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Innovation and Advanced Technology Markets in the European Union and Poland in the Context of the Renewed Lisbon Strategy

Abstract

The aim of the paper is to present main trends in the advanced technology market in Poland as a New Member State of the EU in the context of the adjustment to the Renewed Lisbon Strategy. The paper consists of two parts. The first of them is based on the literature review regarding innovation and technology transfer's definitions as well as methodological approaches on a macro–economic, international, and global scale. The second part of the paper is related to the analysis of the competitive advantages of Poland in the trading of high technology products as well as competitive position on selected high technology product markets, with special reference to: electronic instruments and equipment and research stands.

1. Introduction

The "Working Together for Growth and Jobs: A New Start for the Lisbon Strategy" document was approved in March of 2005 by the European Council Summit. It modified the original strategy of the year 2000. The following were proposed as priority actions on the part of the European Union and Member States by the year 2010:

- make Europe a more attractive place for investment and work,
- develop knowledge and innovation for growth,
- create a greater number of permanent jobs.

These priorities were translated into the Strategic Community Guidelines for the years 2007–2013.

2. Technology Transfer: an Overview of Basic Concepts and Definitions as well as Methodological Approaches on a Macro–Economic, International, and Global Scale

The **innovativeness of an economy** is understood as the capacity and motivation of businessmen to continuously seek and utilize in practice the results of scientific studies, and research and development work, new concepts, ideas, and inventions as well as improve and develop existing technologies involving production and exploitation, while in the sphere of services, introducing new solutions in organization and management, and perfecting and developing infrastructure in the area of collecting, processing, and providing access to information.

A key role in improving the innovativeness of an economy is played by **technology transfer, which takes place on an international and global scale – i.e. on the level of technology and know–how transferred through international trade and within the framework of transnational corporations**.

Technology plays a significant role in **international production**. It is contained in both capital goods exported abroad, including to foreign divisions of transnational corporations, and is measured by the value of such export by foreign divisions (externalization through the sale of goods with high technology and human capital input, licenses, franchising, subcontracting, and minority share joint ventures (Papanastassiou, R. Pearce, p. 53). Technology delivered by way of contractual agreements or contracts dealing in the manufacture of original equipment is measured by value paid and associated inflows. Technology transferred through training and the transfer of know–how is measures by the cost of resources used to conduct it. Payment for technology delivered in the form of royalties (e.g. for copyright) as well as licensing fees demonstrates a systematic growth ever since the nineteen–eighties, where intra–firm trading taking place between parent companies and their foreign divisions is showing steady growth. These changes reflect the fact that foreign investments are continuously becoming a part of technologically intensive fields (in parallel with their high and growing share in the service sector), where technological assets are becoming increasingly important for transnational corporations by improving their competitiveness. The greatest part of this growth is occurring in

economically highly developed countries where royalty payments and inflows are growing more rapidly than foreign direct investment inflows. Those countries concentrated 88% of payments and 98% of inflows generated by cross–border flows of royalties and licensing fees on a world scale in 1997. Also stressed is the major importance attached to the system for protection of intellectual property that is in place in selecting a country for depositing capital by a transnational corporation.[1] Thus, foreign direct investments have become a basic channel for the transfer of technology whose role has increased significantly compared with traditional channels such as what was once the granting of licenses.

The level of innovativeness of an economy also bears fruit in its high competitiveness, which is especially witnessed by export results (where the dominant goods are those with the relatively highest growth in demand on foreign markets), which include goods that are a part of the high–tech group (Wysokińska 2001).

3. Technology Transfer Evaluation Indicators on a Macro–Economic Level as Well as on an International and Global Scale

The **World Bank Institute (WBI) and experts from the World Development Report** perform measurements on several indicators that define the level of an economy's integration with the world economy in terms of its competitiveness.[2]

- Reading and writing skill indicator (above the age of fifteen),
- Telephone quantity indicator (stationary and mobile) per 1,000 inhabitants,
- Intellectual property rights observance indicator,
- Level of economy openness – level of tariff and extra–tariff barrier
- Number of technical publications per one million inhabitants,
- Scientific and research staff involvement in research and development,
- Share of trade in manufacturing industry goods as a percentage of the GDP,
- Overall level of the economy measured as the annual GDP growth rate,
- Export of high technology goods as a percentage of manufacturing industry goods exports,

[1] More on this topic may be found in (Nerdrum 1999, pp. 186–187).

[2] www.worldbank.org.

- Internet access points per 10,000 inhabitants,
- Share of companies that introduced new or improved products to the market over the analyzed period of time, including small and medium enterprises,
- Relation of outlay on innovative activities to sales volume (intensity of innovation in industry and in the market services sector),
- The indicator of inventions (or patents) submitted by residents per 10,000 inhabitants may also be examined.

Table 1. Phases in Technology Development through Increased Innovative Effort

Leading Innovations The creation of new technologies and their development.
Improving and Monitoring Technology The improving of products, processes, and worker skills in order to increase productivity and competitiveness on the basis of in–house research and development, licensing, and collaboration with other companies and institutions.
Significant Adaptation Changes in products and processes, company equipment, management productivity and quality control systems, public procurement methods, and logistics in order to adapt technology to match local and export market needs. This centers on domestic experimentation and research and development as well as on studies and interaction with other companies and institutions.
Primary Production Personnel training in main production areas and the development of a technical staff; achieving a capacity to develop models and production on a company level; configuring products and processes; creation of quality management systems; institute consulting; management, procurement, and logistic systems.

Source: UNCTAD, World Investment Report, 2005.

Table 2. Innovation Internationalization Model

Category	Entities	Forms
Innovation created in the given country utilized on an international scale	Domestic and transnational companies as well as independent units generating profits	• Export of innovative products • Patent and license cohesiveness • Foreign innovative goods production on the basis of models prepared and developed in the company
International collaboration on a technical–scientific scale	Universities and public centers Domestic and international companies	• Joint scientific projects • Scientific exchange • International student exchanges • Joint ventures in international projects • Production agreements with technical information or equipment exchange
Generating innovation on an international scale	Transnational corporations	• Research and development or other innovative activities both in the parent country and in the country accepting the investment • Takeover of existing scientific–research units or "greenfield" investments in the accepting country

Source: UNCTAD, World Investment Report, 2005.

Table 3. Manufacturing Industry Classification by Research and Development Input

Industry Category	R&D Intensity	Industries
High Technology	>5%	Aviation and aerospace, pharmaceutical, office, computer and calculating equipment, radio, television, and telecommunication equipment, medical, precision, and optical instruments
Medium Technology	1.5%–5%	Machines and electrical devices not classified elsewhere, vehicles, trailers, chemicals (excluding pharmaceuticals), road transportation equipment not classified elsewhere
Medium–Low Technology	0.7%–1.5%	Petroleum products and nuclear fuel, rubber and plastic products, other nonmetallic mineral products, ship and boat building and repair equipment, basic metal products, manufactured metal products (excluding machines and equipment)
Low Technology	0.7%	Processed products not classified elsewhere, recycling, lumber, pulp, paper, paper products, printing and publishing, food products, tobacco products and stimulants, textiles, textile and leather products, footwear

Source: United States, NSB 2004, Table 6–1.

Table 4. Innovative Capacity Index Components as Developed by UNCTAD

Index	Components	Assigned Weight
Technological Activity Indicator	• R&D personnel employment per million population • United States patents per million population • Scientific publications per million population	All three components are assigned the same weight
Human Capital Indicator	• Ability to read and write as a percentage of the population • Enrolment in secondary schools as a percentage of the relevant age group • College enrolments as a percentage of the relevant age group	Weight: 1 Weight: 2 Weight: 3
UNCTAD Innovative Capacity Index	• Technological activity index • Human capital index	Both indexes have equal weight

Source: UNCTAD, World Investment Report, 2005.

Level of telecommunication infrastructure treated as a basic criterion of improvement of an economy's competitiveness by the authors of the *World Competitiveness Yearbook*.[3] This includes:

- investments in the telecommunication sector – share of investment outlay in the GDP,
- stationary telephone connections – number of lines per 1,000 inhabitants,
- costs of international telephone connections (for three–minute calls),
- mobile phone users – number of users per 1,000 inhabitants,
- costs of mobile telephone connections (for three–minute calls),
- state of telecommunication technology,
- computer use (number of computers per one inhabitant),
- internet users,
- costs of Internet use,
- access to broadband Internet – number of users per 1,000 inhabitants,
- costs of broadband Internet access,
- telecommunication technology sector workers,
- technological cooperation,
- technology development and application,
- technological development financing,

[3] http://www02.imd.ch/wcc/criteria/index.cfm?display=in2.

- export of high–tech goods, in millions of dollars,
- share of high–tech goods in the export of manufactured goods,
- cyberspace security.

The best known high technology "lists" are those of the United States Bureau of the Census, which are prepared and verified on the basis of studies by many American institutes, as well as "lists" that are processed and collected jointly by the OECD and European Union statistical offices, which have a more international character.

It is mainly these "lists" that are modified by regional specifications to meet the needs of other countries and organizations. Sectors of industry are defined rather simply by their level of competitiveness. Their selection is based on intensity of research in individual industry sectors – i.e. the share of research and development of those sectors (expressed as outlay on research and development, employment of research staff, wages paid to such staff, etc.) in terms of sales volume for industry as a whole (cut off above a certain level). However, it is ultimately a group of experts that decides as to qualifying a given sector as high technology because boundaries are essentially by convention and defined by political decision (research and development outlay, employment, wages).

The list of industrial sectors ranked as high technology by the United States Bureau of the Census includes:

- biotechnology,
- the medical sciences,
- optoelectronics,
- information and communications,
- electronics,
- adaptive production,
- high technology materials,
- aviation and aerospace technology,
- armaments,
- nuclear technology.

The American list of Advanced Technology Products (ATP) encompasses approximately 500 goods from among approximately 22,000 goods covered by the American Standard Industrial Classification (SIC) system. The basis for the qualification of these goods is their meeting of the following criteria:

1. The goods code encompasses products belonging to a sector of industry considered high technology (one of the ten sectors described above).

2. The products encompass “peak” technologies of the given industrial sector.
3. The products encompass a significant portion of all products covered by the given goods code.

There are other high technology product classification systems, such as the DOC–3 list, which is based on a division of entire sectors of industry into “high” and “low” technology products. This is a broader definition as it includes all products within a sector considered high technology (usually, this results in at least a doubling of goods turnover, where defining indicators for analysis is easier as is their linking to industry).

In the United States, these indicators are mainly used to define:

1. Technology leader(s).
2. The competitiveness of individual sectors of industry.
3. The impact of high technology goods trading on employment and wages.

List of High Technology Transfer Indicators According to the OECD

The OECD uses indicators in defining categories of sectors of industry that differ from those applied by the United States:

I. By technology intensiveness:
- high technology,
- medium technology,
- low technology.

II. By wage level:
- high wages,
- medium wages,
- low wages.

III. By specialization:
- raw material intensive,
- labor intensive,
- large–scale production,
- specialized suppliers,
- science–based activities.

The classification of sectors of industry by technological intensity is based on a foundation of research intensity—i.e. the ratio of outlay on research and development to the whole of sales in the given sector as selected for the nineteen–seventies and eighties out of nine high technology sectors. These sectors were selected through analysis of the average weighed expenditures for research and development and the total sales value conducted for twenty–one

industry sectors for ten OECD countries for which the set of such data was accessible (United States, Japan, Federal Republic of Germany, France, Great Britain, Italy, Canada, Australia, Netherlands, and Denmark). It was within these sectors that the OECD Secretariat, in collaboration with the German Fraunhofer Institute, selected high technology goods defined in the Standard International Trade Classification, Revision 3 (SITC, Rev. 3), which is useful in analyzing competitiveness in international cooperation. The list of these sectors as well as goods within them is depicted by the specification below. They have their classification counterparts in both production and international trade classifications.

Table 5.

Manufacture of aircraft and spacecraft
Manufacture of office machines and computers
Manufacture of radio, television, and telecommunication equipment and devices
Manufacture of pharmaceutical goods
Manufacture of medical, precision, and optical instruments, as well as clocks and watches
Manufacture of electrical machines and devices not classified elsewhere
Manufacture of chemical products, excluding pharmaceuticals
Manufacture of machines and equipment not classified elsewhere
Manufacture of arms and ammunitions

Source: Own analysis based on OECD data – Oslo Manual, 1995.

Measures Used in OECD Classification

The OECD, together with the European Union, conducted a new subdivision of industry sectors in 1995 to include:

- the high technology sector,
- the medium–high technology sector,
- the medium–low technology sector,
- the low technology sector.

These sectors were modified in 1997. Their ranges are presented by the following table.

Table 6. Classification of Manufacturing Industry Sectors by Technology Level as Published by the OECD in 1997 (OECD 1997 classification of manufacturing sector by level of technology)

Description in accordance with the Polish Activity Classification system (PKD)
High Technology
Manufacture of aircraft and spacecraft
Manufacture of pharmaceuticals
Manufacture of office machines and computers
Manufacture of radio, television, and communication equipment and devices
Manufacture of medical, precision, and optical instruments as well as clocks and watches
Medium–High Technology
Manufacture of machines and equipment not classified elsewhere
Manufacture of electrical machines and devices not classified elsewhere
Manufacture of motor vehicles, trailers, and semitrailers
Manufacture of chemical products, excluding pharmaceuticals
Manufacture of railroad and tramway locomotives as well as railroad and tramway rolling stock Manufacture of motorcycles and bicycles Manufacture of transportation equipment not classified elsewhere
Medium–Low Technology
Manufacture and repair of ships and boats
Production of coke, petroleum products, and nuclear fuel
Manufacture of rubber and plastic goods
Production of other nonmetallic raw materials
Metal production
Manufacture of ready metal goods, excluding machines and equipment
Low Technology
Production of food products and beverages Production of tobacco products
Textile manufacturing g Manufacture of clothing and fur products Manufacture of tanned leather and tanned leather goods
Production of lumber and manufacture of wood, straw, and wicker products
Production of fiber pulp, paper, and paper products
Publishing, printing, and reproduction of information media
Manufacture of furniture, production activity not classified elsewhere Waste management

Source: Own analysis based on OECD data – Oslo Manual, OECD, Paris, 1997.

The above–presented methods for classifying and measuring the intensity of streams of advanced technology goods as well as streams of foreign direct investment in the high–tech sectors make possible an analysis of the real flow of

technology transfer on an international scale as well as on the scale of the main economic regions of the world, including Europe, identifying the primary centers for technology transfer within the framework of the global economy and liberalized market.

4. Analysis of the Competitive Advantages of Poland in the Trading of High Technology Goods as well as Competitive Position on Selected High Technology Product Markets: A Case Study in Electronic Instruments and Equipment and Research Stands

4.1. Analysis of Relative Competitive Advantages of Poland in Trading in High Technology Goods on the European Market

An analysis of Poland's competitive advantages in exports to the Unified European Market for highly–processed goods as well as applied technology input shows that the revealed comparative advantage (RCA) indicator was at a favorable level for groups of goods such as electrical arc metal welding machines and equipment (including plasma arcs), completely or partially automatic, and automatic typewriters and word–processing machines, as well as with respect to polyethylene terephthalate. Product groups for which the RCA indicator was closest to a positive value over the investigated period, although that level is not yet reached, includes fiber–optic cables, selenium, tellurium, phosphorus, arsenic, boron, automatic typewriters and word–processing machines, numerically controlled knee and column milling machines, calcium, strontium, barium, rare earth metals, scandium, yttrium, including mixed and melted, other numerically controlled drills, cinematographic cameras, shearing machines (including presses), other than combination punch and die shearing presses, numerically controlled, machines and apparatus for separating isotopes and parts for such equipment, not listed elsewhere, other electron tubes, other nonorganic bases, metal oxides, hydroxides, and peroxides, and other metal milling machines involving material removal (compare with Table 7). Table 8 presents the detailed results of the ranking of Poland's competitive advantages on the Unified European Market with respect to goods with a high input of technology and high level of processing.

Another conclusion that may be drawn from the analysis is that 2005 saw a small improvement in the indicator, with respect to a small group of products such as penetrating, punching, and shearing machines (including presses) and including combination punching and die shearing machines, numerically

controlled, and fiber–optics together with optical bundles and fiber–optic cables, polarizing substance sheets and panels, and unmounted optical elements not listed elsewhere, albeit with no disclosing of advantage (compare with Table 8).

A detailed analysis of the presented competitiveness indicators points to low innovativeness and competitiveness of export from Poland to the Unified European Market in the case of goods characterized by a high input of technology and highly–qualified workers, however. This state is primarily the result of low outlay on scientific development over the whole period of systemic transformation as well as on what is known as the commercialization of research work by technical universities, which could work to increase the new invention practical application indicator, especially by small and medium enterprises. The only hope for improvement of this condition might be the raising of the share of outlay on the research and development sphere to approximately 3 percent of the GDP, which is in line with Lisbon Strategy requirements. However, as can be deduced from the conducted studies in the area of export competitiveness indicators for the examined groups of goods, increasing outlay on the production and trading of the groups of goods found in at least the first twenty positions of the competitiveness advantages ranking presented in Table 7 should bring about a significant improvement in the situation over the upcoming years and increase utilization of skills and innovation, thus improving Poland's competitive position on the European market as well as on the markets of other countries, especially those with high growth in demand for imported merchandise at their disposal. These opportunities are especially visible in the context of the new active strategy of the European Union in trade with third party countries, and in particular with the dynamically developing region of Southeast Asia (the APEC countries).

Table 7. Ranking of Revealed Comparative Advantage Indicators in Polish High–Tech Exports on the European Internal Market – 2003–2005

Groups of Products	RCA Indicator in Polish High–Tech Exports on the European Internal Market Poland/EU24 (excluding Poland): RCA Ranking for Poland 2005			Share of the High–Tech Group of Products in Polish Exports		
	2003	2004	2005	2003	2004	2005
Total Exports	**0.00**	**0.00**	**0.00**	**100.00**	**100.00**	**100.00**
Total High–Tech Exports	**-0.1278**	**-0.1186**	**-0.1185**	**2.85**	**2.87**	**3.20**
Polyethylene terephthalate	-0.0004	-0.0002	0.0009	0.02	0.04	0.15
Arms and ammunition	0.0004	-0.0010	0.0007	0.12	0.03	0.15
Machines and apparatus for arc welding (including plasma–arc) metal, fully or partly automatic	0.0001	0.0002	0.0001	0.02	0.03	0.03
Fiber–optic cables	0.0000	-0.0019	0.0000	0.02	0.02	0.02
Selenium, tellurium, phosphorus, arsenic, and boron	0.0001	0.0000	0.0000	0.01	0.01	0.00
Automatic typewriters and word–processing machines	0.0000	0.0000	0.0000	0.00	0.00	0.00
Milling machines, knee–type, numerically controlled	0.0000	-0.0001	0.0000	0.00	0.00	0.00
Calcium, strontium, barium, rare earth metals, scandium, and yttrium, whether or not intermixed or interalloyed	0.0000	0.0000	0.0000	0.00	0.00	0.00
Other drilling–milling machines, numerically controlled	0.0000	0.0000	0.0000	0.00	0.00	0.00
Cinematographic cameras	0.0000	-0.0002	0.0000	0.00	0.00	0.00
Shearing machines (including presses), numerically controlled, other than combined punching and shearing machines	0.0000	-0.0001	0.0000	0.00	0.00	0.00
Machinery and apparatus for isotope separation, and parts thereof, n.e.s.	-0.0001	0.0000	0.0000	0.00	0.00	0.00
Other valves and tubes	0.0000	-0.0002	0.0000	0.00	0.00	0.00
Other inorganic bases, other metal oxides, hydroxides, and peroxides	0.0000	0.0000	0.0000	0.01	0.01	0.01
Machine tools for working any material by removal of material, by laser or other light or photon beam, or ultrasonic, electro–discharge, electrochemical, electron beam, ionic beam or plasma–arc processes	-0.0001	-0.0001	0.0000	0.02	0.02	0.04
Microwave tubes (excluding grid–controlled tubes)	-0.0001	0.0000	-0.0001	0.00	0.00	0.00
Syringes, needles, catheters, cannulae, and similar	-0.0001	-0.0061	-0.0001	0.00	0.00	0.00
Other boring–milling machines, numerically controlled	0.0000	0.0000	-0.0001	0.00	0.00	0.00
Silicon	-0.0001	0.0000	-0.0001	0.00	0.00	0.00

Photographic (other than cinematographic) cameras	-0.0003	-0.0001	-0.0001	0.00	0.00	0.00
Parts, n.e.s., and accessories suitable for use solely or principally with the machine tools of groups 731 and 733	0.0001	0.0001	-0.0001	0.11	0.09	0.08
Punching or notching machines (including presses), including combined punching and shearing machines, numerically controlled	-0.0001	-0.0003	-0.0001	0.00	0.00	0.00
Other milling machines, numerically controlled	-0.0001	-0.0001	-0.0001	0.00	0.00	0.00
Fiber–optics, and fiber–optic bundles and cables, sheets of polarizing material, unmounted optical elements, n.e.s.	-0.0002	-0.0005	-0.0001	0.01	0.01	0.01
Other sound–reproducing apparatus	-0.0003	-0.0115	-0.0001	0.00	0.00	0.00
Bending, folding, straightening, or flattening machines (including presses), numerically controlled	-0.0001	-0.0001	-0.0002	0.01	0.01	0.01
Machines and apparatus for resistance welding of metal, fully or partly automatic	-0.0002	-0.0002	-0.0002	0.00	0.00	0.00
Machine tools for working any material by removal of material, by laser or other light or photon beam, or ultrasonic, electro–discharge, electrochemical, electron beam, ionic beam or plasma–arc processes	-0.0002	-0.0002	-0.0003	0.00	0.00	0.00
Machine tools for deburring, sharpening, grinding, honing, lapping, polishing, or otherwise finishing metal, sintered metal carbides or cermets by means of grinding stones, abrasives, or polishing products (other than gear–cutting, gear–grinding or gear–finishing machines of subgroup 731.7, excluding 731.62, 731.64, 731.66, 731.67, 731.69)	-0.0002	-0.0001	-0.0003	0.00	0.00	0.00
Piezoelectric crystals, mounted, parts, n.e.s., of the electronic components of group 776	-0.0003	-0.0003	-0.0003	0.00	0.00	0.00
Boards, panels (including numerical control panels), consoles, desks, cabinets, and other bases, equipped with two or more apparatus of subgroup 772.4 or 772.5, for electrical control or the distribution of electricity (including those incorporating instruments or apparatus of groups 774, 881, 884 or of division 87, but excluding the switching apparatus of subgroup 764.1) for a voltage exceeding 1,000 V	-0.0004	0.0002	-0.0003	0.15	0.14	0.16
Electrical capacitors, fixed, variable, or adjustable (pre–set, excluding 778.61, 778.66–778.69)	-0.0007	-0.0007	-0.0004	0.00	0.00	0.00
Contact lenses	-0.0004	-0.0003	-0.0005	0.00	0.00	0.00
Nuclear reactors, and parts thereof, fuel elements (cartridges), non–irradiated, for nuclear reactors	-0.0005	-0.0005	-0.0005	0.00	0.00	0.00
Other gas turbines	-0.0009	-0.0008	-0.0005	0.00	0.00	0.00
Direction–finding compasses, other navigational instruments and appliances	-0.0007	-0.0004	-0.0006	0.00	0.00	0.00
Printed circuits	-0.0010	-0.0009	-0.0007	0.18	0.17	0.03
Photocopying apparatus incorporating an optical system or of the contact type, and thermo–copying apparatus (excluding 751.33, 751.35)	-0.0007	-0.0007	-0.0007	0.00	0.00	0.00

Hormones, natural or reproduced by synthesis, derivatives thereof, used primarily as hormones, other steroids used primarily as hormones, not put up as medications of group 542	-0.0004	-0.0006	-0.0008	0.01	0.01	0.00
Video–recording or reproducing apparatus, whether or not incorporating a video tuner	-0.0009	-0.0008	-0.0008	0.01	0.01	0.02
Optical instruments and apparatus, n.e.s.	-0.0008	-0.0004	-0.0008	0.01	0.01	0.01
Antibiotics, not put up as medications of group 542	-0.0011	-0.0009	-0.0010	0.03	0.02	0.02
Synthetic organic coloring matter and color lakes, and preparations based thereon	-0.0014	-0.0012	-0.0011	0.01	0.01	0.01
Electric sound or visual signaling apparatus (e.g. bells, sirens, indicator panels, burglar and fire–alarms), other than those under heading 778.34 or 778.82	-0.0008	-0.0116	-0.0011	0.02	0.03	0.03
Radioactive and associated materials	-0.0012	-0.0011	-0.0011	0.00	0.00	0.00
Electrical machines and apparatus, having individual functions, n.e.s., parts thereof	-0.0014	-0.0015	-0.0012	0.05	0.06	0.05
Parts for the gas turbines under heading 714.89	-0.0015	-0.0015	-0.0013	0.02	0.03	0.03
Insecticides, rodenticides, fungicides, herbicides, anti–sprouting products and plant–growth regulators, disinfectants and similar products, put up in forms or packages for retail sale or as preparations or articles (e.g., sulfur–treated bands, wicks and candles, and fly–papers)	-0.0019	-0.0017	-0.0015	0.07	0.07	0.07
Medications containing antibiotics or derivatives thereof	-0.0023	-0.0021	-0.0020	0.01	0.01	0.01
Diodes, transistors, and similar semiconductor devices, photosensitive semiconductor devices (including photovoltaic cells, whether or not assembled in modules or made up into panels), light–emitting diodes	-0.0020	-0.0063	-0.0021	0.01	0.01	0.01
Recorded media, n.e.s.	-0.0017	-0.0010	-0.0021	0.25	0.21	0.20
Orthopedic appliances (including crutches, surgical belts, and trusses), splints and other fracture appliances, artificial parts of the body, hearing–aids and other appliances that are worn, or carried, or implanted in the body to compensate for a defect or disability (excluding 899.65, 899.69)	-0.0020	-0.0024	-0.0025	0.01	0.01	0.01
Electro–diagnostic apparatus for medical, surgical, dental, or veterinary purposes, and radiological apparatus	-0.0031	-0.0010	-0.0030	0.02	0.02	0.02
Medications containing hormones or other products of subgroup 541.5, but not containing antibiotics	-0.0034	-0.0034	-0.0034	0.02	0.04	0.08
Glycosides, glands or other organs and their extracts; antisera, vaccines, and similar products	-0.0038	-0.0041	-0.0043	0.03	0.03	0.02
Engines and motors, non–electric (other than those of groups 712, 713, and 718), parts, n.e.s., of such engines and motors (excluding 714.89, 714.99)	-0.0063	-0.0049	-0.0047	0.11	0.18	0.18

Measuring, checking, analyzing, and monitoring instruments and apparatus, n.e.s. (excluding 874.11, 874.2)	-0.0047	0.0009	-0.0050	0.45	0.49	0.43
Electronic integrated circuits and microassemblies	-0.0100	-0.0065	-0.0102	0.28	0.26	0.24
Parts and accessories (other than covers, carrying cases and the like) suitable for use solely or principally with the machines of group 752	-0.0106	-0.0065	-0.0103	0.07	0.10	0.10
Aircraft and associated equipment, spacecraft (including satellites) and spacecraft launch vehicles, parts thereof (excluding 792.8, 792.95, 792.97)	-0.0191	-0.0067	-0.0130	0.13	0.16	0.10
Automatic data–processing machines and units thereof, magnetic or optical readers, machines for transcribing data onto data media in coded form, and machines for processing such data, n.e.s. (excluding 752.9)	-0.0198	-0.0132	-0.0188	0.12	0.15	0.17
Telecommunication equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within division 76 (excluding 764.93 and 764.99)	-0.0203	-0.0128	-0.0214	0.40	0.35	0.67

Revealed comparative advantage indicator (RCA) formula: Polish exports of product k / Polish total exports – EU24 exports of product k / total EU24 exports.

Source: Zofia Wysokińska, own calculations based on Polish Central Statistical Office (GUS) and Eurostat data.

4.2. Identification of Competitive Advantages and Analyses of Trends on Selected Product Markets within the High Technology Area of the "Fifteen" and the Twelve New Member States of the European Union (that Entered the European Union as a Result of the 2004 Expansion)

Analysis of the Competitive Position of Companies from the European Union, including Poland, on the European Electronic Apparatus and Equipment and Research Stand Market

The markets for two selected groups of high–tech goods **classified pursuant to** the European Union CN9031.20 (CN) and the Standard International Trade Classification, Rev. 3 (SITC) were subjected to analysis.

Analysis encompassed production, export, import, and market volume calculated for each product group for the years 2000–2005.

The product groups encompassed by the analysis were defined as follows:

1. CN9031.20 – Research stand, inclusive of apparatus and equipment making it possible to confirm if the given product is made in agreement with its design.
2. CN9031.80 – Electronic devices and equipment encompassing:

a. electronic instruments and machines for measuring and monitoring geometrical dimensions (inclusive of comparators and coordinate–based measurement equipment),
b. electronic instruments and equipment, …, for measuring or monitoring geometrical dimensions, other,
c. instruments and equipment, …, for measuring or monitoring geometrical dimensions, other,
d. non–electrical measurement–monitoring instruments and equipment, excluding those for measuring or monitoring geometrical dimensions, balancing mechanical parts, research stands, and optical instruments and equipment.

The analysis encompassed the markets of twenty–seven member states of the European Union—France, the Netherlands, Germany, Italy, Great Britain, Ireland, Denmark, Greece, Portugal, Spain, Belgium, Luxembourg, Sweden, Finland, Austria, Malta, Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Romania, Bulgaria, Slovenia, and Cyprus.

Methodology of the Analyses as Conducted

Work was mainly based on electronic EUROSTAT resources (DVD–ROM and the Europa–Eurostat home page as well as official printed data such as the *Eurostat Yearbook* for the relevant years and the statistical yearbooks of the specific countries, to a lesser extent).

Data concerning the foreign trade of the countries of the European Union are data officially published by EUROSTAT in line with the Combined Nomenclature (CN), assessed in euro. The eight–character product codes used are accessible for foreign trade, but such detailed data are not available for industry. In order to define market aggregates it is necessary to characterize production volume with the same degree of detail as foreign trade. Thus, what was used was product data from the PRODCOM–EUROSTAT List. Available items of this list were not complete. They were estimated and separated using other available information, where missing data were approximated. Thus, production data at this level of detail should be treated as an approximation. Data from the Prodcom List are reported by producers, while foreign trade data are derived from SAD documents—i.e. border crossing records. For this reason, they are not completely congruent and there are divergences in the tables. Moreover, the large share of re–export of certain countries (e.g. Germany), warps the market analysis and sometimes the market volume takes on a negative value.

Description of Results Received

The selection of the product groups for analysis—i.e. electronic instruments and equipment, and research stands-turned out to be a good choice from the point of view of development potential of high technology product markets in Europe. Precisely electronic instruments and equipment (an increase of 53.1 percentage points) are of greatest importance in this growth and they are ranked as goods of relatively high importance on the European Union market. The second group of products with a very high production growth rate (132.9%) in the conducted analysis turned out to be research stands.

Table 8. Dynamics of Production Growth on the European Market in the Examined High Technology Product Groups

High Technology Product	Growth in Production in 2005 (2000=100)
1. Electronic instruments and equipment	153.1
2. Research stands	132.9

Source: Own calculations based on Eurostat data and the national statistics of the examined countries.

Conclusions Based on the Conducted Analyses

A detailed analysis of the high technology product groups identified the two most important high technology groups with strong development trends in terms of production and market potential in the European Union.

They are:

- electronic instruments and equipment,
- research stands.

Below is a presentation of the main observations and conclusions with respect to manufacturing, export, and import of these product groups in the "Old" and "New" Member States of the European Union over the years 2000–2005. A detailed analysis of manufacturing as well as export and import trends and structure of the examined product groups on the European market (in the countries of the "Fifteen" and in the twelve New Member States that entered the European Union in 2004 and 2007) is presented in the graphs found in the Appendix.

Presented below are the main conclusions from the conducted analysis of tendencies on European markets of electronic instruments and equipment as well as research stands, which demonstrate a clearly large and growing development potential.

As can be seen from the conducted analysis, **Poland's competitive position in European Union production** of electronic instruments and equipment was at a level of approximately 0.5%, and at a level of 0.24% in the production of research stands. For its part, **Poland's position in trade** in the examined groups of goods was significantly lower than European production. It was a 0.2% **share in European Union export** with respect to the electronic instruments and equipment group and 0.4% with respect to the research stand group.

In terms of **share in European Union imports**, Poland was in a position expressed by a 3.3% share with respect to electronic instruments and equipment, and 5% with respect to research stands (compare with graphs in the Appendix).

Detailed Analysis with Respect to the Examined Product Groups

I. Electronic instruments and equipment (production growth over the 2000–2005 period: 153.1%).
   1. There is a growth trend seen in manufacturing for this product group in both the European Union "Fifteen" and in the New Member States (2004 and 2007 expansion).
   2. The dominant production share was held in 2005 by companies from Germany (51%), France (23%), Great Britain (7.6%), and Italy (5.2%). Companies from the New Member States achieved shares in European Union production as follows: Poland – 0.5% and the Czech Republic and Hungary – 0.2%, each.
   3. Export in the discussed group showed a slight upward trend in all of the member states of the European Union (27) over the whole examined period.
   4. The main exporters of this product group from among the "Fifteen" were companies from Germany (a 57% share), Italy (9%), and Great Britain and France (7%, each). The shares in European Union export of companies from the New Member States was at the following level: Czech Republic – 0.5%, Hungary – 0.4%, Slovenia – 0.3%, and Poland – 0.2%.
   5. Imports of the examined product group in the "Fifteen" demonstrated a downward trend over the years 2001–2003 and then slight growth over the years 2003–2005. The New Member States showed a slight growth trend throughout the whole of the examined period.
   6. The main importers in the year 2005 included companies from Germany (a 31% share), France (15%), Great Britain (9.5%), Italy (8.8%), and Austria (4.5%). From among the New Member States the dominant

companies were from Poland (3.3%), the Czech Republic (2.6%), Hungary (1.2%), and Romania (0.95%).

II. Research stands (production growth over the 2000–2005 period: 132.9%).

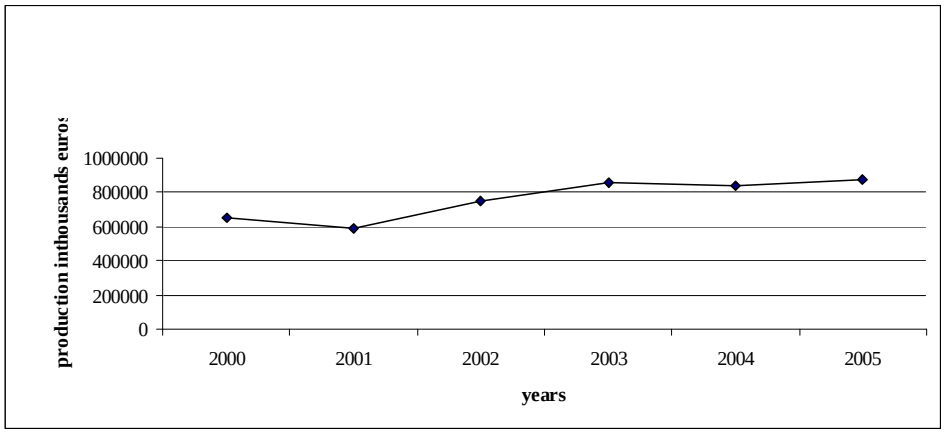
1. Production in this product group has been witnessing a growth trend in the European Union "Fifteen" as of the year 2001, while in the New Member States (the 2004 and 2007 expansion) the growth trend is as of 2002.
2. The dominant shares in production are held by companies from Germany (40%), France (22%), Austria (12%), and Italy (10%). Companies form the New Member States achieved shares in European Union production as follows: Czech Republic – 0.31%, Hungary – 0.24%, and Poland and Slovakia – 0.07%, each.
3. Export in the discussed group showed an upward trend in all European Union (27) member states over the whole of the examined period.
4. The main exporters in this product group from among the "Fifteen" were companies from Germany (with a 51% share in exports), France (13%), Italy (7%), and Great Britain (5%). The share in European Union exports from companies from the New Member States was at a level as follows: Czech republic (1.7%), Romania (0.9%), and Poland (0.4%).
5. The imports for this product group demonstrated a downward trend over the years 2000–2004 and growth starting with the year 2004 for the countries of the "Fifteen." The New Member States saw a growth trend over the years 2000–2003 and very clear growth over the years 2003–2005.
6. The main importers in the year 2005 included companies from Germany (a 17% share), Great Britain and Spain (8%, each), and Italy (7.5%). From among the New Member States, dominant companies were from Poland (5%), and Hungary and Slovakia (4%, each).

5. Conclusions

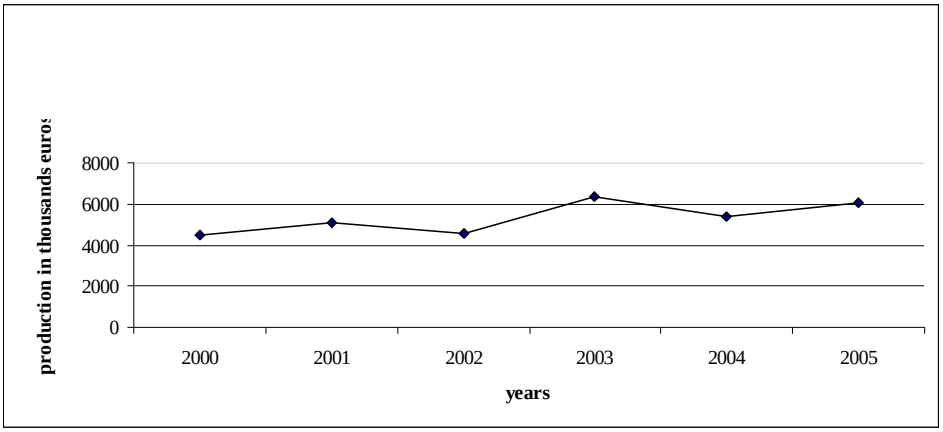
1. The renewed Lisbon Strategy gives priority in European Union strategic actions and programs in its Member States to innovation and the implementation of knowledge based economy tasks.
2. Technologies and innovation are of special importance in raising the competitiveness of the European economy in the upcoming years.

3. Poland demonstrates a low competitiveness indicator on the European market in terms of its achievements in high technology and advanced technology goods.
4. Detailed analyses of the advanced technology goods markets such as electronic instruments and equipment as well as research stands over the 2000–2005 period show that they are developing very dynamically and feature significant growth in demand.
5. The leading positions on the European market in these products are held by companies from the countries of Western Europe, although their "young" competitors from the New Member States of the European Union are marking their presence to an ever–growing degree.

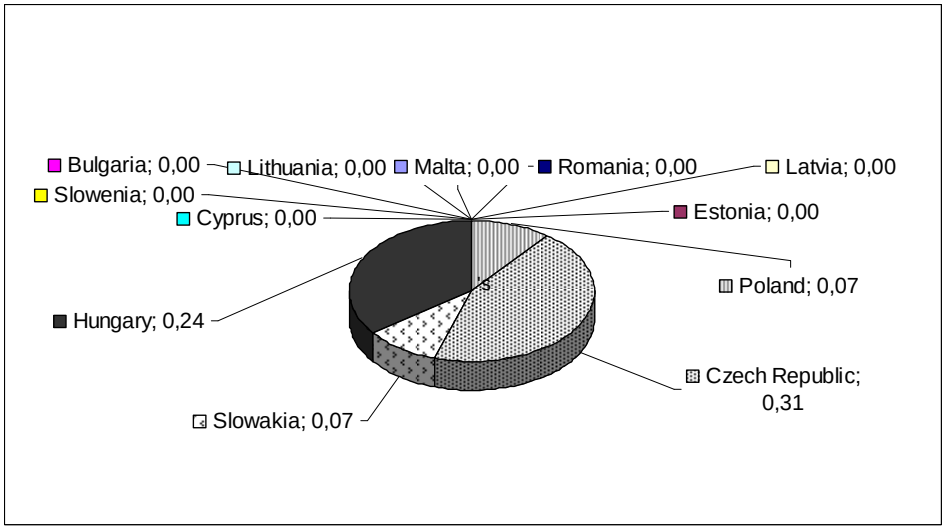
Appendixes – Graphs



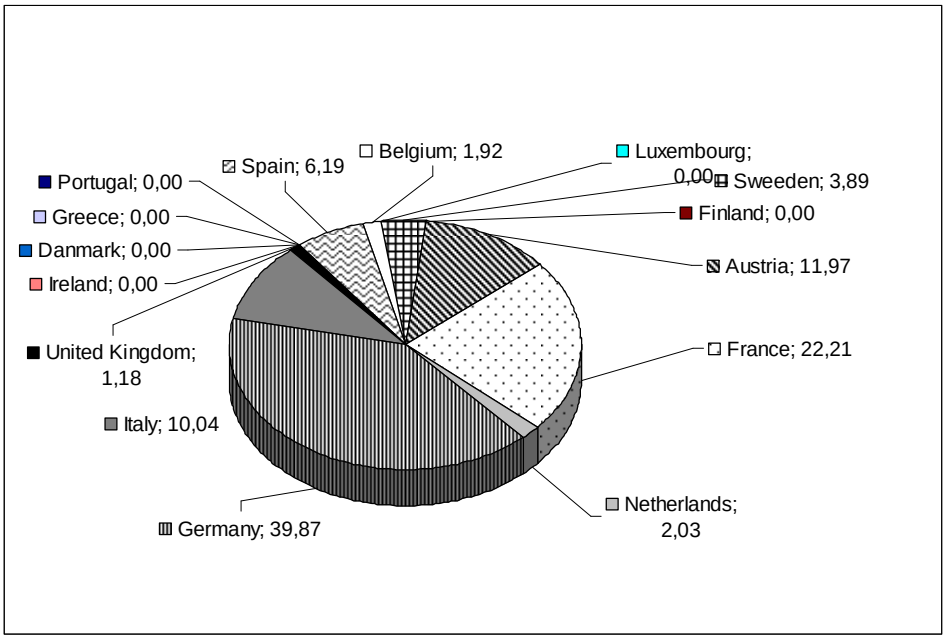
Graph 1. Trends in production of testing equipment in EU(15) in 2000–2005



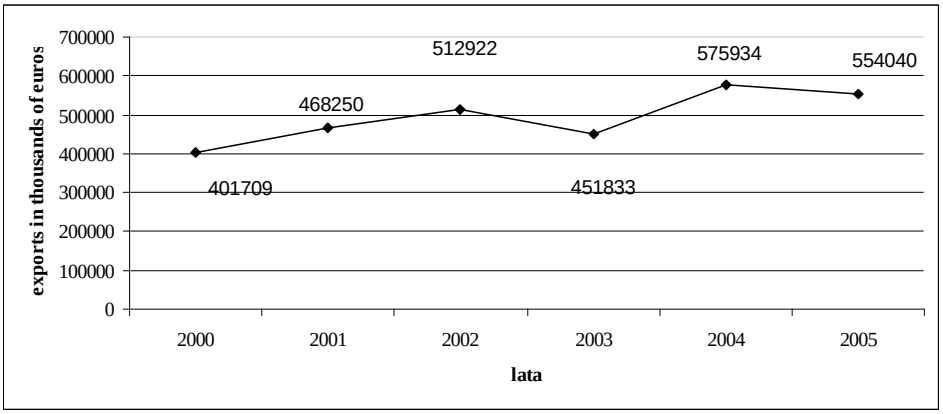
Graph 2. Trends in production of testing equipment in EU(12) in 2000–2005



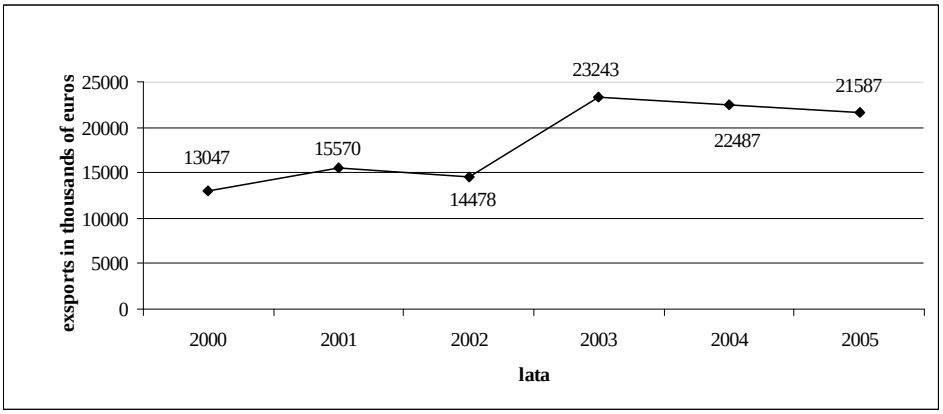
Graph 3. Geographical structure of testing equipment's production in EU(12) In 2005 (in %)



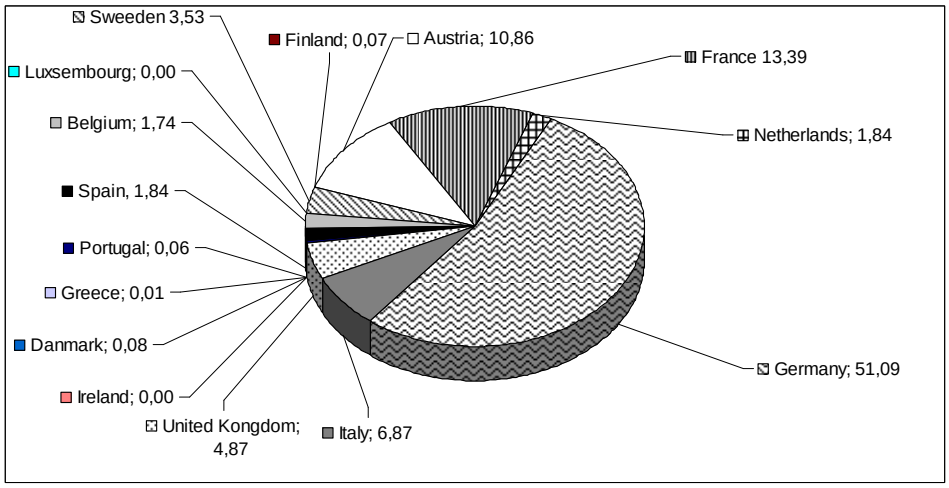
Graph 4. Geographical structure of testing equipment's production in EU(15) in 2005 (in %)



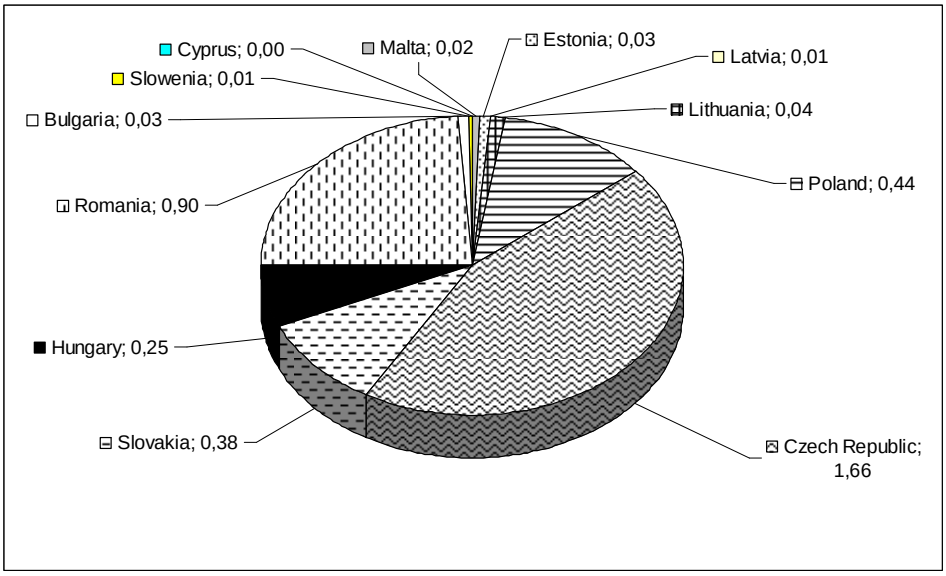
Graph 5. Trends of exports of testing equipment in the EU(15) in the years 2000–2005 in thousands of euros



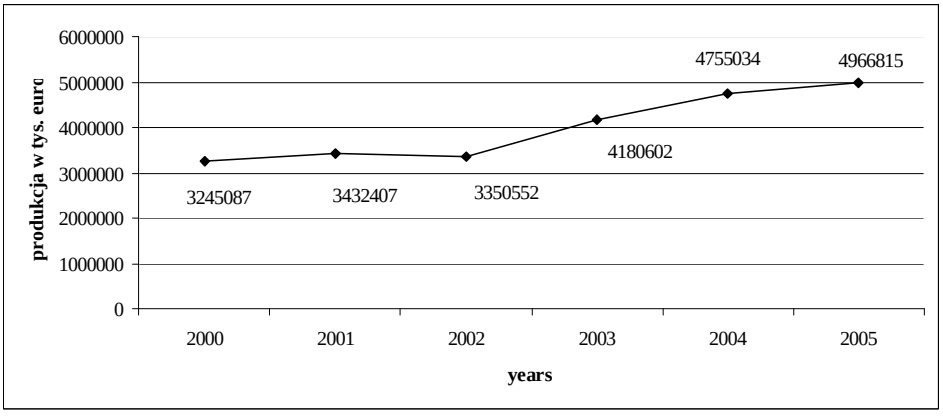
Graph 6. Trends of exports of testing equipment in the EU(12) in the years 2000–2005 in thousands of euros



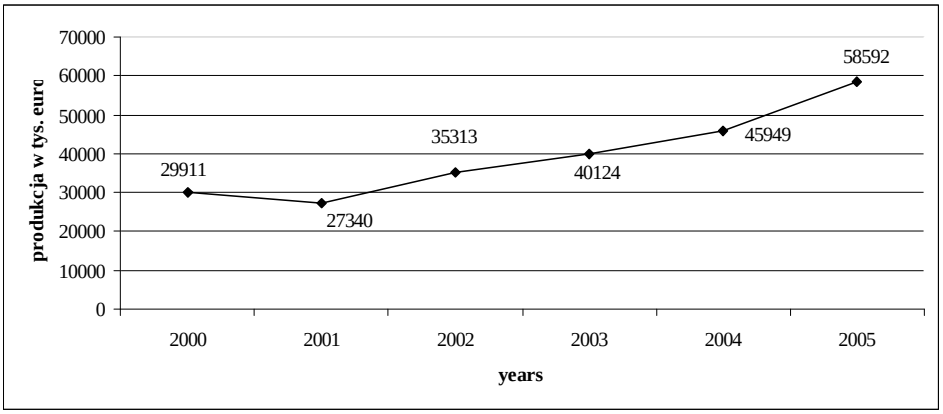
Graph 7. Geographical structure of exports of testing equipment in the EU(15) in 2005 (in %)



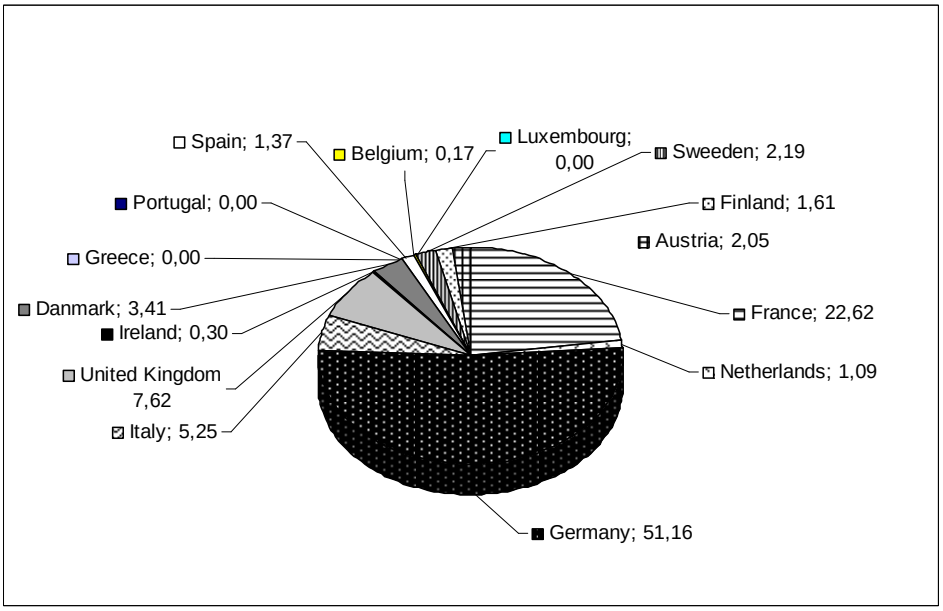
Graph 8. Geographical structure of exports of testing equipment in the EU(12) in 2005 (in %)



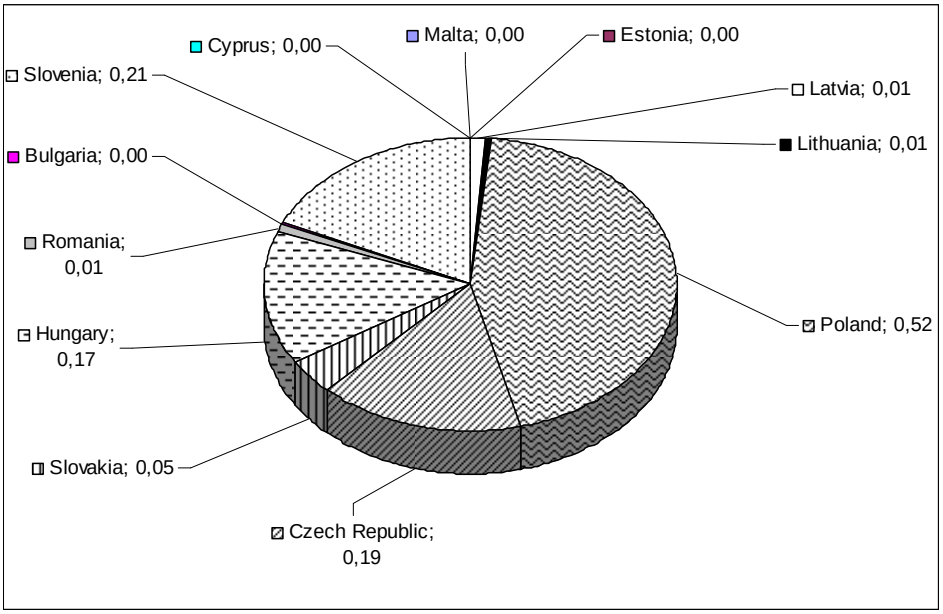
Graph 9. Trends of production of electronic instruments and equipment in the EU(15) in the years 2000–2005 in thousands of euros



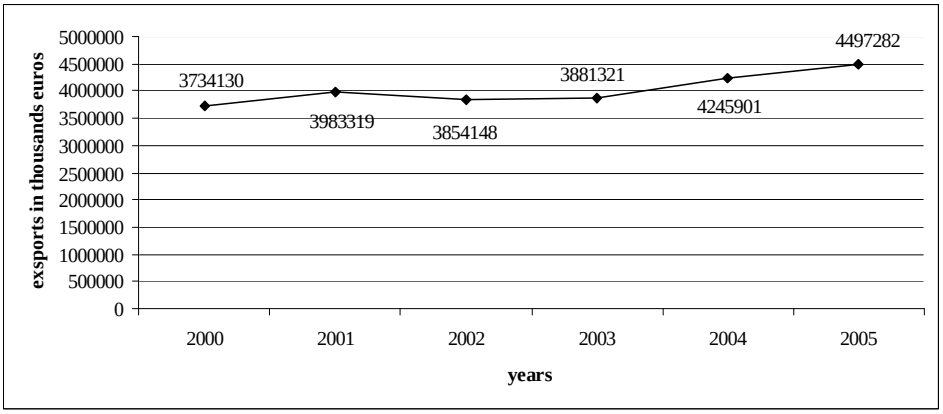
Graph 10. Trends of production of electronic instruments and equipment in the EU(12) in the years 2000–2005 in thousands of euros



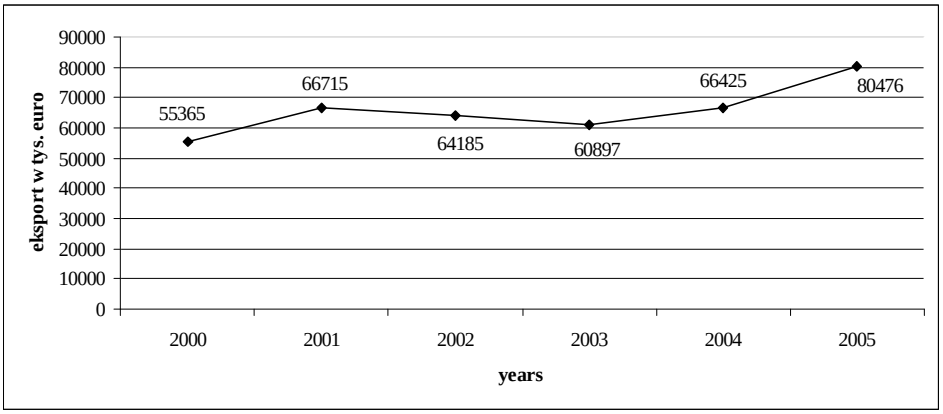
Graph 11. Geographical structure of production of electronic instruments and equipment in the EU(15) in 2005 (in %)



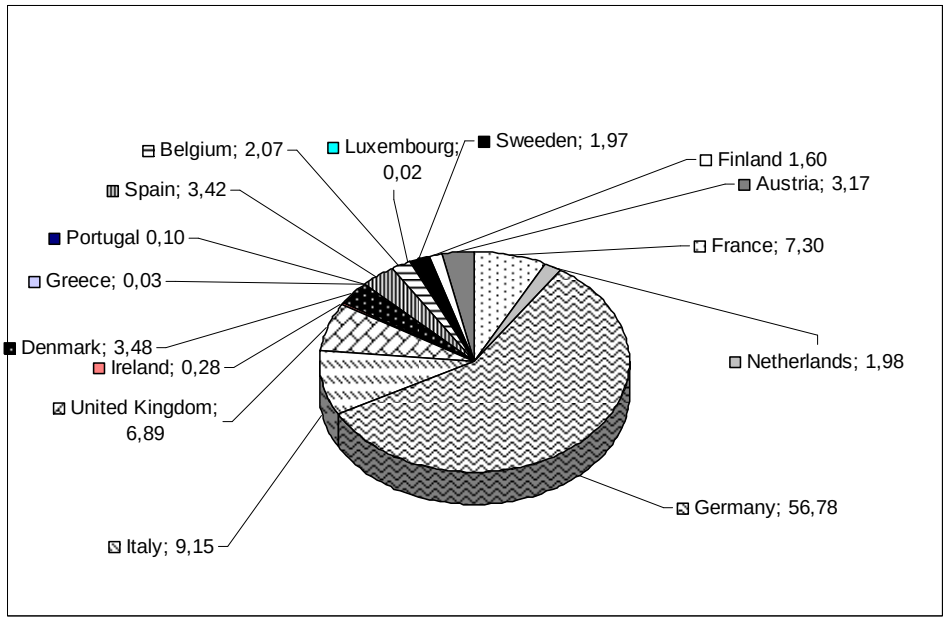
Graph 12. Geographical structure of production of electronic instruments and equipment in the EU(12) in 2005 (in %)



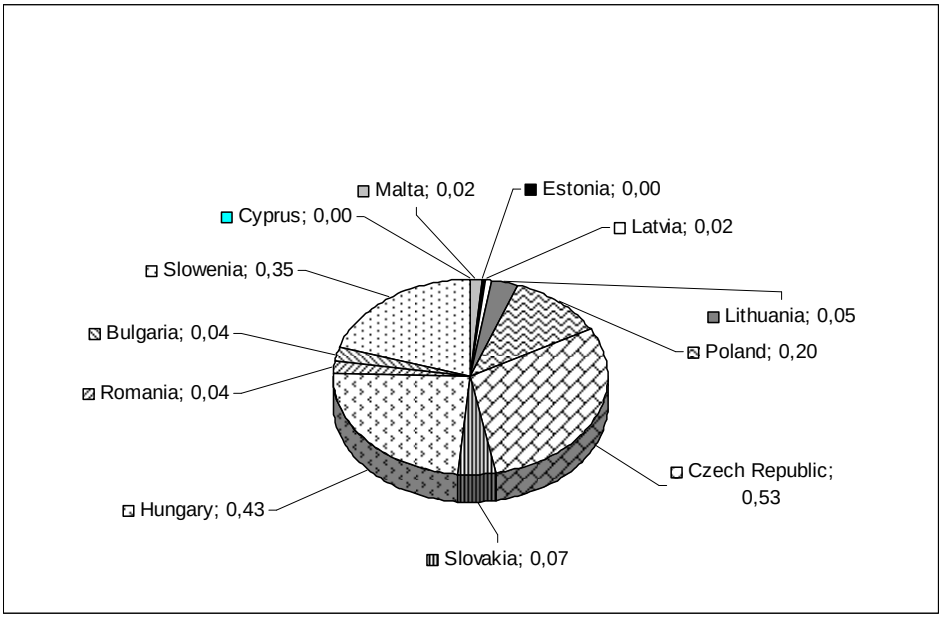
Graph 13. Trends of exports of electronic instruments and equipment in the UE(15) in the 2000–2005 in thousands euros



Graph 14. Trends of exports of electronic instruments and equipment in the UE(12) in the 2000–2005 in thousands euros



Graph 15. Geographical structure of exports of electronic instruments and equipment in the EU(15) in the year 2005 (in %)



Graph 16. Geographical structure of exports of electronic instruments and equipment in the EU(12) in the year 2005 (in %)

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