CONFERENCE PAPER FOR 35-th ANNUAL CONFERENCE RESHAPING THE BOUNDARIES OF THE FIRM IN THE ERA OF GLOBAL INTERDEPENDENCE

Valencia, Spain December 13th- 15th 2009

Topic: International corporate strategies

Creating new firm structure in European electronics and electrical goods industries

Abstract

This article documents and analyses delocalization processes in the European electronics industry for period between years 2002-2009. The authors ponder the reasons for relocation in West-Europe electronics and discuss factors behind inward investment in Central and Eastern Europe.

There are several reasons why Central and Eastern Europe has been favourable choice for new investors. The most important reason for transfer of production has been labour price difference between different states within EU. Market extension, opening of markets and rise of purchasing power were internal factors initiating the growth in eastern part of Europe.

Keywords: L63, O32, R12 electronics industry, innovation in industry, location of electronics industry

Introduction

In 2006 there were approximately 3,3 million employees in the manufacturing of electrical and optical equipment in European Union (EU-25). Concentration of electronics industry jobs was particularly high in certain regions of Germany, Slovakia and the Czech Republic, as well as in Ireland. In absolute numbers employment in electronics industry in Europe has been slightly declining between 2000 and 2006 (11 per cent). However general number doesn't show great delocalization of workplaces. Tens of thousands of workers have lost their jobs in Western part of Europe and tens of thousands of new jobs have been created mostly in new (EU-25 and EU-27) member states.

Electronics industry is more than other manufacturing sectors affected by technology development. Several analysts and forecasters count the creation of new products and new technologies as most important factor determining the success of firms, states and economic blocs. New technology cycle creates new winners. Quite often factories with morally old technology are rejected with the social impacts to local welfare. Electronics industry offers jobs for very different skill levels. Majority of jobs are simple manual tasks but quite substantial part of electronics is real high technology jobs requiring extensive training on university level.

The authors, based on the extensive field and desktop research try to document immense change that has taken place in the geography of electronics industry in Europe in recent 10 years and discuss the reasons behind. Our central hypothesis is that delocalisation from Western Europe to Eastern Europe is mainly influenced by labour cost. There is substantial difference in labour cost between Western part of Europe and Eastern part of it. That difference was caused by the previous existence of Socialist system, collapse of this system and later integration of countries in this system into world economy. However there is one considerable difference from other emerging markets: several former socialist countries had relatively high development level with educated workers, engineers and in several cases with existing plants.

The data was acquired from multiple sources both publicly available and interviews. Main public data were acquired from the European Database of Restructuring (European Restructuring Monitor), European electronics portal evertiq.com and British Broadcasting Corporation (BBC). Data sample included 350 events from approximately[1] 50 mostly big firms. Data covered time period 2001-2007. This time period don't include all European delocalisation because process of delocalisation started already with the fall of "Iron Curtain" in the beginning of 1990-s. In our research main unit is workplace or person who is employed. We are not talking much about the quality of job-places like engineering job versus simple assembly-worker job. When describing the relocation of jobs we are not limited to manufacturing operations but also services offered by electronics companies like logistics and development. In research we use *meso* level (Gereffi 2005: 160) units like country and corporation networks to characterise relocation process.

[1] There were mergers between firms.

Article is widely based on company announcements. Sample is slightly biased towards positive events like opening of new factories and investments because companies themselves and government sources are more active to give information in such cases. Dismissals are less announced by companies and get most attention from local media and opposition parties.

The paper is structured into six parts except introduction. The first part of article induces the literature of delocalization and theoretical concepts. In second part of it we present methodology and data used. Third part of article quantifies the relocation both on the European level and on the company level. Fourth part analysis main reasons of relocations of electronics industry in Europe. Fifth part deals with the government activities and their impact on the relocation process. In the final part we summarize previous findings and discuss them in the light of existing literature.

1. Delocalization process in literature

Delocalisation as socially acute process has interested in several researchers. Researchers from several domains have contributed to the knowledge body of delocalisation. Delocalisation phenomena were noted already in 1960-s (Vernon 1966). Delocalisation theory has several relatives but two particular theories could be called its parents: TNC (Trans National Corporation) internationalization approach and location theory (Gereffi, Humphrey, Sturgeon 2005, Feenstra 1998). To explain the phenomena of delocalization researchers try first to answer question "why". Why are firms relocating? Why is economic activity changing geography (in absolute and or relative terms[2])? Answers could have social perspective, factors perspective or technology perspective (Gereffi, Humphrey, Sturgeon 2005). Unit of analysis could be firm, entity of firm or workplace.

Delocalization as process has three independent dimensions: **activity dimension** describing economic sector, **geographic dimension** describing what are departure and destination of relocation and **functional dimension** describing corporate function that is transferred (for example R&D, administration, manufacturing, design). In simplified form we can ask: who is moving, where from and where to and what part of value chain is moving?

Activity dimension based delocalization research tries to explain geographical organization of industrial organization within industrial branch and to explain why industry sector finds particular place(s) attractive for its operations. Sectoral literature of relocation analyses relocation activities inside particular industry.

In every sector exists exogenous forces that determine internal logic of functioning and therefore configuration of industry. Changes in output and input conditions change internal logic and create new economic geography of industries, new centres and decline the old ones. Industrial structure could change when there are changes in inputs, consumption market or process technology (Weber 1909). Technology change could cause changes in industrial geography in short term. Product innovations, process innovations and new raw material are factors that could have substantial impact to processing location.

Interests present for researchers activities that could easily change location and have strong impact on communities. Such activities are often labour intensive thusemploy substantial share of local people. Big part of delocalization literature deals with apparel and footwear industry (Gereffi 2005; Camuffo *et. al*. 2006; Vale, Caldeira 2007). Interesting sectors for researchers are also car industry (Domanski et al.) and various sub-sectors of electronics like semiconductors and medical apparatus.

Interest of countries to different sectors is determined by endowment with local resources. In developing countries main focus is on sectors that could employ urbanizing

[2] Absolute relocation is transferring economy to other location. Relative movement is investing into other locations without divestment in old location.

population. Such sectors are characterized with big share of relatively simple manual operations.

In developed countries special interest of governments are high technology industries. High-technology industries are priority areas for technological and economic development and it is believed that they could give competitive advantage for whole economy, are associated also with new firm and job-place creation that should substitute decline in traditional manufacturing sector (Lau, Green 2001; Malecki 2007).

Several authors (Hsu et al. 2006; Malecki 2007) have pointed to the dual nature of several industries with existence of production plants with limited innovative capacities in peripheral places and performing mainly manufacturing and logistics operations. Non-routine administrative and innovative activities are performed in special locations. Such attractive locations are also new firm establishment places in sector. Study made in computer, semiconductor, medical instrument and programming sectors in the USA found that there is relatively little dispersal from high tech regions in North-East and West of USA (Malecki 2007).

Electronics products mass manufacturing tends to be concentrated in Eastern Europe in big industrial parks. Concentration of manufacturing activities both by the creation of bigger assembly sites and tying suppliers to nearby industrial parks are trend in sectors using JIT (Just-In-Time) like automobile and electronics (Gadde, Hakansson 2001, Schoenberger 1997).

Geographic approach to delocalization tries to explain changes in local employment and delocalization process between geographical regions. Big part of research is dedicated to explanation of regional advantages and disadvantages in the delocalization process. Important indicator is creation or closure of enterprises and their relation with geographical regions. Second indicator is structure of economic activities. Instead of simple job creation developed countries prefer relatively safe jobs with high value added creation (Malecki 1997). Main destination of research is economic development of geographical region.

Explanation of the geographic aspects of delocalization could have dynamic or static approach. Static approach of delocalization tries to compare economic, educational, technological, cultural and legal condition between localities and to examine relationships between location characteristics and intensity of economic activity. Dynamic approach is describing methods, condition and process of transfer from one region to another.

There are several factors that link geographical region with the enterprise competitiveness. Traditionally land-, resource- and transportation cost dominate the location calculations of manufacturing industries (Appold 21: 2005). In addition to objective resource factors exist also subjective factors that are difficult to identify and measure. It is believed that presence of local traditions and culture or existence of nearby

industries is primary factor determining the potential location for research laboratories (Schein 1999; Feldman 1994). The laboratories are, to a significant extent, reacting to each other's actions, creating symbolic, rather than functional, communities and that the locus of power determining local growth is diffused among location decision-makers. (Appold 2005).

Delocalisation result for regions could be leaving of industries, investment by new industries and transforming industrial structure with new economic mix. As a successful example serve here North Carolina economy that was transferred from textile to high technology. Special interest for transformation countries are R&D activities. It is widely believed that R&D activities give competitiveness beyond factor costs (Lau and Green 2001). Low tech industries do not assure economic convergence of new members in EU (Mora). There are also substantial side effects of high-tech industries. Spill-overs of knowledge, creation of local cluster are among those effects. (Malecki 23).

Public policies aim is to control relocation or diminish its effects. In general public policies could be divided into creation of favorable economic structure in region and prevention of divestments in region. It has been said that globalization has reduced tools for economic policies (Berger et al. 2001). Rather better is to say that there has been redistribution of economic tools from local to national and supranational level. European Commission has strong influence to competition, tax and environment policies.

Itinerant nature of industrial investments has forced countries to adopt different strategies for attracting investors. Two common options are: inviting investors with later upgrading their investments or invite selected group of investors. (Zou, Belderboos 2005; Lau, Green 2001). Short term economic policies are often confined with the providing of solutions for ailing industries and less for local renewal (upgrading). Among the closure reasons are changing geography of trade bloc, origin of owners, change in the market characteristics, unfavorable labour characteristics and agglomeration effects (Aláez-Aller, Barneto-Carmona 2008).

Functional approach covers delocalization of different corporate activities. This includes the analysis of value chains, the methods of dividing them and methods of shifting activities to new locations. Goal of analysis is to create corporate structure where resources are used in the optimal way and firm has optimal location units vis-à-vis to raw materials and markets. Object of analysis are stages in supply chain and/or transactions between the stages. Different stages are corporate functions like manufacturing and design. How are corporate functions organized globally, where is good location for headquarter or IT unit are typical questions for research.

Result of research is optimization of supply chain. Nowadays supply chains are characterized by continuous integration and disintegration. Disintegration happens when for company becomes too difficult to manage all functions in competitive way or company perceives activities as non-core. Integration of activities happens when firm(s) expect economies of scale or smaller transaction costs.

Initial reason for the analysis of supply chains was efficient functioning of every step. Dividing of several functions assured measurability of every stage and ability to substitute uncompetitive parts. Systematic approach to breaking-up supply chain started in 1920-s in car industry (Drucker 1999).

Specialization is driven by competencies and factor cost (economies of scale). High modularity is precondition for breaking of supply chain. Modularity means well defined characteristics and possibility to substitute uncompetitive parts in supply chain. Different stages have different needs for labour and materials. Additional incentive for splitting supply chain could be different regulations like environment protection laws and access to cheaper natural resources.

Supply chain slicing could be based on labour-, specially skilled labour-, capital- and technology intensity (Gereffi 2005). Three different type of labour tasks are routine production services, in-person services and symbolic-analytic services (Malecki pp. 123). Gereffi (2005) notes that in US firms lead networks U.S: firms specialized in soft competencies like definition of standards, designs and product architecture. Taiwanese, Korean and Singaporean counterparts concentrated on hard competencies like the provision of components and basic manufacturing. To organize suppliers further main contractors could use system called triangle manufacturing i.e. using intermediary firms to organise local production systems that extend to third countries (Labrianidis Kalantaridis 2004; Hsu et al. 2007).

Splitting of integrated firm doesn't lead to similar supply chains. Competition strategy is based on perceived strength factors and could lead to different supply chains. New system has created different global value chains (Gereffi, Humphrey, Sturgeon 2005). In addition to market and hierarchy inside the firm Gereffi et al distinguished 3 additional types of networks: modular, relational and captive. Factors determining the choice of governance are complexity of transaction, ability to codify and capabilities of supply base. With integration of global economy it became possible to leverage material and intellectual resources like knowledge, know-how and intellectual property.

Networks must combine cost competitiveness with product differentiation and speed to market (Gereffi pp. 173). Asian crisis accelerated slicing supply chain (Borrus via Gereffi). Reaction from Asian countries differed. Taiwan upgraded itself step by step. It relied more on SME-s. Korea relied more on *chaebols.* Electronics contract manufacturing (ECM) industry evolved as product of disintegration of big electronics firms. ECM is characterized with high modularity.

There are several methods to transfer distinct activities to other locations: direct investment to foreign firm, off-shoring and outsourcing. Choice of method depends on firm competition strategies and internationalization strategies. Same products could be delivered to market by different supply chains.

Performing operations in distant locations raises several challenges. Firms must have capabilities to move transfer activities abroad and to retain control of supply chain

(Berger et al., pp. 62). In the initial period of relocation outsourcer is single owner of know-how about customers and technology. By time contracting company could have substantial knowledge about production process and raise therefore its negotiating power.

Managing the parts of supply chain that are located in other cultural environments could be difficult and costly. Biggest risk for technology firm is loss of intellectual property and therefore also core competence. Management and protection of intellectual property could be therefore key issues for technology firms in off-shoring process. Equally important are protection of market share and trademark.

Because different functions are committed in different geographical locations rise problems related to the governance of transactions. Among the transaction costs are costs of control of suppliers, cost of information, negotiation costs and costs related to opportunistic behaviour (Williamson 1985, Gereffi 2005).

In previous literature suitable location for R&D operations was any locations except same firms manufacturing locations. Omitting manufacturing location enabled to work without every-day problems (Schoeneberger 1997, pp. 55). Shorter development periods have lead toward intensive communication between development and manufacturing and therefore separated existence is virtually impossible. (Schoenberger 1997)

Splitting supply chain and relocating its parts creates new business opportunities. In positive cases the resources are freed and utilized in better way. When activities in new location are outsourced appear opportunities for new agglomerations. Activities that were considered less attractive by several firms could be merged and new scale economies created.

Relocation could give also access to new markets and create new product niches. In new location subcontracted industries could create new industries by adding different capabilities and customizing products to local markets. This could also change substantially the configuration o supply chain.

Disintegration of big electronics firms gives incentives for horizontal integration in sectors like contract manufacturing, big retail and component production. In electronics industry last decade is characterized by separation of semiconductor production and contract manufacturing from large integrated firms. During the last two decade also the geographical focus of electronics has changed.

As an examples serve here car industry in Korea. Korean car manufactures started from producing parts for Japanese firms. By time different functions were added and combined and final solution was creation of original car manufacturing. Same path are trying to follow firms in Taiwan, China and other East Asian countries. Growing local market gives good chances for success of such strategy (Hsu et al. 2007).

Delocalisation is not distinct phenomena but also wider economic changes and therefore delocalisation has part in the literature of economical and global issues, FDI, political issues and labour issues (Gereffi 2005, Berger, Kurz, Sturgeon, Voskamp, Wittke 2001, Blinder 2006).

2. Delocalisation process on state and unit level

There are several economic indicators showing the development of particular economic sector. Hiring new workers and making investments are indicators of real growth in economic sector. Electronics industry (or manufacturing of electrical and optical equipment) was one of the fastest changing economic activities in terms of people employed in last decade in European Union. Changes in electronics industry employment are substantial compared to changes in manufacturing employment. Countries most affected by relocation in EU in period between 1999 and 2004 were Ireland, United Kingdom Slovakia and Estonia. General trend is that new workplaces were created in Eastern Europe and people lost their jobs in Western European electronics manufacturing. Aggregate change of workplace numbers was negative on the level of European Union as whole. Approximately 60 thousand new workplaces were created in new member-states and approximately 360 thousand employees left electronics industry in Western- Europe.

Table 1: Number of employees in manufacture of electrical and optical equipment

	Number of jobs in 1999	Number of jobs in 2004	Change in % to previous period	Change in absolute numbers	Change compared to all manufacturing jobs (A4/ all manufacturing jobs)
	A1	A2	A3	A4	A5
Belgium	50835	44251	-13%	-6584	1.1%
Denmark	47532	43332	-9%	-4200	1.0%
Germany	1021067	997206	-2%	-23861	0.3%
Ireland	65199	52791	-19%	-12408	5.6%
Spain	149662	141840	-5%	-7822	0.3%
France	500324	426720	-15%	-73604	1.9%
Italy	378909	354749	-6%	-24160	0.5%
Netherlands	88558	79463	-10%	-9095	1.2%
Austria	72824	68575	-6%	-4249	0.7%
Portugal	56116	46176	-18%	-9940	1.1%
Finland	64813	65163	1%	350	0.1%
Sweden	101597	79675	-22%	-21922	2.7%
United Kingdom	521734	355283	-32%	-166451	4.9%
EU 25 (without Lux. and Greece)	3119170	2755224	-12%	-363946	1.4%
Romania	82683	90324	9%	7641	0.5%
Slovakia	42638	60339	42%	17701	4.4%
Poland	160574	157762	-2%	-2812	0.1%
Hungary	115812	149770	29%	33958	4.1%
Latvia	5506	6598	20%	1092	0.7%
Lithuania	15927	20169	27%	4242	1.6%

Estonia	8151	12200	50%	4049	3.1%
Bulgaria	37449	30786	-18%	-6663	1.0%
Czech Republic	134277	165657	23%	31380	2.3%
New members -(EU 2004, EU 2007) without Malta, Slovenia and Cyprus	634994	694360	+9%	59366	1.1%

Source: Eurostat

Change trends in electronics industry have not been similar to all countries. Among the older EU members are visible two trends: long-term restructuring process and the end of boom related mostly to telecommunication industries. Long term restructuring pioneers are UK, Italy, Austria and Netherlands. Restructuring started later in France and Germany. New member states could be also ranked according to the speed of growth after the collapse of Soviet-communist system. Electronics industry has grown fast in Czech and Hungary. More difficult has been growth in Bulgaria, Lithuania and Romania (appendix 2). Creation and disappearance of workplaces didn't happen equally in all regions inside the member states. We should also have in mind that by size European Union countries are very different. Delocalisation changes affected different regions in different way.

Investments in electronics industry are substantially depending on economic cycle. End of 1990-s was boom period for electronics sales and investments. Investments grew both most of the regions all over the world. Difficult times for electronics industry came in 2002. Several enterprises in Western Europe reduced their investments and laid-off workers. At the same time several electronics industry companies made greenfield investments into Eastern Europe and extended their existing operations there. In same period it came clear that first members will be soon admitted into European Union and this further extended investment activities into Poland, Czech Republic, Hungary, Slovakia and Estonia. Share of electronics industry investments into future EU2004 and EU2007 member states grew from 6-8% to 12-13% in total portfolio of EU electronics industry investments (see appendix 4). In new member states work approximately 20% of all electronics industry employees of European Union (2004) and this share has growth trend.

Different countries show also different investment patterns in electronics industry. Investment level per employee in Eastern Europe is lower than in Western Europe but difference is decreasing (see appendix 3). Firms in certain countries have decided to cease local operations and relocate. In other countries firms have decided to invest more heavily to technology and to move away from middle and low technology markets. Investment trends and current investment level per employee are brought in table 2.

Table 2: Investment trends per employee

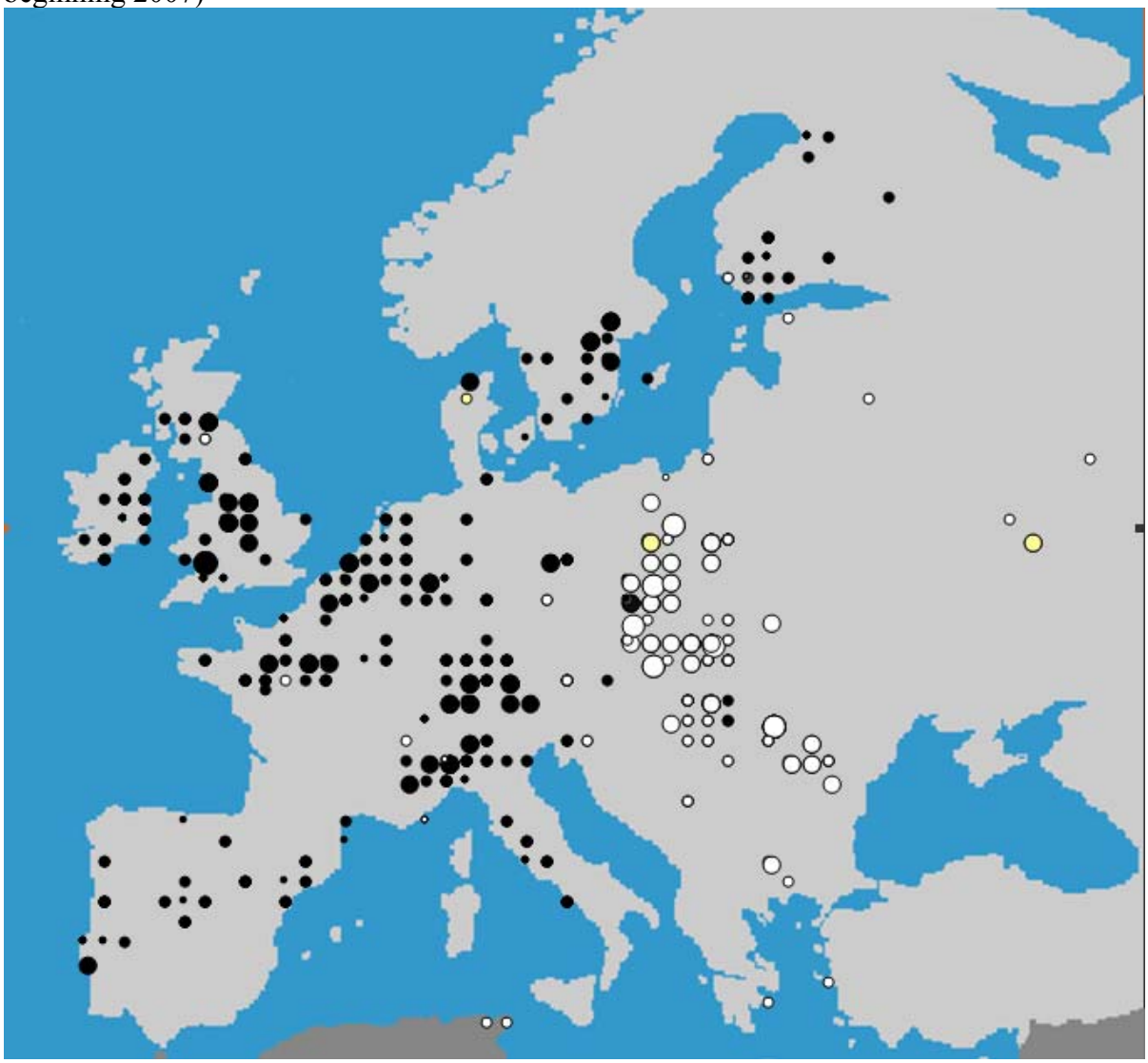
	High level	Below average level
Growing investments per employee	Ireland, Italy, Austria	Estonia, Slovak
Stabile investments	Denmark, Germany, France, Portugal, Sweden	Bulgaria, Spain, Cyprus, Czech, Poland, Hungary, Romania, Latvia, Lithuania

Decreasing investments	UK, Netherlands, Finland, Belgium	

Source: Compiled by authors from DATA of Eurostat

Another way to look to the changing geography of electronics industry is to look to the enterprise level. We draw a figure indicating 318 cases in European electronics industry.

Figure 1: Creation and disappearance of job places in European electronics (end 2001-beginning 2007)



Lay-offs	● more than 5000	● 4999-1000	• 999-200	• 199-1
New jobplaces	○ more than 5000	○ 4999-1000	○ 999-200	○ 199-1

Main sources: European Restructuring Monitor, Evertiq.com - European Electronics industry Portal, BBC -British Broadcasting Corporation

When looking to the Figure 1 is clearly visible that most of the workers in electronics lost their job in Western Europe and most of job creation happens in former Eastern bloc. Job loss in electronics is especially visible in region called by French geographer Roger Brunet "Blue banana". Main regions that lost electronics jobs in Western Europe were Ireland, Scotland, Wales, Midlands of England, Benelux, Loire Valley, Paris Region, Grenoble, Catalonia, Madrid, Northern Italy, Rhein-Valley, Southern Germany, Great Stockholm and Great Helsinki.

Receiving regions in Central and Eastern Europe were Poland (especially northern part of the country and Lower Silesia), Czech Republic, Slovakia, Hungary and Romania (Transilvania and Bucarest). There is no common name for that area except that majority of locations in different historical periods have been ruled by Habsburg monarchy.

When most of factory openings and closures follow general trend there are exclusions. Closure of factories in Eastern Europe has been caused by company restructuring when firm as whole showed weak economic results. Another reason for closure has been using of ageing technology. Early investments into cathode ray tube (CRT) TV factories were made obsolete by the use liquid crystal display (LCD) technology.

Job creation in Western Europe has been mainly in defence industry (Hudson 2003) and new technology sub-sectors like (wind energy, solar energy, nanotechnology). Global increase in military spending has benefited job creation in military electronics (Stockholm International Peace Research Institute 2006).

Electronics is scale intensive industry and relocation of manufacturing activities in Europe is accompanied with consolidation. There is smaller number of new factories and locations but the factories tend to be bigger in new sites. Consolidation of factories gives for firms incentives to automatize production and to use machinery of higher productivity.

Relocation of manufacturing or electronics industry in general should not be seen as European Union centred process. There is substantial electronics industry development in Russia and Ukraine and shifts in Turkey and North-Africa (Tunisia).

When modelling of relocation we can see processes as waves. First wave in electronics was development of electronics at UK, Germany and other technological innovators. Second wave came in 1990 where substantial part of manufacturing activities were shifted to Western part of Eastern Europe and major metropolis in Eastern Europe. Third wave that lasts now is shifting manufacturing activities further to eastern part of Eastern Europe and peripheral regions.

Sub-sectors of electronics industry behave differently in relocation process. In energy- and industrial automation sector is active relocation. Companies establish local units for specific markets and transfer production activities to cheaper locations. In telecommunication industry is active consolidation and adjustment to lesser capacity. There is reduction of activities in Western Europe. Several activities are outsourced to

EMS firms. Sector is also affected by restructuring of big firms like Alcatel-Lucent, Marconi (now part of Ericsson) and Nokia Siemens Networks. Non European origin firms are relocating their activities. There is also significant relocation of European firms to Asia.

In consumer electronics Asian firms invest actively to Eastern Europe and in several cases relocate from Western Europe to Eastern Europe. European origin companies relocate but less actively. Exception is biggest European origin producer Electrolux who actively transfers production to cheaper locations. Home appliances sector is characterized with big seasonality and sensitivity to big contracts. Computers and peripherals industries have active delocalizing its activities.

Components industries in general follow the main customers. Car electronics firms follow delocalization of car industry and printed circuit boards (PCB) industry follows its customers in home appliances and telecommunication sector. Customer industries often create big supply parks for different sub-suppliers.

Certain exception is semiconductor industry where main trend is adjusting of capacity for industrial needs. Relocation inside the Europe is not very active. Investors tend to leave UK semiconductor industry.

Military electronics still tends to be domain of national defence policies. Countries have special procurement rules that prevent active delocalization.

4. Why it has happened?

Every economic process has initiators and causes. Decision to open or close company unit is one of the most strategic ones (Rumelt *et al.*, 1994). Understanding the reasons for relocations helps countries to form economic policies and firms to plan further strategy. Decision to stop production or substantially to reduce volume of production is often caused by multiple reasons. In the case of electronics firms major determinants of relocation are macroeconomic factors, microeconomic (firm related) factors and technology development (Figure 2). (Dicken 1998, Ward 2003, Hudson 2003)

Among the macroeconomic factors are labour price differences between Western and Eastern Europe, currency exchange regimes, trade barriers (Hudson 2003, Ward 2003), foreign investment rules, growth of local markets purchasing power in Eastern Europe and cumulative moving effect when big firms relocate and their suppliers follow.

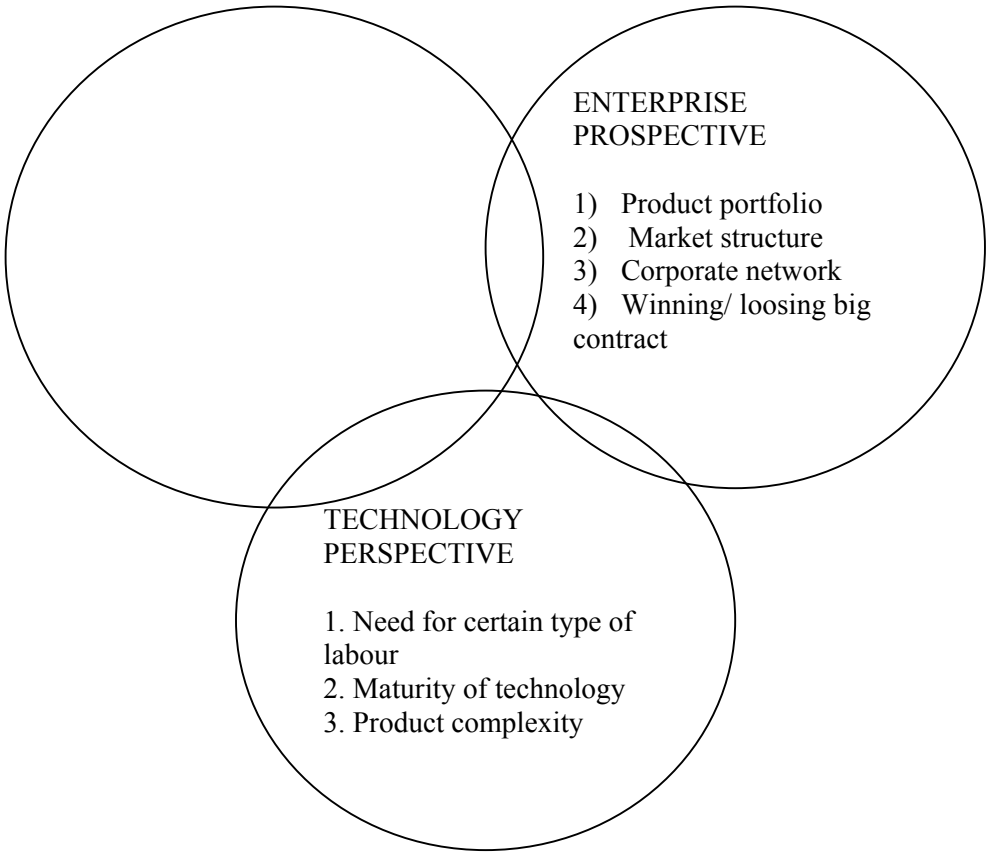


Figure 2.Creation and dismissal of jobs in European electronics (end 2001- beginning 2007) Source: Compiled by authors

Fall of Iron Curtain changed substantially European logistics systems. Previously divided into two separate systems it became one: lasting from Atlantic coast until Ukraine. Centre of gravity of new system moved also to the East. Change of political systems allowed countries to move manufacturing bases to Eastern Europe. Eastern European locations like Wroclaw, Prague, Bratislava and Budapest are closer to Germany, Austria and

Northern Italy (Southern part of Blue Banana) than UK, Ireland and Iberian Peninsula. To the Benelux countries they are at the same distance.

Integration of Eastern- Europe into European Union has helped to raise local purchasing power. Market in Eastern Europe is the reason for establishing of new factories or acquiring existing firms. Generalisation could be made that Western Europe is attractive market area for several sophisticated goods but Eastern Europe is important as consumer market.

Globalisation has created several global players in electronics. For Asian investors geographical reason for extending operations into Eastern Europe is wish to get bigger territorial covering and market share in Europe.

1990-s was the period of fast internationalization for European, US and Japanese firms. Several Western European firms had mergers, acquired foreign units and established subsidiaries. Several British, French, Finnish and other firms became pan-European firms. Business goal for firms was to be a market leader at least in own continent. American and Japanese firms created European subsidiaries and factories. Beginning of new century is internationalization period for latecomers like Chinese, Taiwanese and some Korean firms. For newcomers was easier to use Eastern Europe as expansion platform to whole European Union. Extended market serves also as incentive to create local service units.

Simplified look to the delocalization is that it is simple shift of manufacturing jobs mainly from Western Europe to Eastern Europe. However it is only partial view. In several cases is more precise to say optimization of production networks.

Maturing of several sub-sectors forced companies to merge in the beginning of millennium (Hudson 2003). Most notable of such mergers were Alcatel with Lucent and Hewlett-Packard with Compaq. Both companies had in Europe their business structures consisting development, manufacturing and service. For economies of scale, business optimization and capacity optimization some units were closed or restructured. Recent acquisition of Solectron by Flextronics leads to the new closures of units (evertiq.com).

Simplest reason to cease production activities is low market competitiveness and previous over-optimistic calculations. Every sector has stronger and weaker firms and it is common that during downturns weaker firms go out of the market. Initiator of changes could be previously made not so good acquisitions. As an examples here serve BenQ and Alcatel-Lucent.

Reason for restructuring could be changed focus and re-determining core competencies. After acquisitions traditional German electronics company Braun became the part of consumer goods conglomerate Procter & Gamble. Under new ownership company outsourced several manufacturing activities and focused itself to product and brand development. Core competences were determined differently and company focus changed.

Certain branches of electronics industry are dependent on several big customers. Loosing of British Telecom competition for XXI Century Network forced Marconi for sell-off list.

Strongest factor determining electronics industry development is technology development. New technologies create new champions, change use of materials, create new market niches and further business opportunities. Common target for technology development has been creation of new products, increased functionality of existing products, lesser use of materials and environmental issues. With the product and process development electronics products have became physically smaller, need less expensive materials and need less labour for manufacture and logistics. Some notable changes like substituting of CRT (cathode ray tube) to LCD (liquid crystal display) in TV sets or substituting film cameras with digital cameras redrafted almost all supply chain by eliminating some actors and joining new-ones.

With the introduction of new technology old technology and factories obtain the value of scrap or in some rare cases could be used outside of Europe. Technology cycle gives good incentives to build totally new factories. When choosing new location for factory firms could have incentive to break up existing social ties and to establish new ties and learning systems in new location. This follows the example of United States when new industries were mainly established in West Coast rather than in traditional industrial regions of North-East.

Certain branches of electronics industry have reached mature stage in product life cycle and consumption is flat or even falling. This drives toward the consolidation of production. Among such branches in developed economies are home appliances and fixed telephones.

Spatial distribution of company units is the result social process and has the character of social process (Appold, 2005). Successive location choice by pioneering companies promotes particular locations and serves as signal for other companies in their choice for location. Same tendency is visible in the case of leaving certain locations. Shutting the doors by one company serves as alert for other companies about changing macroeconomic environment or companies particular difficulties.

In the literature delocalisation process have been analyzed from the two viewpoints: supply chain structure and complementary specialization.

Globalisation has lead electronics industry towards economies of scale and tremendous growth. Rapid market growth and need for additional resources for production, logistics, distribution and development. Growth of production volume and shortened life cycles lead to the splitting of supply chain (Gereffi 163). First activity that was contracted out was manufacturing during peak times and manufacturing of non-core products. At the same time electronics firms realised that there are good opportunities to offshore certain labour intensive processes. As a result of off-shoring appeared the international division of labour (Marin 2006).

Different entities have approached splitting differently. Companies use different methods for breaking up old structures and building new supply chain (Gereffi et al 2005). Firms use methods better suiting for them based on local conditions (Marin 2006) found that primary reasons for growing intrafirm imports (splitting supply chain) are falling trade costs, reduced level of corruption and improvement of contracting environment of Eastern Europe

New supply chains of several firms cause changes in the industrial structure of regions and countries. New industrial structure is caused on complementary specialisation to skill, labour, capital and technology/ knowledge intensive activities (Kurz & Wuttke).

Structures need also new type of governance. In most of cases occurs change from traditional integrated corporation into network system (Lüthje, 1). We can even say that outsourced model has evolved as main manufacturing system (Lüthje, 1).

Splitting does not affect only industrial structure but also causes changes in spatial structure and social structure. Regions could not only win but also loose substantial skills and knowledge in the process of localization and therefore come to the dead end situation (Labrianidis, Kalantaridis 2004).

When looking to historical perspective we can say that current splitting of value chains does not affect like industrial structures as simple as did contracting in the past. Substantial parts of delocalisation are knowledge and technology intensive activities that further raise competition for future.

5. Regulation of delocalization by public policies

As we mentioned before, it is Central European countries (Poland, Hungary Czechia and Slovakia) that received the bulk of FDI in electronics. The only country of Eastern Europe, that now enjoys relatively big interest of investors is Romania, but the country is relatively newcomer in this regard. Interestingly, this picture is not only characteristic for electronics, but also for other manufacturing activities, like automotive (see: Pavlinek et. al., forthcoming). This shows, that apart from cheap labour and geographical location, the macroeconomic indicators, political stability, sufficient business and technical infrastructure are important factors behind the observed distribution of new plants. This raises also the question of the role of policy in different spatial levels. The main question for this part of the article is to discover whether there exists competition for investors based on incentives between the old member states and new member states.

The two regulatory measures seem to have been crucial in shaping the spatial behaviour of electronics companies. On the pan-European scale the most important regulation regarding electronics are tariffs. With higher taxation of ready-made products and lower taxation of components and supplies European Commission promotes the investments into assembly factories within EU free trade area. The latter are key for new-member states as recently they became the favourite location for several Asian and American investors, for example, Sharp, Orion, Toshiba, LG and Flextronics.

The second measure is policy of state aid. The main priority of such aid delivered by EU members to companies is to improve the competitiveness of EU industry and creating sustainable jobs (for example aid for R&D, innovation and risk capital for small firms) [*Vademecum*, 2007, pp.2]. European Commission clearly recognizes that while state aid delivered to single companies play important role in competitiveness of the regional economy, simultaneously 'such measures also distort competition as they discriminate between companies that receive assistance and others that do not' [thus] 'granting of such aid can be justified in exceptional circumstances'. [*Vademecum*, 2007, pp.2].

A significant dilemma is connected with the bargaining power of different countries and regions. While the authorities themselves regard financial incentives and subsidies as one of the most crucial tools of local and regional development (Rodríguez-Pose, Arbix, 2001, Ward 2003), the weaker embedded a given territory is with resources of different kind (for example convenient location to market, good infrastructure, qualified labour) the bigger incentives must offer to attract mobile investment. To put it differently, using the D. Smith (1966) model of spatial margins to profitability the further away you are from optimal location point the bigger intervention in spatial curve of costs is required to compensate you handicapped position. At the same time, electronics companies, mainly transnational corporations are especially eager to retrieve from the given territorial unit as much assistance as possible and simultaneously possess substantial bargaining power when negotiating new location. It is due for three reasons at least:

1. The establishments are usually big with hundreds or even thousands workers employed, thus attracting them seems to be a remedy for local and regional labour market problems.

2. Although many jobs in electronics is obviously not ‘high-tech’ and ‘high-end’ jobs the branch as a whole is perceived in this way. Therefore electronics sector gets often more attention and sometimes resources than other manufacturing industries and in several countries and regions electronics industry is considered among the priority sectors of economy.
3. Plants performing assembly operations that have majority of workplaces in the industry are relatively footloose. The threat to cease an operation in given location unless special privileges are given may become are powerful weapon in negotiations, while loss of jobs may have strong local impact (Hudson 2001).

In several regions in Europe, especially depressed old-industrial regions in last decades we observed the ‘policy-induced’ growth by incentives offered to TNC-s (North-East England, Scotland and Wales). However, one of the paradoxes of policies of incentives is the fact that the higher the state aid for attracting a given company or industry, the lower sunk costs for investor therefore higher footlooseness. Some firms receiving financial aid in Central Europe got the same type aid approximately decade ago in locations in Western Europe. LG Philips, for example, got £220 million aid for the creation of jobs in Newport, Wales and closed factory in 2003 (*BBC* 2003) after less than decade of operation. In 2006 the same company applied for aid of 206 million euros in Poland and got approval from European Commission (European Commission, 2006, Lumiste, 2007). Competing by incentives bring about also side-effects described by Cheshire and Gordon (1998) as territorial competition (Hudson Ward 2003). Because the number of mobile investors is always lower than the territories wanting to attract them competitive struggle between the places takes place in the way of „the formation of politics designed to promote local economic development, often explicitly, but certainly implicitly, in competition with other territories” Cheshire and Gordon (1998, p. 321). This is exactly was we are observing at present. Several Eastern European governments have given to TNCs substantial grants and financial aid. Boom of establishing new LCD factories have raised internal competition between Eastern Europe governments. Polish, Czech, Slovakian and Hungarian governments offer different aid packages. Toshiba got in this way €22 million, LG Philips LCD €206 million by Polish Government and €74.9 Million (2006) by Slovak government are results of such negotiations. Also local authorities in Eastern Germany (Saxony, Brandenburg) have supported some big investments. AMD receives €262 million financial aid to establish semi-conductor plant in Dresden.

The evolution of special economic zones programme in Poland is another good example of bargaining between major international investors, European Commission, the central government and local authorities. With more than 170 locations in Poland enjoying now a special status, the SEZs designed as a tool of a regional policy (support declining regions) transformed itself into standard tool of supporting investors regardless of their location on the territory of Poland (Gwosdz et al., forthcoming). Not surprisingly, all new big greenfield projects in electronics were located within the borders of SEZ and new subzones were established purposely to encompass the location chosen by LG Electronics, Sharp and Orion. On the whole, investors representing electronics industry spent approximately €860 Million till the end of 2006 what constitutes 9% of all investment outlays in polish SEZ (*Information*, 2007).

In the 1990s governments of CEE countries were very generous to the investors and the aid substantially exceeded the incentives in the EU. Polish SEZ, among other offered full corporate income tax exemption for ten years from the beginning of operation in the zone. Similarly Hungarian government established industrial free-trade zones, where companies located had not to pay for customs and were granted import duty-free their inputs (Guagliano and Riela 2005). Subsequent amendments harmonizing the rules of granting public aid significantly phased out the fiscal attractiveness of CEE countries.

The differences in the level of aid between old and new member states, has been substantially narrowed after 2003. Only two new member states: Hungary and Slovakia spent more than the EU-25 average in 2005, but it is mainly due to earlier to pre-accession commitments. It is clear that at present all member states playing the game using the same rules. At the same time the labour-cost gap between the old and the new member state is huge. Therefore, there is no direct competition based on incentives between the old and the new member states at the moment but rather there is internal competition between new member states on new investors.

As for the while, although massive relocation is under way, firms leave in developed countries the "good" parts of the labour market, mainly non-production competencies, namely research and development, marketing and purchasing (quotations from MOVE). Thus western European countries are trying to create R&D infrastructure with development centres, research laboratories and people training. However, because of necessity of close interrelationship between production and its developments (research, testing, prototypes) keeping some production capacities is essential. Therefore it is questionable whether in the long run will endure core-periphery pattern clearly visible at the moment in electronics industry in Europe.

CONCLUSIONS

(what type of new geography is created)

In our article we analyzed delocalisation of electronics industry in Europe. Delocalisation of electronics in 1990 and in the beginning of XXI century has enormous effect to the firms and people. Relocation on European level is enormous and hundreds of thousand of people are affected. Competition in electronics industry is however limited to the Europe but happens in global scale. Global firms compete in all three developed global regions and also in developed world.

Delocalisation creates new production systems. However new systems are not deeply embedded. Under the economic pressure firms are forced always to look to alternative locations. States and public authorities in general have limited control in location process. Financial and technological capital often have stronger position vis-à-vis to labour and governments.

Europe is attractive market for global firms and therefore competition between firms is very intensive. Active competition between firms forces to find better and cheaper

solutions and therefore to relocate their labour intensive processes. Transfer of jobs has affected most United Kingdom and France. Main labour places creation destination were Hungary, Czech, Poland and Slovak in first stage and Romania in second stage. Main reasons for delocalisation were related to technological development, macroeconomic environment and enterprises own competitiveness.

Earlier relocation was mainly based on salary difference between Eastern Europe and Western Europe. However with the accession of new members into the European Union and active labour migration price differences between Eastern- and Western Europe are getting smaller. At the same time rising purchasing power in new EU member states creates new consumers for electronics products. Certain factories that have been created in Eastern-Europe are relying on cheap labour force and therefore very price sensitive. There is already lack of manual workers in Czech and Hungary. Their long term competitiveness is not sustainable.

In longer terms competitiveness in electronics depends on technology and innovation creation rather than cheaper inputs. Price factors play important role but major setbacks to electronics firms have been technological like choosing wrong standard or slow following of technology trends. Consumers have heavily benefited such products like Nintendo Wii or Apple iPod for technological and fashion attractiveness rather than for low price.

Developments in electronics have not created competition between Western Europe and Eastern Europe but rather between Eastern European countries. Main government policies were attracting foreign investments to particular sectors. Relocation of factories from West to East has created new production system in Europe. This has helped not only to solve price competition issues but also other problems like consolidation of production and access to market for non-EU firms.

When transfer of manufacturing operations has been relatively active then relocation of development units form West to East have been modest. One reason could be that development activities are more difficult to transfer due to the big scope of tacit knowledge. Primary difference compared to the relocation of US enterprises to Mexico (maquiladora programme) or Japanese enterprises to Taiwan and China is high educational level and existence of both infrastructure and skilled people. Factories like Škoda Works and talented people with scientific background existed before the communist system already since industrialisation at the end of 19-th century.

In short terms delocalisation is limited with the tariff borders of European Union. However there is permanent search for cheaper locations and bordering regions are viable options. Next destination for electronics industry is probably Russia with growing consumer market. Political instability prevents investments into Ukraine, Eastern-Balkans and missing skills are obstacle for Northern Africa. Despite of that several analysts see Ukraine, Middle East and North Africa (UMENA) as future region for electronics industry to grow.

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Electronical resources

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APPENDIX 1: Companies in sample and drawing

Sector	318 firms[3]
Energy and automation	ABB (9), Siemens (29), GE (5), Schneider (9), Alstom (14)
Telecommunication	Nokia (11), Ericsson (14)–Marconi (6), Alcatel-(Lucent) (22), Motorola (5) , BenQ- Quisda (6), Huawei (2)
Home electronics	NEC (2), LG (10), Thomson (6), Philips (18), Sony (8), Sharp (1), Toshiba (7), Electrolux (20), Sanyo (5), Braun (2), Whirlpool (6), Samsung (12), Gorenje (2), Moulinex (1), Indesit (8), Bosch-Siemens (4), Videocon (1)
EMS	Elcoteq (4), Jabil (4), Flextronics (16)+ Solectron (4), Celestica (6), Sanmina (6), Foxconn (3), Videoton (2), Lacroix (1)
Components	Tyco (7), Perlos (2), Aspocomp (3), Fuba (1)
Semiconductors	Infineon -Qimonda(6), NXP- Philips Semicon. (2), STM (8), Intel (2), TI (2), NEC (1), Freescale (2)
Car electronics	PKC (2), Continental Automobile Systems (1)
Computers	HP+ Compaq (16), Dell (12), Lenovo (3), IBM (12)
Military electronics	Thales (5), Finmeccanica (2)

Sources: European Restructuring Monitor http://www.eurofound.europa.eu/emcc/erm/
Evertiq.com - European Electronics industry Portal http://http.evertiq.com
BBC -British Broadcasting Corporation http://news.bbc.co.uk/

[3] Several firms are multi-divisional producing goods in different segments: if possible they were split between different categories. For example NEC (Nippon Equipment Corporation) is brought under categories of home appliances and semiconductors.

APPENDIX 2 Number of employees in manufacture of electrical and optical equipment

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
EU (25 countries)	:	:	:	:	38070	39202	38913	37788	36112	35000	:		
Belgium	57547	54927	53141	52933	53320	54332	55236	:	47618	46671	45151	43856	42677
Germany	:	:	:	:	1023389	1049695	1052180	1027612	1008834	1012103	1002031	997028	1027871
Denmark	46239	46442	46866	46301	48368	54656	53030	51375	47052	44018	46457	49194	51425
Ireland	46018	48521	57411	60222	65275	69030	65720	56955	53230	52880	53495	51485	55379
Greece										18787	16333	16544	15592
France	:	495478	495685	501055	506981	517161	518892	504294	469414	432452	424628	370965	373765
Italy	456990	470470	453772	455009	451110	464227	453216	450917	438133	422510	417244	427775	418178
Luxembourg	1891	2006	2109	2082	1998	2069	2141	2461	2418	2549	2655	2612	2993
Netherlands	100021	99583	97730	93719	90586	100294	100747	92699	82665	81740	78920	78996	69726
Austria	79311	75271	74573	75097	73918	74669	75446	72799	70512	70045	70302	75155	74563
Portugal	50218	53502	54704	59096	57351	57544	57751	51073	49027	46773	49619	46670	43756
Finland	50522	52421	56253	60235	65124	67907	68303	69447	67769	65603	65987		
Sweden	86899	91473	97510	98971	103141	110783	124967	102653	91778	86946	84808	78238	82208
UK	:	532990	544131	532803	531109	522519	474503	440624	386420	363768	346448	326970	318978
Spain	134285	140261	140326	149358	159311	161087	171677	161284	154570	148439	149636	150827	152374
Bulgaria	:	56464	49819	46509	39015	35055	34374	32434	31867	32622	32898	36396	37541
Czech Rep.	137789	146937	152612	154188	155595	170929	185069	179980	184240	186851	:		203445
Estonia	:	:	:	:	:	10939	10563	10407	10862	12260	14182	14592	14441
Cyprus	:	:	:	:	:	801	805	852	810	819	665	683	678
Latvia	:	:	:	8984	5516	5578	5411	6058	6159	6656	6425	6586	7146
Lithuania	25656	21543	20113	17714	16165	15638	15989	17420	19134	20448	19172:	16265	13063
Hungary	:	:	:	101147	116602	138624	153646	150835	145567	153969	150501	146968	145786
Malta	:	:	:	:	5172	5714	5667	5499	:	:	:		
Poland	:	183573	191772	191831	:	:	:	176542	173410	178928	187807	202555	218427
Romania	:	:	108523	97131	89212	83770	84297	84823	88509	91005	108922	113165	121495
Slovenia	:	:	:	:	:	:	:	30276	29093	:	28063	27408	28097
Slovakia	:	:	:	:	:	48039	50393	52480	57712	60421	66172	67539	73428

Source: Eurostat

APPENDIX 3 Investment per person in electronics (000 euros)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	:	:	:	:	7,9	9,3	7,9	:	4,1	4	3,9
Bulgaria	:	:	:	:	:	:	1,1	1	1,2	1,1	1,4
Czech Republic	:	:	:	:	:	:	3,1	2,5	2,6	2,9	:
Denmark	6,6	6,6	5,9	10,1	6,7	11,1	8,6	7,9	7,5	6,4	6,3
Germany	:	:	:	:	6,2	7,6	8,9	6,2	5,2	5,8	5,9
Estonia	:	:	:	:	:	2,1	1,6	1,6	2,9	4,3	3,2
Ireland	11,1	14,1	16,4	21,4	17,6	15,1	27,1	22,3	10,5	25,8	35,6
Greece	:	:	:	:	:	:	:	:	:	4,2	4
Spain	0	0	:	3,8	5,2	6,5	7,2	4,8	5,3	4,8	5,4
France	:	6,3	5,9	6,2	6,7	10,4	8,2	6,7	5,7	5,9	5,5
Italy	5,5	6,2	5,9	5,4	5,5	9,7	11	5,9	5,9	6,3	5,1
Cyprus	:	:	:	:	:	3,1	3,7	1,8	1,1	1,6	4,1
Latvia	:	:	:	:	1,3	1,2	1,6	1,5	1,9	1,4	4
Lithuania	:	:	:	:	:	2,4	3,9	2,8	2,9	2,8	1,2
Luxembourg	8,1	3,8	6,4	8,3	:	:	:	:	5,2	4,2	3,6
Hungary	:	:	:	:	:	5,9	5	3,8	4,5	5,7	4,4
Malta	:	:	:	:	9,5	31	10,9	9,5	:	:	:
Netherlands	5,6	9,5	6,3	7,6	7,6	7,7	7,2	6,3	6,3	5,6	5,8
Austria	6	:	6	6,6	7	11,7	13,3	8,6	6,4	7,1	6,8
Poland	:	:	:	:	:	:	:	2,4	2,4	2,3	2,5
Portugal	4,1	:	:	:	5,1	5,7	5,9	4,4	6	6	3,9
Ro Romania	:	:	:	:	:	2,5	2,8	1,5	1,9	2,1	2,4
Slovenia	:	:	:	:	:	:	:	3,6	3,9	:	5,2
Slovakia	:	:	:	:	:	1,9	1,6	1,8	2,6	2,9	3,2
Finland	9,1	6,2	8,9	10,1	10,1	10,8	22,5	6,9	5,1	5,5	7,3
Sweden	6,9	6,5	7	6,8	:	10	7,3	4,8	4,4	4,2	4,1
United Kingdom	:	5,5	8	8	6,1	8,8	7,9	5	4,1	4,7	4,8

Source: Eurostat
http://epp.eurostat.ec.europa.eu/portal/page/portal/european_business/data/database

APPENDIX 4: Net investment in tangible goods in Electronics (million euros)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belgium	:	:	:	:	354,3	:	401,9	:	133,4	139,9	133,5
Denmark	257,5	199,3	220,2	398,6	261,5	505,9	381,4	356	277,4	204,7	239,3
Germany	:	:	:	:	5972,3	7657,1	9029,5	5999,7	4894,4	5543,5	5441.8
Ireland	477,2	665,3	921,9	1220,2	1096,9	1007,9	1757,7	1237,7	485,4	1314,2	1882.3
Greece	:	:	:	:	:	:	:	:	:	75	46.1
Spain	:	416,2	:	424,4	623,3	813,4	958,9	580,2	585,4	599,2	581.1
France	:	:	:	2730,2	2624,3	4873,4	3983,1	2928,2	2396,6	2316,9	1973.1
Italy	2214,4	2603,4	2558,1	2264,9	2285,5	4125,9	4524,7	2134,2	1918,3	2233,7	1275.6
Luxembourg	15,2	5,3	13,1	12,3	:	:	:	:	12	10,2	9
Netherlands	:	:	:	:	690,9	715,6	624,5	361,6	494,2	424,1	342.7
Austria	430	:	439,7	465,6	489,4	831,3	957,7	628,3	428,4	459,3	450,9
Portugal	:	:	:	:	415,1	404,1	410,7	292,3	384,2	396,5	338,5
Finland	402,8	293,1	452,6	475,6	523,5	589,3	615,9	413,7	243,6	302,3	342.8
Sweden	:	:	534,9	527,3	290,6	849,4	51,2	205,8	159,5	282,7	264.6
UK	:	2695,6	4033,3	3965,4	2641	3915,5	3144,1	1377,7	1107,5	1058,3	816.1
Bulgaria	:	:	:	:	:	19,9	:	27,2	28,2	25,1	38.1
Czech Republic	:	:	:	:	:	:	:	378,5	440,3	490,6	:
Estonia	:	:	:	:	:	22,4	16,2	14,7	30,5	47,7	38.9
Cyprus	:	:	:	:	:	1,2	2,6	1,3	0,8	1	1,9
Latvia	:	:	:	:	:	:	:	8,7	11,1	8,9	24.9
Lithuania	:	:	:	:	:	34,9	54,3	42,9	46,5	47,5	21.9
Hungary	:	:	:	:	:	801,9	746,5	542,1	632,3	851,4	635,5
Malta	:	:	:	:	:	:	:	:	:	:	:
Poland	:	:	:	:	:	:	:	:	:	:	69.2
Romania	:	:	:	:	:	187	227,2	76,5	159,4	180,2	224,6
Slovenia	:	:	:	:	79,9	94,1	3,9	92,7	102,4	129,3	:
Slovakia	:	:	:	:	:	83,3	66,6	80,8	130,8	160,2	182.4

Source: Eurostat