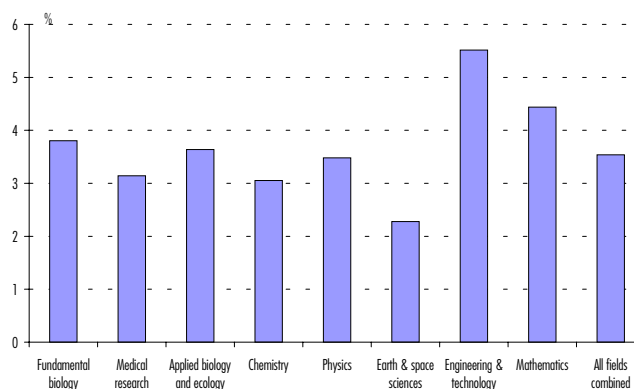
Share in the World scientific literature - 1999



Share in the CEECs's zone scientific literature

	1995	1999	1999 base 100=1995
Fundamental biology	3,3	3,8	115
Medical research	2,8	3,1	111
Applied biology and ecology	2,4	3,6	153
Chemistry	2,4	3,1	127
Physics	3,0	3,5	118
Earth & space sciences	2,2	2,3	105
Engineering & technology	4,9	5,5	114
Mathematics	4,4	4,4	101
All fields combined	3,0	3,5	117

Share in the scientific literature of the CEECs zone - 1999



Specialisation index (World)

Specialisation index

Country	1992	1995	1999	1995 base 100=1992	1999 base 100=1995
Fundamental biology	1,5	0,7	0,7	49	92
Mediical research	0,3	0,5	0,6	164	117
Applied biology and Ecology	1,5	0,6	0,8	39	140
Chemistry	0,7	1,6	1,7	239	102
Physics	0,2	1,4	1,4	646	98
Earth and Space science	0,7	0,6	0,6	84	95
Engineering and Technology	4,2	1,8	1,7	44	90
Mathematics	1,0	2,7	2,2	261	80

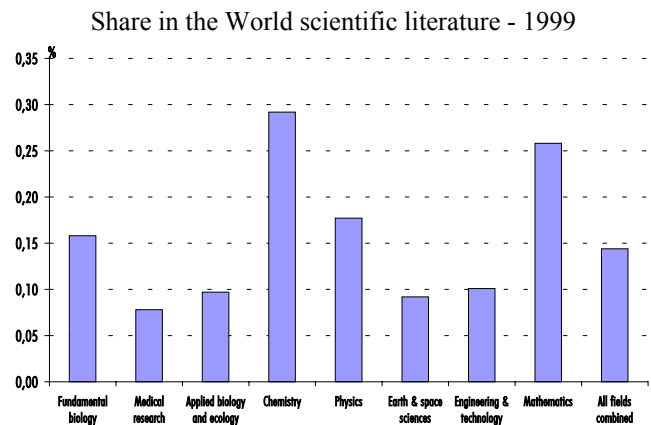
Sources: ISI data, OST treatments.

●●● Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).

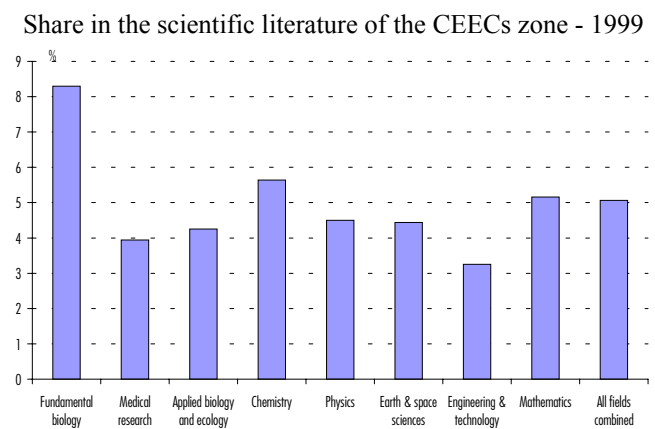
●●● Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).

Table 51. Slovakia. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

World share in the scientific literature			
Country	1995	1999	1999 base 100=1995
Fundamental biology	0,1	0,2	107
Medical research	0,1	0,1	113
Applied biology and Ecology	0,1	0,1	108
Chemistry	0,3	0,3	90
Physics	0,1	0,2	132
Earth and Space science	0,1	0,1	119
Engineering and Technology	0,1	0,1	102
Mathematics	0,2	0,3	111
All fields combined	0,1	0,1	107



Share in the CEECs's zone scientific literature			
	1995	1999	1999 base 100=1995
Fundamental biology	8,5	8,3	98
Medical research	5,0	3,9	79
Applied biology and ecology	4,6	4,2	92
Chemistry	6,1	5,6	92
Physics	3,6	4,5	124
Earth & space sciences	3,7	4,4	121
Engineering & technology	3,3	3,3	97
Mathematics	4,9	5,2	106
All fields combined	5,3	5,1	96



Specialisation index (World)

Specialisation index			
Country	1995	1999	1999 base 100=1995
Fundamental biology	1,10	1,06	97
Medical research	0,51	0,55	107
Applied biology and Ecology	0,67	0,65	97
Chemistry	2,41	2,20	91
Physics	0,99	1,13	114
Earth and Space science	0,57	0,64	111
Engineering and Technology	0,73	0,66	91
Mathematics	1,72	1,75	101

Sources: ISI data, OST treatments.

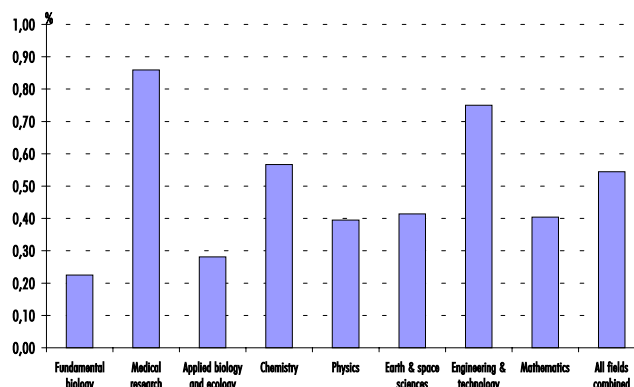
••• Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).

••• Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).

Table 52. Turkey. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

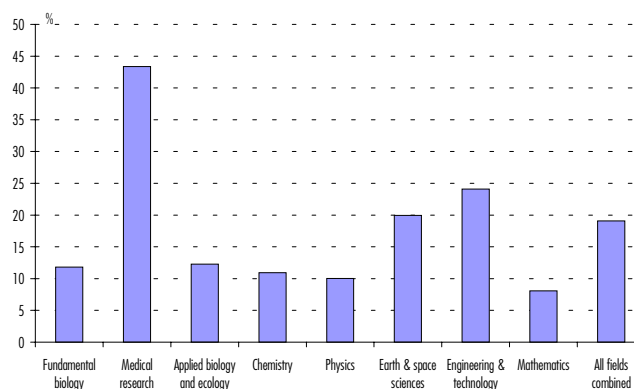
World share in the scientific literature					
Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,1	0,1	0,2	142	165
Medical research	0,2	0,4	0,9	220	197
Applied biology and Ecology	0,1	0,2	0,3	153	157
Chemistry	0,2	0,4	0,6	164	162
Physics	0,1	0,2	0,4	185	182
Earth and Space science	0,2	0,3	0,4	123	164
Engineering and Technology	0,3	0,5	0,8	149	163
Mathematics	0,2	0,2	0,4	137	182
All fields combined	0,2	0,3	0,5	178	180

Share in the World scientific literature - 1999



Share in the CEECs zone scientific literature					
	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	4,9	7,8	11,8	160	152
Medical research	16,5	31,5	43,4	192	138
Applied biology and ecology	6,5	9,2	12,3	142	134
Chemistry	4,1	6,6	10,9	160	165
Physics	3,5	5,9	10,0	171	170
Earth & space sciences	12,4	12,0	20,0	96	167
Engineering & technology	10,5	15,6	24,1	148	155
Mathematics	3,1	4,6	8,1	150	174
All fields combined	6,7	11,7	19,1	176	163

Share in the scientific literature of the CEECs zone - 1999



Specialisation index (World)

Specialisation index					
Country	1991	1995	1999	1995 base 100=1991	1999 base 100=1995
Fundamental biology	0,6	0,5	0,4	80	94
Medical research	1,2	1,4	1,6	124	108
Applied biology and Ecology	0,7	0,6	0,5	86	88
Chemistry	1,3	1,2	1,1	92	91
Physics	0,7	0,7	0,7	104	101
Earth and Space science	1,2	0,8	0,8	69	94
Engineering and Technology	1,8	1,5	1,4	84	92
Mathematics	1,0	0,7	0,7	77	101

Sources: ISI data, OST treatments.

●●● Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).

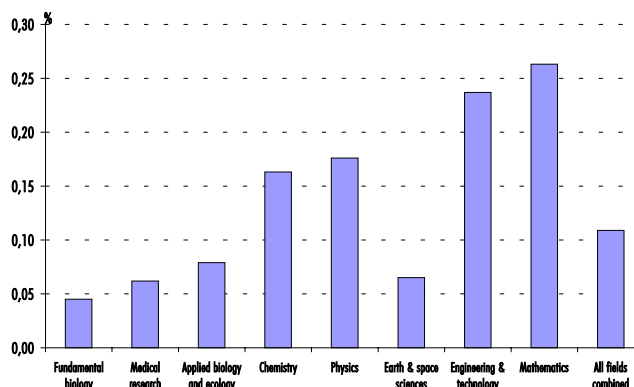
●●● Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).

Table 53. Yugoslavia. Share in the scientific literature of the World and the CEECs zone and scientific specialisation index

World share in the scientific literature

Country	1991	1995	1999	1995	1999
				base 100=1991	base 100=1995
Fundamental biology	0,2	0,1	0,0	32	90
Medical research	0,2	0,1	0,1	29	105
Applied biology and Ecology	0,2	0,1	0,1	32	118
Chemistry	0,5	0,1	0,2	30	120
Physics	0,4	0,2	0,2	42	114
Earth and Space science	0,2	0,1	0,1	37	72
Engineering and Technology	0,4	0,2	0,2	60	107
Mathematics	0,5	0,2	0,3	43	124
All fields combined	0,3	0,1	0,1	36	110

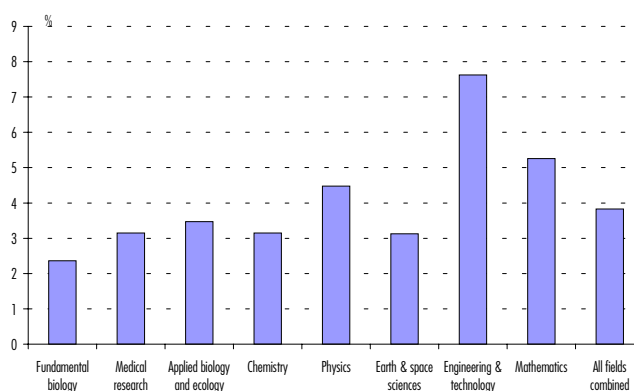
Share in the World scientific literature - 1999



Share in the CEECs zone scientific literature

	1991	1995	1999	1995	1999
				base 100=1991	base 100=1995
Fundamental biology	7,8	2,9	2,4	36	83
Medical research	17,2	4,2	3,2	25	74
Applied biology and ecology	11,4	3,4	3,5	30	101
Chemistry	8,9	2,6	3,1	29	123
Physics	10,8	4,2	4,5	39	106
Earth & space sciences	14,7	4,3	3,1	29	73
Engineering & technology	12,6	7,5	7,6	59	102
Mathematics	9,4	4,4	5,3	47	118
All fields combined	10,7	3,9	3,8	36	99

Share in the scientific literature of the CEECs zone - 1999



Specialisation index (World)

Specialisation index

Country	1991	1995	1999	1995	1999
				base 100=1991	base 100=1995
Fundamental biology	0,6	0,5	0,4	89	89
Medical research	0,8	0,6	0,6	78	99
Applied biology and Ecology	0,8	0,7	0,7	89	104
Chemistry	1,7	1,4	1,5	81	111
Physics	1,4	1,6	1,5	115	98
Earth and Space science	0,9	0,9	0,6	101	69
Engineering and Technology	1,4	2,2	2,1	164	96
Mathematics	1,8	2,1	2,4	118	111

Sources: ISI data, OST treatments.

●●● Note on world share indicators: world share evolutions are calculated with the 'base 100' indicator. When the evolution between 1995 and 1999 is positive, data are written in red (blue when the ratio is negative).

●●● Note on specialisation indexes indicators: when the specialisation index is higher than 1,2 (strong specialisation), all the data are written in red. When the specialisation index is lower than 0,8 (strong despecialisation), all the data are written in blue. When the evolution measured with base 100 indicators between 1995 and 1999 is positive data are written in red and bold character (blue when the ratio is negative).

Methodological Annex

This report is mainly based on standard OST methods, summarised in the methodological annex of OST reports (OST Report 2002, Economica, Paris, 2002).

The level of scientific production and collaboration is evaluated through the "bibliometric" observation of publications in scientific journals. The major bibliographical databases record these types of publications following a selection process, in a summary and codified format. Bibliometric methods apply various quantitative techniques (statistics, data analysis, etc.) to these data.

However, materials published in peer-reviewed academic journals cannot sum up the activity of the research community. Patents, or to a certain extent reports, can also be treated by bibliometric means, but other dimensions of researchers' activity, such as teaching and expertise, are beyond the scope of these methods.

Another crucial point is that output indicators cannot be interpreted independently from the global human and financial resources of the country, summed up in approximate way by population or GDP, and from the specific resources allocated to research. The approaches in terms of scientific productivity should be very cautious, because of many methodological pitfalls.

1. Source: SCI database

Indicators used in this study to measure scientific activities and collaboration are calculated in a customised version of the Science Citation Index (SCI *stricto sensu*) and Compumath (CMCI) databases from ISI, using the dynamic set of journals, which is updated every year (between 3500 and 4000 journals). The SCI has become the main bibliometric tool used by international indicators producers; consequently, both the specificities and biases inherent to the SCI database should be carefully examined given that they can affect the total international statistics based on scientific publications.

SCI combines a series of features valuable for bibliometric usages. The first principle is the "cover-to-cover" process of a full set of selected journals. The selection of these journals is primarily based on the number of citations received by a journal's articles; this criterion does not necessarily provide an absolute guarantee as to the database's level of representation, or an adequate balance between disciplines. A possible over-representation of clinical medicine (30% of all science) has been discussed in former OST works.

The most commonly held criticisms of the SCI pertain to its biases in favour of both the "hard" sciences and the Anglo-American areas of scientific specialisation, but many irregularities are also caused by nationally-oriented journals, whatever the language. As far as the language is concerned, the overwhelming majority of publications listed in the SCI are published in English, and this trend does not appear to be levelling off. It may reflect some linguistic bias, but it is nonetheless indicative of the prevailing international model in science. In order to read by a wide international community, an article should be written in the international language.

SCI is generally considered representative of the international landscape for highly internationalised fields, such as physical sciences or fundamental biology. The same may not be true of fields with a strong national specificity, a prevalence of diffusion modes outside journals (e.g. proceedings, books...), a specific restriction to dissemination (secrecy, proximity of patents), a high degree of application or field anchorage (ex. tropical agronomy). Isolated fields may also be under-represented. National biases in favour of US activity are much more pronounced in several of the "Social and Human science" subject areas covered by other ISI databases: SSCI - Social Sciences Citation Index; A&HCI. We excluded those fields from the present study as they are from standard OST indicators.

2. OST standards

1. Perimeter and item selection

The SCI-based indicators are calculated on the SCI/CMCI original perimeter, on the principle of the variable (or "dynamic") collection of journals, which relies on the incoming/outgoing movements of journals tracked by the ISI. This aims at achieving a measure of long-term relevance despite the volatility exhibited by short-term fluctuations. Very few changes have been brought to the SCI perimeter.

Only four types of documents deemed to be the most "citation-worthy" are selected herein: articles, reviews, notes and letters. Articles from congress proceedings may be retained or not. They are excluded from this report.

The 1988-1990 data encompass ca. 450000 documents a year, while for 1993-1995, the base moved up to 490000. For example 1996-1998, 520000 documents are taken into account.

2. The counting method

The construction of bibliometric indicators implies a series of methodological choices. The first one concerns the type of counting technique for multi-authored articles. In fractional counting, each document is ascribed an equal unitary weight, to be split among the contributing institutions. The same rule can be applied to co-authorship: then the sum of links existing between authors for a given document is unitary. Here we split each bilateral relationship, so that the total co-publication of a country in a given multi-authored article is equal to its fractional publication in this article. The indicators present the advantage to preserve an overall consistency and additive properties whatever the scale of observation.

An alternative counting considers that the contribution is one for a player on an article if it is present (at least one occurrence) in this article. At aggregate level, a particular country's figure shows the fraction of science the country is active in. It follows that the co-publication count of country A and B is one in an article if they are both present (at least one occurrence) in this article. This count of "presence" (or integer-distinct) is easily interpretable for co-publication studies but not stable in scale changes (region, country, zone level...).

The following tables give an overview on the volume of treated data respectively for fractional and presence counting.

Table 54. Volume of the scientific literature (1000 publications) - fractional counting method (three years average) - all selected countries – 1989, 1995, and 1999 (Ranking for the year 1999)

Country	1989	1995	1999
USA	156,7	175,2	162,3
Japan	33,3	42,8	46,8
United-Kingdom	37,5	44,2	42,9
Germany	27,6	32,9	36,6
France	20,5	26,3	27,8
Italy	11,2	16,3	18,3
Spain	5,7	10,8	13,2
The Netherlands	8,2	10,7	10,7
Sweden	7,1	8,2	8,6
Belgium	3,5	4,6	5,1
Danemark	3,4	4,1	4,2
Finland	2,7	3,6	4,0
Poland	3,8	3,8	4,0
Austria	2,3	3,1	3,6
Turkey	0,6	1,6	2,9
Greece	1,3	2,0	2,5
Hungria	1,7	1,6	1,8
Czech Republic	2,6	2,1	1,8
Portugal	0,4	0,8	1,3
Ireland	1,2	1,2	1,3
Bulgaria	1,1	0,9	0,8
Slovakia	na	0,7	0,8
Romania	0,5	0,6	0,7
Yugoslavia	1,1	0,5	0,6
Slovenia	na	0,4	0,5
Croatia	na	0,5	0,5
Estonia	na	0,2	0,2
Lithuania	na	0,2	0,2
Latvia	na	0,1	0,1
Cyprus	0,0	0,0	0,1
Macedonia	na	0,0	0,0
Luxemburg	0,0	0,0	0,0
Malta	0,0	0,0	0,0
Albania	na	0,0	0,0
Bosnia	na	0,0	0,0

Sources: ISI data, OST treatments.

••• In an effort to enhance the indicators' applicability, all calculations are based on three-year averages, namely on the periods 1987-1989 and 1997-1999. In formatting the study's tables, the last year of available information for a given period is used to date the indicator (e.g. "1999" for the period 1997-1999).

The following table shows the presence counting.

Table 55. Volume of scientific literature (1000 publications) - occurrence numbers (three years average) - all the selected countries - 1989, 1995, and 1999 - (Ranking for the year 1999)

Country	1989	1995	1999
USA	165,8	192,8	183,6
United-Kingdom	41,3	51,8	52,9
Japan	34,8	46,4	51,7
Germany	31,4	40,3	46,8
France	23,3	32,0	35,4
Italy	12,8	19,7	22,9
Spain	6,3	12,8	16,2
The Netherlands	9,4	13,3	14,2
Sweden	8,3	10,3	11,4
Belgium	4,3	6,2	7,2
Denmark	4,0	5,3	6,0
Poland	4,4	5,0	5,5
Finland	3,0	4,5	5,2
Austria	2,7	3,9	4,9
Turkey	0,7	1,8	3,3
Greece	1,6	2,6	3,3
Hungary	2,1	2,3	2,7
Czech Republic	2,9	2,8	2,5
Portugal	0,5	1,1	1,8
Irlande	1,4	1,6	1,7
Bulgaria	1,3	1,2	1,2
Slovakia	na	0,9	1,1
Romania	0,5	0,8	1,0
Slovenia	na	0,5	0,7
Yugoslavia	1,4	0,6	0,7
Croatia	na	0,7	0,6
Estonia	na	0,3	0,4
Lithuania	na	0,2	0,3
Latvia	na	0,2	0,2
Cyprus	0,0	0,1	0,1
Macedonia	na	0,0	0,1
Luxembourg	0,0	0,0	0,1
Malta	0,0	0,0	0,0
Albania	na	0,0	0,0
Bosnia	na	0,0	0,0

Sources: ISI data, OST treatments.

●●● In an effort to enhance the indicators' applicability, all calculations are based on three-year averages, namely on the periods 1987-1989 and 1997-1999. In formatting the study's tables, the last year of available information for a given period is used to date the indicator (e.g. "1999" for the period 1997-1999).

At macro-level the rank of countries is generally little sensitive to the counting method. But there are exceptions, depending on particular structure of collaborations. Some countries are advantaged with the fractional counting method (Poland, Slovenia, and the United-Kingdom), whereas shares decrease for others (Finland, Japan, and Yugoslavia).

3. Science classification.

ISI assigns each journal to one or several "subject category class" in SCI. OST defines eight academic large disciplines as aggregates of subject category codes, each category belonging to a unique discipline. The following table shows the weight of each discipline according to the OST breakdown.

Table 56. Breakdown by subject area (in percentage, 1988-1990 and 1996-1998)

Break-down by subject area - %, 1988-1990 and 1996-1998		
	1990	1998
fundamental biology	17,4	18,1
medical research	30,0	29,9
applied biology and ecology	7,5	6,8
chemistry	13,9	13,9
physics	11,8	11,8
earth & space sciences	5,3	5,8
engineering & technology	7,6	8,1
mathematics	3,5	3,6
Multidiscipline	3,0	2,0
All fields combined	100	100

Sources: ISI data, OST treatments.

Some journals publish scientific articles in several disciplines. Those journals are assigned to "multidisciplinary", a heterogeneous class with prestigious (Nature, Science, PNAS) and less prestigious journals. They are reckoned in the total output of countries (zones), but not in the specialisation indexes or collaborations figures.

3. Specific settings and warnings

Let us recall some basic settings of this study.

1. Selection of countries

We distinguish:

- European Union candidate countries engaged in the process of enlargement of the European Union, which launched on 30 March 1998, and where the basic principle of negotiation is that all the applicant countries must accept existing EU laws. The thirteen considered countries are Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia and Turkey;
- Other Central and Eastern European Countries: Albania, Croatia, Bosnia, Macedonia, and Yugoslavia;
- The USA, Japan and the European Union countries, particularly Portugal, Greece, Spain, for references and comparisons.

We also display another possible aggregation of the Central and Eastern European Countries, with a breakdown between South-East European countries and the Central European countries, a distinction related to institutional, cultural, political differences anchored in history.

Table 57. The selected countries and zones

Candidates countries			South East countries		
Bulgaria	Bulgarie	BGR	Albania	Albanie	ALB
Cyprus	Chypre	CYP	Bosnia	Bosnie-Herzégovine	BIH
Estonia	Estonie	EST	Bulgaria	Bulgarie	BGR
Hungary	Hongrie	HUN	Croatia	Croatie	HRV
Latvia	Lettonie	LET	Cyprus	Chypre	CYP
Lithuania	Lituanie	LTV	Macedonia	Macédoine	MAD
Malta	Malte	MLT	Malta	Malte	MLT
Poland	Pologne	POL	Romania	Roumanie	ROM
Czech Republic	République Tchèque	CSK	Slovenia	Slovénie	SLO
Romania	Roumanie	ROM	Turkey	Turquie	TUR
Slovakia	Slovaquie	SLQ	Yugoslavia	Yougoslavie	YUG
Slovenia	Slovénie	SLO			
Turkey	Turquie	TUR			
Other Central and Eastern European countries (CEEC)			Central Europe countries		
Albania	Albanie	ALB	Czech Republic	République Tchèque	CSK
Croatia	Croatie	HRV	Estonia	Estonie	EST
Bosnia	Bosnie-Herzégovine	BIH	Hungary	Hongrie	HUN
Macedonia	Macédoine	MAD	Latvia	Lettonie	LET
Yugoslavia	Yougoslavie	YUG	Lithuania	Lituanie	LTV
			Poland	Pologne	POL
			Slovakia	Slovaquie	SLQ
EU 15 countries			Large Europe		
Austria	Autriche	AUT	Candidates countries		
Belgium	Belgique	BEL	EFTA (Island, Liechtenstein, Norway, Switzerland)		
Danemark	Danemark	DNK	EU 15 countries		
Finland	Finlande	FIN	Other CEEC		
France	France	FRA			
Germany	Allemagne	DEU	Zone CEEC		
Greece	Grèce	GRC	Candidates countries		
Ireland	Irlande	IRL	Other CEEC		
Italy	Italie	ITA			
Luxemburg	Luxembourg	LUX	Other countries		
Portugal	Portugal	PRT	USA	États-Unis	USA
Spain	Espagne	ESP	Japan	Japon	JPN
Sweden	Suède	SWE			
United Kingdom	Royaume-Uni	GBR			
The Netherlands	Pays Bas	NLD			

Sources: OST

Table 58. Definition of zones in the OST's database

Continental Area	Zone Area	Code ISO	Country	Continental Area	Zone Area	Code ISO	Country	Continental Area	Zone Area	Code ISO	Country
Europe	EU	AUT	autriche	Africa	Other Africa	CVP	cap vert	Latin America	Other Latin America	GUY	guyana
Europe	EU	BEL	belgique	Africa	Other Africa	COM	comores	Latin America	Other Latin America	HND	honduros
Europe	EU	DEU	allemagne	Africa	Other Africa	COG	congo	Latin America	Other Latin America	MEX	mexique
Europe	EU	DNK	danemark	Africa	Other Africa	CVJ	cote d'ivoire	Latin America	Other Latin America	NIC	nicaragua
Europe	EU	ESP	espagne	Africa	Other Africa	DJI	djibouti	Latin America	Other Latin America	PAN	panama
Europe	EU	FIN	finlande	Africa	Other Africa	ERI	erythree	Latin America	Other Latin America	PER	perou
Europe	EU	FRA	france	Africa	Other Africa	ETH	ethiopie	Latin America	Other Latin America	PRY	paraguay
Europe	EU	GBR	royaume uni	Africa	Other Africa	GAB	gabon	Latin America	Other Latin America	SRI	surinam
Europe	EU	GRC	grece	Africa	Other Africa	GBM	gambie	Latin America	Other Latin America	SLV	salvador
Europe	EU	IRL	irlande	Africa	Other Africa	GHA	ghana	Latin America	Other Latin America	URY	uruguay
Europe	EU	ITA	italie	Africa	Other Africa	GNB	guinee-bissau	Latin America	Other Latin America	VEN	venezuela
Europe	EU	LUX	luxembourg	Africa	Other Africa	GIN	guinee				
Europe	EU	NLD	pays bas	Africa	Other Africa	GNQ	guinee-equatoriale	Industrial ASIA	Japan	JPN	japon
Europe	EU	PRT	portugal	Africa	Other Africa	MUS	ile maurice	Industrial ASIA	NIC	KOR	coree du sud
Europe	EU	SWE	suede	Africa	Other Africa	KEN	kenya	Industrial ASIA	NIC	SGP	singapour
Europe	EU candidates	BGR	bulgarie	Africa	Other Africa	LSO	lesotho	Industrial ASIA	NIC	TWN	taïwan
Europe	EU candidates	CYP	chypre	Africa	Other Africa	LBR	liberia	Industrial ASIA	ANASE	IDN	indonesie
Europe	EU candidates	EST	estonie	Africa	Other Africa	MDG	madagascar	Industrial ASIA	ANASE	MYS	malaisie
Europe	EU candidates	HUN	hongrie	Africa	Other Africa	MLI	mali	Industrial ASIA	ANASE	PHL	philippines
Europe	EU candidates	LET	lettonie	Africa	Other Africa	MWI	malawi	Industrial ASIA	ANASE	THA	thailande
Europe	EU candidates	LTV	lituanie	Africa	Other Africa	MRT	mauritanie				
Europe	EU candidates	MLT	malte	Africa	Other Africa	MOZ	mozambique	China	China	HKG	hong-kong
Europe	EU candidates	POL	pologne	Africa	Other Africa	NAM	namibie	China	China	CHN	chine
Europe	EU candidates	CSK	republique tcheque	Africa	Other Africa	NER	niger				
Europe	EU candidates	ROM	roumanie	Africa	Other Africa	NGA	nigeria	India	India	IND	inde
Europe	EU candidates	SLQ	slovaquie	Africa	Other Africa	UGA	ouganda				
Europe	EU candidates	SLO	slovenie	Africa	Other Africa	CAF	republique centrafricain	Other Asia	Near and middle East	SAU	arabie saoudite
Europe	EU candidates	TUR	turquie	Africa	Other Africa	RWA	rwanda	Other Asia	Near and middle East	BHR	bahrein
Europe	EFTA	ISL	islande	Africa	Other Africa	STP	sao tome et principe	Other Asia	Near and middle East	ARE	emirats arabes unis
Europe	EFTA	LIE	liechtenstein	Africa	Other Africa	SEN	senegal	Other Asia	Near and middle East	IRN	iran
Europe	EFTA	NOR	norvege	Africa	Other Africa	SYC	seychelles	Other Asia	Near and middle East	IRQ	irak
Europe	EFTA	CHE	suisse	Africa	Other Africa	SLE	sierra leone	Other Asia	Near and middle East	JOR	jordanie
Europe	Other CEEC	ALB	albanie	Africa	Other Africa	SOM	somalie	Other Asia	Near and middle East	KWT	koweït
Europe	Other CEEC	BIH	bosnie herzegovine	Africa	Other Africa	SDN	soudan	Other Asia	Near and middle East	OMN	oman
Europe	Other CEEC	HRV	croatie	Africa	Other Africa	SWZ	swaziland	Other Asia	Near and middle East	QAT	qatar
Europe	Other CEEC	MAD	macedoine	Africa	Other Africa	TCO	tchad	Other Asia	Near and middle East	YEM	yemen du nord
Europe	Other CEEC	YUG	yougoslavie	Africa	Other Africa	TZA	tanzanie	Other Asia	Near and middle East	YMD	yemen du sud
CIS	Russia	CEI	federation de russie	Africa	Other Africa	TGO	togo	Other Asia	Other Asia	AFG	afghanistan
CIS	Other CIS	ARM	armenie	Africa	Other Africa	ZAR	zaire (congo kinshasa)	Other Asia	Other Asia	BTN	bhoutan
CIS	Other CIS	AZE	azerbaïdjan	Africa	Other Africa	ZMB	zambie	Other Asia	Other Asia	BGD	bangladesh
CIS	Other CIS	BLR	belarus	Africa	Other Africa	ZWE	zimbabwe	Other Asia	Other Asia	MDV	maldives
CIS	Other CIS	GEO	georgie	Northern America	USA	USA	etats unis	Other Asia	Other Asia	MNG	mongolie
CIS	Other CIS	KAZ	kazakhstan	Northern America	Canada	CAN	canada	Other Asia	Other Asia	NPL	nepal
CIS	Other CIS	KZG	kirghizie					Other Asia	Other Asia	PAK	pakistan
CIS	Other CIS	MDA	moldavie	Latin America	Brasil	BRA	bresil	Other Asia	Other Far East	LKA	sri lanka
CIS	Other CIS	TJK	tadjikistan	Latin America	Other Latin America	BHS	bahamas	Other Asia	Other Far East	BRN	brunei
CIS	Other CIS	TKM	turkmenistan	Latin America	Other Latin America	BRB	barbade	Other Asia	Other Far East	KHM	cambodge
CIS	Other CIS	UKR	ukraine	Latin America	Other Latin America	BLZ	belize	Other Asia	Other Far East	PRK	coree du nord
CIS	Other CIS	UZB	ouzbekistan	Latin America	Other Latin America	BLZ	belize	Other Asia	Other Far East	LAO	laos
Southern Mediterranean	Israel	ISR	israel	Latin America	Other Latin America	CUB	cuba	Other Asia	Other Far East	BUR	myanmar
Southern Mediterranean	Other Southern mediterranean	DZA	algerie	Latin America	Other Latin America	DMA	dominique	Other Asia	Other Far East	VMN	vietnam
Southern Mediterranean	Other Southern mediterranean	EGY	egypte	Latin America	Other Latin America	GRD	grenade	Oceania	Australia / New zealand	AUS	australie
Southern Mediterranean	Other Southern mediterranean	LBN	liban	Latin America	Other Latin America	HTI	haiti	Oceania	Australia / New zealand	NZL	nouvelle-zelande
Southern Mediterranean	Other Southern mediterranean	LBY	libye	Latin America	Other Latin America	JAM	jamaïque	Oceania	Other Oceania	COK	iles cook
Southern Mediterranean	Other Southern mediterranean	MAR	maroc	Latin America	Other Latin America	MSR	montserrat	Oceania	Other Oceania	FJI	fidji
Southern Mediterranean	Other Southern mediterranean	SYR	syrie	Latin America	Other Latin America	DOM	republique dominicaine	Oceania	Other Oceania	FSM	micronesie
Southern Mediterranean	Other Southern mediterranean	TUN	tunisie	Latin America	Other Latin America	LCA	sainte lucie	Oceania	Other Oceania	KIR	kiribati
Africa	Southern Africa	ZAF	afrique du sud	Latin America	Other Latin America	VCT	saint vincent	Oceania	Other Oceania	MHL	iles marshall
Africa	Other Africa	AGO	angola	Latin America	Other Latin America	TTO	trinite et tobago	Oceania	Other Oceania	NRU	nauru
Africa	Other Africa	BEN	benin	Latin America	Other Latin America	ARG	argentine	Oceania	Other Oceania	PLW	palau
Africa	Other Africa	BWA	botswana	Latin America	Other Latin America	BOL	bolivie	Oceania	Other Oceania	PNG	papouasie nouvelle gu
Africa	Other Africa	BFA	burkina faso	Latin America	Other Latin America	CHL	chili	Oceania	Other Oceania	SLB	iles salomon
Africa	Other Africa	BDI	burundi	Latin America	Other Latin America	COL	colombie	Oceania	Other Oceania	TON	tonga
Africa	Other Africa	CMR	cameroun	Latin America	Other Latin America	CRI	costa rica	Oceania	Other Oceania	TUV	tuvalu
						ECU	equateur	Oceania	Other Oceania	VUT	vanuatu
						GTM	guatemala			WSM	samoa occidentales

Sources: OST

2. Period

The study covers a decade span, 1989-1999. For reliability, all calculations are based on three-year averages, namely 1987-1989 and 1997-1999. In formatting the study's tables, the last year of available information for a given period is used to date the indicator (e.g. "1999" for the period 1997-1999). Dates correspond to actual "publication years" of documents and not to entry in the database.

The following table indicates the individual years, which are available at OST for each CEEC. In our study, we only retained three years

Zone	Code ISO	Country	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
EU candidates	BGR	Bulgaria	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EU candidates	CSK	Czech Republic	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EU candidates	CYP	Cyprus	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EU candidates	EST	Estonia	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
EU candidates	HUN	Hungary	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EU candidates	LET	Latvia	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1
EU candidates	LTV	Lithuania	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
EU candidates	MLT	Malta	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EU candidates	POL	Poland	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EU candidates	ROM	Romania	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EU candidates	SLO	Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
EU candidates	SLQ	Slovakia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
EU candidates	TUR	Turkey	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Other CEEC	ALB	Albania	0	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Other CEEC	BIH	Bosnia	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Other CEEC	HRV	Croatia	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1
Other CEEC	MAD	Macedonia	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Other CEEC	YUG	Yugoslavia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Note: 1 means that data are available for the considered year. 0 means that data are not available for the considered year.

Sources: ISI data, OST treatments.

3. Specific warnings

The general limitations and biases of ISI-based bibliometrics apply. Caution is recommended in interpreting the results, especially when, analysing small statistical units, for example from small countries, or obtained by cross-tabulations (discipline-country) or square linkages (co-publications). Such figures are also expected to be strongly fluctuating in time series. Moreover, asymmetrical statistical distributions, common in bibliometrics make some figures extremely sensitive to the values generated by highly productive individuals. This general rule applies to many of the countries studied in this report, which are of small scientific size (Estonia, Lithuania, Latvia, Cyprus, Malta, Macedonia, Bosnia and Albania.). In most tables, a size threshold has been practiced. We only retain the most represented countries i.e. these, which have, for instance, a publication number higher than 500, or at least nearly 50 as well as a world share higher than 0,1% in the world scientific publication.

Then, a problem, which arises for all countries with a strong national tradition, may be particularly severe for a few countries under scrutiny. For various reasons, SCI includes several low-impact and low-internationalised journals, for France and Germany for example, but also for Russia and several Eastern Europe countries. As OST works have shown⁹, the effect on activity measures can be dramatic, especially for FSU countries, but also for countries which are small in terms of output and nevertheless not deprived from an editorial power. In such case, the output figures can be extremely dependent on the presence of a few home journals, strongly "nationally-oriented". This is true for the overall production of the country, but especially for the disciplinary specialisation index that can be jeopardised. For example, the specialisation of Romania in chemistry and mathematics, of Latvia in chemistry, may be at least partly explained by editorial reasons.

4. Production indicators

••• World share indicators

Absolute production numbers are purely indicative since they depend at the first order on the coverage of the database. The basic indicator for each zone or country is in terms of world share (percentage). Its secondary dependence on

⁹ See <http://www.obs-ost.fr>

coverage, and time fluctuations, justify the 3-years averaging. Tables also show shares relative to Europe¹⁰ and CEECs zone¹¹.

This indicator, naturally, is vulnerable to the above-mentioned SCI's coverage issues. As mentioned above, international positions cannot be interpreted independently of national resources.

Table 59. Density index of scientific publication in comparison with the population - 1999

Country	(Number of publication / Population)*10000
United-Kingdom	8,9
USA	6,6
France	6,0
Germany	5,7
Japan	4,1
Spain	4,1
Italy	4,0
Slovenia	
Greece	Between
Hungary	2 and 4
Estonia	
Slovakia	
Portugal	
Croatia	Between
Bulgaria	1 and 2
Poland	
Cyprus	
Latvia	
Lithuania	
Malta	Between
Yugoslavia	0,5 and 1
Czech Republic	
Turkey	
Romania	
Macedonia	
Albania	< 0,3
Bosnia	

Sources: ISI data, OST treatments.

We have divided the total number of scientific publications for the 1999 year (occurrence counting method) by the population (latest available data from UNO, division de la population [2000]).

••• Specialisation indicators

The sectoral specialisation index ("activity index", "relative advantage index") relates the share of a given country in a specific discipline to the country's share in all disciplines, or identically the share of a given discipline within the country to the share of this discipline in all sciences. This probabilistic index is one that enables establishing and comparing the discipline-by-discipline profile of various countries.

The dispersion observed in these index values for a given country provides a perception of the overall level of specialisation in the country's research strategy: a more widespread investment strategy vs. a "niche" strategy, which is often imposed on smaller countries. The relative dominance of a given country (e.g. the United States) serves to influence the magnitude of the corresponding specialisation index. We herein retain this indicator in its most direct form, without re-standardisation of the variation interval.

5. International collaboration indicators

The scientific community is heavily interconnected, with a portion of these interconnecting relation retaining some kind of usable trace in publications. The number of co-signatures evidences the actual co-operative networks, whereas the

¹⁰ See the selected zones and countries.

¹¹ Calculated for the EU candidate countries (Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia and Turkey) and the other Central and Eastern European countries: Albania, Croatia, Bosnia, Macedonia and Yugoslavia.

virtual, information-sharing networks are reflected in the citation-based relationship. Quite obviously, co-publication does not represent all forms of scientific exchanges, among them circulation of citations, joint programmes, large facilities sharing, international mobility of students and researchers. In this report we limit ourselves to describe the international network of co-publications (co-signed articles).

As mentioned above, the standard type of counting, in this report, is fractional ("exchanged fractions"). For example, a France-France-US-Spain article (4*4 table), ignoring the diagonal, generates 12 unilateral links with weight 1/12 (or else 6 bilateral links). In this example, France's linkage with France is 1/6, with US 1/6, with Spain 1/6, giving a sum of 1/2, the fractional contribution of France. This type of counting is additive in scale changes, for example from country level to zone level.

6. Conclusion

To conclude, let us emphasise that the interpretation of the scientific activity indicators measured in the SCI must acknowledge the feature of this data source, meant to represent the internationally-visible outputs of academic research.

Caution is therefore required when it comes to interpreting the SCI's series of scientific activity measurements, especially with respect to the increase in performance registered for some non-English-speaking countries, which over the past several decades, have undertaken their conversion to the "transnational" dominant model. In an earlier OST work, some signs of this transition were underlined: gradual relinquishing of the national language and - at times - national publishers; rise in international co-publications; investment in more recognisable publication supporting structures, namely those selected in the ISI databases.

For some of the countries studied, the transition is more specific, with a re-alignment of their networks from East to West (see Grupp-Hinze works). The rising trend line in the number of publications, as measured in the SCI data source for these countries seeking to reach greater international recognition, does not necessarily go hand in hand with an improvement in research systems, yet sometimes leads to expanding their potential for international communication. Nonetheless it can be considered that, over the long run, assimilating the international scientific model's processes of competition and co-operation does in all likelihood serve to enhance efficiency.

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One of the most important challenges that the Central and Eastern European Countries (CEECs) are facing is the development of integrated scientific and technology competencies as well as the integration of Research and Development systems into the network of European and international scientific cooperation.

In this context, it is interesting to provide science policy makers with the tools helping them in drawing up priorities and strategies.

The UNESCO- ROSTE has commanded this study to OST. OST is a Public Interest Group (GIP) set up in 1990 at the initiative of the Ministry of Research. Thirteen other institutions (public research organisations and ministries) are members of OST. OST missions include the production of indicators about the scientific, technological and innovative activities, in order to assess the strategies of the actors, to provide policy analysis and to produce knowledge relevant to policymaking. OST has set up a database that brings together various sets of data: scientific publications, patents, OECD data, foreign trade data, etc...

The purpose of this study is to perform a state-of-the-arts positioning of each CEEC in the world scientific literature and to appreciate their strengths and weaknesses in the major scientific specialities. Moreover, in the context of enlargement of the EU to the CEECs, it is interesting to document the past and existing scientific collaborations between the CEECs and the Member States. This study measures the “certified collaborations” between researchers, expressed in co-authoring of scientific publications.



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