COMPETE

Analysis of the contribution of transport policies to the competitiveness of the EU economy and comparison with the United States

COMPETE Annex 5

Structural change and its implications for transport

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Co-ordinator:

ISI
Fraunhofer Institute Systems and
Innovation Research, Karlsruhe, Germany

Partners:

INFRAS
INFRAS
Zurich, Switzerland

TIS
Transport, Innovation and Systems
Lisbon, Portugal

EE
Europe Economics
London, United Kingdom

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Authors:	Crespo Fernando, Caiado Goncalo, Carmona Miguel (TIS), Schade Wolfgang (ISI)
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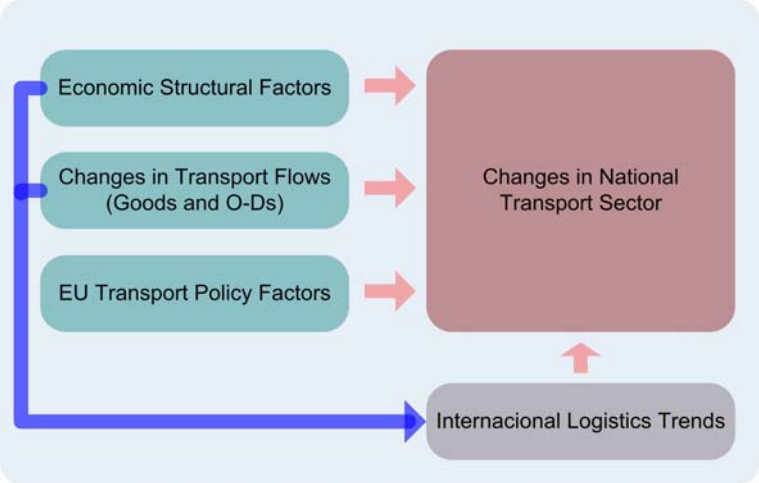
List of abbreviations

3PLP	Third Party Logistics Service Providers
4PLP	Fourth Party Logistics Service Providers
BPO	Business Process Out-sourcing
BTD	OECD Bilateral Trade Database
CDC	Central Distribution Centre
CPI	Consumer Price Index
EC	European Commission
EDI	Electronic Data Interchange
EILU	European Intermodal Loading Unit
EU	European Union
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
ICT	Information and Communication Technology
IOT	Input-Output Tables
ISIC	International Standard Industrial Classification
IT	Information Technologies
ITS	International Trade Services
MNE	Multinational Enterprises
NACE	Classification of Economic Activities in the European Community
NAFTA	North American Free Trade Agreement
NMSs	New Member States
OECD	Organisation for Economic Co-operation and Development
OEMs	Original Equipment Manufacturers
SAD	Structural Analysis Database
SNA	System of National Accounts
TEU	Twenty-feet Equivalent Units
UK	United Kingdom
UN	United Nations
UNSD	United Nations Statistics Division
US	United States
USEIA	United States Energy Information Administration
WTO	World Trade Organisation

Annex 5: Structural change and its implications for transport

1 Mega-trends affecting transport

The identification and analysis of economic mega-trends at global level - will allow framing the on-going (and eventually future) logistic trends in their wider arena: global economy. In this respect, one should note that "logistic trends" should not be understood separately from the wider economic trends analyzed in the previous sub-tasks. In fact, one could refer to "logistic trends" as the set of generalized reactions at micro-economic level to wider macro-economic trends (for instance, the spatial concentration of production and inventory trend at European level - already on-going - basically results from the adaptation of large manufacturers, seeking for lower production costs, to the trade liberalization in the EU). This driving - follower relation is represented in a blue arrow in Figure 1.



Source: own elaboration

Figure 1: Schematic organization of Task 4

The term Globalization refers to:

> *The worldwide phenomenon of technological, economic, political and cultural exchanges, brought about by modern communication, transportation and legal infrastructure as well as the political choice to consciously open cross-border links in international trade and finance. It is a term used to describe how human beings are becoming more intertwined with each other around the world economically, politically, and culturally*[1].

In the last two decades, the political changes together with the new economy organization and technological progress have significantly influenced the freight transport system, namely by determining the reinstallation of large industrial parks and logistical platforms. However, the on-going globalization process, based on the increasing market opening, infers fathom-

[1] http://en.wikipedia.org

less alterations in transport systems, hardening its medium and long term planning process. In return, the transport infrastructure network improvement plays a major role in the development process, by promoting investment opportunities and establishing commercial relations.

The globalization process in itself can be understood as a set of several inter-connected macro-economic world-wide mega-trends, with relevant impacts on logistic processes at micro level and, consequently, in transport systems. The main macro-trends can be identified as follows:

- **Population growth;**
- **Opening of national economies;**
- **Increase of international investment;**
- **Advances in technologies.**

1.1 Population growth

Population growth accounts for roughly one-third of total future GDP growth and is thus one of the most important fundamental drivers of passenger and freight transport growth. According to estimates published by the United States Census Bureau, the Earth's population hit 6.5 billions on Saturday the 25th of February 2006. In line with population projections, this figure continues to grow at rates that are unprecedented prior to the 20th Century. Approximately one fifth of all humans that have existed in the last six thousand years are currently alive. By some estimates, there are now one billion[2] young people in the world between the ages of 15 and 24.

The United Nations Population Fund designated October 12th, 1999 as the approximate day on which world population reached six billion. It was officially designated "The Day of 6 Billion". This was about 12 years after the world population reached five billion, in 1987. The child that has been proclaimed by the United Nations Population Fund and welcomed by the U.N. Secretary-General Kofi Annan as the six billionth baby, was born on the designated day two minutes after midnight, not in India or China, as might be expected, but to Fatima Nevic and her husband Jasminko in Sarajevo, Bosnia.

The last 70 years of the 20th Century saw the biggest increase in the world's population in human history:

- 2 billion was reached 125 years later in 1927;
- 3 billion was reached 34 years later in 1961;
- 4 billion was reached 13 years later in 1974;
- 5 billion was reached 13 years later in 1987;
- 6 billion was reached 12 years later in 1999.

[2] One billion = one thousand millions

From the figures above, the world's population has tripled in 72 years, and doubled in 38 years up to the year of 1999. The UN estimated in 2000 that the world's population was then growing at the rate of 1.4 percent (or 91 million people) per year. This represents a decrease in the growth rate from its level in 1990, mostly due to decreasing birth rates. The first five years of the 21st Century saw something of a decline in the overall volume of population growth, with the world's population increasing at a rate of about 76 million people per year as of 2005.

The future growth of population is difficult to predict. Birth rates are declining slightly on average, but vary greatly between developed countries (where birth rates are often at or below replacement levels) and developing countries. Death rates can change unexpectedly due to disease, wars and catastrophes, or advances in medicine. The UN itself has issued multiple projections of future world population, based on different assumptions. Over the last 10 years, the UN has consistently revised its world population projections downward.

Current projections by the UN's Population Division, based on the 2004 revision of the World Population Prospects database, are as presented in Table 1.

Table 1: World population growth, projection 2010-2050

Year	World	Africa	Asia	Europe	Latin-America	North America	Oceania
2005	6 453 628	887 964	3 917 508	724 722	558 281	332 156	32 998
2010	6 830 283	984 225	4 148 948	719 714	594 436	348 139	34 821
2015	7 197 247	1 084 540	4 370 522	713 402	628 260	363 953	36 569
2020	7 540 237	1 187 584	4 570 131	705 410	659 248	379 589	38 275
2025	7 851 455	1 292 085	4 742 232	696 036	686 857	394 312	39 933
2030	8 130 149	1 398 004	4 886 647	685 440	711 058	407 532	41 468
2035	8 378 184	1 504 179	5 006 700	673 638	731 591	419 273	42 803
2040	8 593 591	1 608 329	5 103 021	660 645	747 953	429 706	43 938
2045	8 774 394	1 708 407	5 175 311	646 630	759 955	439 163	44 929
2050	8 918 724	1 803 298	5 217 202	653 323	767 685	447 931	45 815

Source: UN's Population Division, 2004

Other projections of population growth predict that the world's population will eventually crest, though it is uncertain exactly when or how. In some scenarios, the population will crest as early as the mid-21st century at under 10 billion, due to gradually decreasing birth rates. In less optimistic scenarios, disasters triggered by the growing population's demand for scarce resources will eventually lead to a sudden population crash, or even a Malthusian catastrophe.

To quote a bon mot by David K. Foot, demography explains two-thirds of everything. Demographic trends impact on the provision of transport systems, namely in terms of infrastructure provision in three respects. First, the revenue side of public budgets is affected because a smaller active population narrows at least the growth potential of the income-related tax

take. Second, as society ages so the structure of demand for public goods shifts. Third, the number of inhabitants, and most importantly the size of the relevant user group, has considerable influence on how efficiently the public good is provided. The number of inhabitants in a region partly determines freight transport volumes. In Europe, transport geography reflects an intense concentration of population and activities in "Banane Bleue" which stretches from London to Milan via Rotterdam.

Therefore, declining population figures clamp the volume of traffic as a whole. On the other hand development in incomes, transport and mobility are income related. Leisure-motivated transport will increase only where disposable incomes can accommodate rising demand for recreational goods. But demographic trends exert severe pressure on an economy's potential growth, i.e. income-related transport volumes will, if anything, expand more slowly than in the past.

1.2 Opening of National Economies

The global market place, with powerful and relatively footloose players, extensive business networks and complex logistics systems, have a dramatic impact on transport systems. The logistics environment creates a high degree of uncertainty and leaves transport system managers puzzled with the question how to respond effectively to market dynamics.

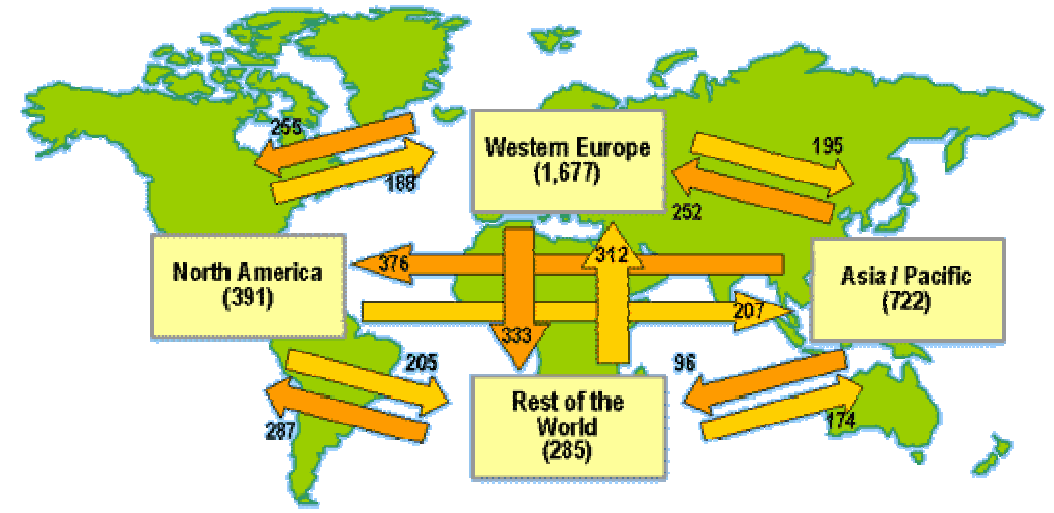
At present, most supply chains are in a state of flux due to delocalisation of production activities to Central and Eastern Europe, China and India. Moreover, manufacturers tend to outsource logistics activities and, as a consequence, investment of international 3PLs (Third Party Logistics Service Providers) tend to follow the investments of their "principals", the big manufacturing companies. This entails changing trade and freight flows and new supply chain requirements.

While in the 80s and 90s supply chains were monolithic and focused around one Central Distribution Centre (CDC), they have now evolved to hybrid supply chains which are calibrated to individual Product Market Combinations and even life cycles of products. Monolithic supply chains are gradually disappearing as an industry paradigm. The effect of hybrid supply chains is that pockets of logistics activity emerge on a global level where once logistics activities were geographically very focused around main ports in the EU, Asia and the USA. New logistics pockets are currently emerging in Central and Eastern Europe, the Middle East, China and India.

Important to understand is that logistics is not a zero sum market. The logistics market is open ended. Logistics opportunities entail logistics investments, if framework conditions and infrastructures are favourable. Outsourcing of logistics activities is still progressing. Moreover, more logistics activities are prone to be outsourced. Every logistics activity from simple transport and distribution to rather complex back office activities and light assembly and postponement activities can be outsourced. As a consequence, different categories of Logistics Service Providers have emerged. Those who engage in complex value adding activities, are the 3PLs. Very few of these are evolving to 4PLs (Fourth Party Logistics Service Providers). The latter have no transport or logistics assets. They contract out all asset based activities and focus themselves on directing and synchronising supply chains flows.

Logistics has become a major growth market. More and more big shippers are now taking steps towards the control of the distribution flows by a logistics service provider. International trade represents a growing share of global output, and growth in trade is expected to outstrip overall growth in output for the foreseeable future. On the basis of current trends, international trade may grow to the equivalent of 30% of world output by 2010 (from its current level of around 15%). The rising significance of trade is a consequence of the increasing integration of the global economy. Legal and cultural obstacles to trade are diminishing at the same time as the motivation to trade is increasing. Integration is occurring both at the regional level, through initiatives such as NAFTA and the EU Single Market, and at the global level, supported by the continuing evolution of World Trade Organization (WTO).

The last three decades have seen important modifications in international trading flows. The bulk of international trade occurs within economic blocs, especially the European Union and NAFTA. Other significant flows are between Asia / Pacific and North America (especially the United States), between Europe and North America and between Europe and Asia / Pacific. For several reasons, such as geographical proximity (Eastern Europe), energy (Middle East) and colonial (Africa), the European Union has significant trading linkages with the rest of the world (see Figure 2).



Source: ESPO, European Sea Ports Organisation, 2004

Figure 2: World trade flows, 2001 in billion $US

For most of the past quarter century, no region of the world has been more economically dynamic than East Asia. Especially China with its high economic development and its fairly recent accession to the WTO. The Chinese economic boom is reflected onto the liner service schedules of major shipping lines. They are dedicating higher capacities and deploying larger vessels to cope with the increasing Chinese container imports and exports, especially in relation to the China-Europe trade. The boost of Chinese exports to Western countries led to low freight rates on the return haul, creating new opportunities for the containerisation of low-value goods. On the eastbound leg between Europe and China, metal scrap, fertilizers and waste paper are among the many goods increasingly being containerised. The China effect

has also resulted in changes to the ranking of the world's largest container ports. China's top ten container ports posted a growth of 34% in 2003 reaching 40 million TEUs.

The likely emergence of China and India as new major global players[3], will transform the geopolitical landscape, with impacts potentially as dramatic as those of the previous two centuries. Economic setbacks and crises of confidence could slow China's emergence as a full-scale great power, however. Beijing's failure to maintain its economic growth would itself have a global impact.

At the same time, other changes are likely to shape the new landscape. These include the possible economic rise of other states[4] which may reinforce the growing role of China and India even though by themselves these other countries would have more limited geopolitical impact. Finally, there is also the possibilities of a stronger, more united Europe and a more internationally activist Japan, although Europe, Japan, and Russia will be hard pressed to deal with aging populations.

The growing demand for energy will drive many of these likely changes on the geopolitical landscape. China's and India's perceived need to secure access to energy supplies will propel these countries to become more global rather than just regional powers, while Europe and Russia's co-dependency is likely to be strengthened.

The rise of India also will present strategic complications for the region. Like China, India may become an economic magnet for the region, and its rise will have an impact not only in Asia but also to the North-Central Asia, Iran, and other countries of the Middle East. India seeks to bolster regional cooperation both for strategic reasons and because of its desire to increase its leverage with the West, including in such organizations as the World Trade Organization (WTO).

By most measures - market size, single currency, highly skilled work force, stable democratic governments, unified trade bloc, and GDP - an enlarged Europe will have the ability to increase its weight on the international scene. Its crossroads location and the growing diversity of its population - particularly in pulling in new members - provides it with a unique ability to forge strong bonds both to the south with the Muslim world and Africa and to the east with Russia and Eurasia.

The extent to which Europe enhances its clout on the world stage depends on its ability to achieve greater political cohesion. In the short term, taking in ten new east European members probably will be a "drag" on the deepening of European Union (EU) institutions necessary for the development of a cohesive and shared "strategic vision" for the EU's foreign and security policy.

1.3 Increase of International Investment

One of the classic drivers of economic growth, and consequently of transport flows, is the investment ratio, which determines the accumulation of real capital. It is included in every

[3] In similar terms to the rise of Germany in the 19th century and the United States in the early 20th Century.

[4] Such as Brazil, South Africa, Indonesia and even Russia.

theoretical and empirical model even though the investment ratio cannot rise forever and in view of declining marginal returns does not allow higher GDP growth per capita but only a higher GDP level in the long run. Furthermore, empirical analyses suffer from endogeneity problems: investment is a function of economic growth in the short run and a function of technological progress in the long run.

One of the main basic driving forces to change in the transport sector emerges from the globalisation process and with it a structural shift from supply-driven to demand driven economies. The supply-driven economy was based on the concept of economies of scale in production, through standardisation and on mass consumption of standard products. This approach was being scrutinized as productivity increases linked to economies of scale met their structural boundaries and as a growing individualism began to reflect on consumption patterns. The outcome was a shift to a more demand-driven economic system, combined with collaborative networks on the supply side of the markets.

Multinational enterprises (MNE) are the key drivers of globalisation. A shift has taken place from capital intensive activities[5] towards another type of activity, which is far less capital intensive and focuses more on developing a strong brand. Branding forms a key concept in the new business model of MNEs. This involves a strong focus on customers and product innovation, whereas production is outsourced to a network of suppliers. MNEs increasingly develop long-term relationships with a limited number of logistics suppliers on the basis of co-makership (Christopher, 1992). As such, a large number of MNEs have adopted flexible multifirm organisation structures on a global scale.

Many of the world's largest MNEs manage extensive networks of globally dispersed inputs. Global sourcing as such is a major driver of world trade. Yet at the customer end of the value chain, very few of the world's largest multinational enterprises actually operate globally, in the sense of having a broad and deep penetration in foreign markets across the world. Instead they are regionally based in terms of breadth and depth of market coverage with most of their sales situated within their home leg of the 'triad', namely in North America, the European Union or Asia. The broad geographic distribution of sourcing and production (back end) versus less broad geographic distribution of sales (customer end) is reflected onto trade patterns, supply chain management needs and shipping requirements.

1.4 Advances in Technologies

Information and communication technologies are among the most significant developments in society today, because they are having a profound influence on the behaviour of business, government, and individuals. Rapid innovation and adoption of new technologies are widespread and will continue if recent trends are any indication. These trends include:

- Equipment that is increasingly portable, powerful and affordable;
- The increasing presence of computers at work and in the home;

[5] Such as ownership and management of a large number of manufacturing sites, distribution centres and sales outlets.

- New services, products, and relationships from the merging of computers and telecommunications;
- Digital wireless and wireline communications of increasing bandwidth available from multiple suppliers;
- Heightened concern about the need for individual and corporate privacy and security surrounding these technologies;
- Human interface technologies easing interaction with equipment;
- Customization and personalization of technology;
- Automation of purchasing transactions; and
- Geo-locating of people and goods.

The common element linking these applications is the opportunity to improve information flows resulting from data capture and analysis. It is this opportunity that makes information and communication technologies important to logistics. Acceptable logistics services packages are no longer concerned only with the physical aspects of the service, but are becoming ever more concerned with the administrative, or information, aspects of managing that service. Increasingly, manufacturers and retailers demand that business be conducted electronically. Moreover, many companies see information systems as being a route to achieving sustainable competitive advantage. To remain competitive, firms must control the major costs in their own value chain and in the upstream and downstream value chains of suppliers, distributors and end customers. Applications of IT have the potential to play a vital part in controlling costs and enhancing service quality.

The upgrading of communications and transport technologies has led to an improvement in the coordination of various economic activities among suppliers, clients and partners abroad, at the same time making the procedure more cost-effective. Communication technologies enable, for instance, a splitting of the production process by which locational advantages and scale benefits can be exploited; furthermore this technology boosts the exportability in the service sector.

Taken together, there seems to be a widespread consensus that globalisation and technological advances in IT represent a fundamental transformation of the economy, which will make familiar relationships between structural change, economic growth and a nation's competitiveness obsolete.

In short, new ITs reduce information transport costs and certain static transaction costs, hence stimulating the international network economy, enhancing the spatial scale of operations of firms, increasing logistic complexity and stimulating the role of logistic service providers. In order to deal with this increased complexity, logistic service providers may develop software and use other ITs to manage global supply chains. Product innovation is not enough, however. Organizational adjustments in supply chains are also required, such as partnership development involving shippers and their core logistic service providers, enhancing the scope of action of the latter in the supply chain and enabling them to upgrade and engage in product innovations with a view to advising, designing, developing and implementing new supply-chain solutions. With this, the focus shifts from ITs-enabled information

exchange towards the dynamic transaction costs of knowledge production and innovation. In our view, innovation is a key variable in any model explaining the relation between ITs and spatial structure. Only if combined product and organisational innovation takes place in supply chains, will spatial impacts be significant. These include the decentralization of distribution activities and differentiation of transport activity at the downstream end of supply chains, and relocation choices of innovative logistic firms away from major transport hubs, such as (sea or air) ports.

2 Implications of structural changes for development of logistics

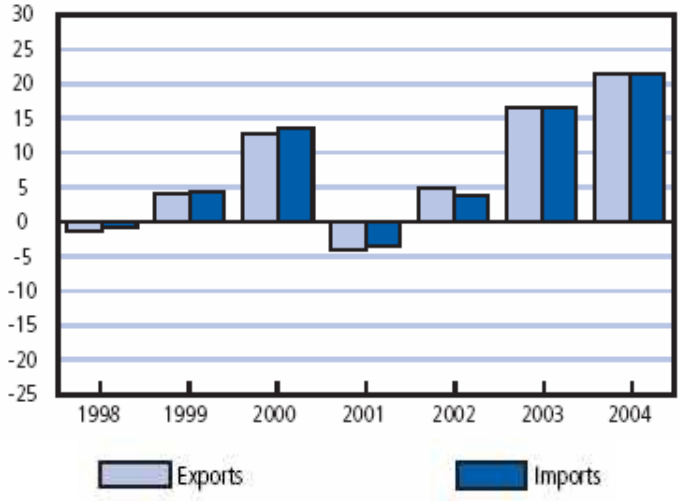
The association of the above presented global mega-trends has triggered or accelerated a set of logistic related trends, more or less internationalized according to the geographical scale where market companies operate (see Table 2). As such, one could understand logistic trends as the set of generalized reactions at micro-economic level to those wider macro-economic trends.

Table 2: Relation between global economic mega-trends and international logistic trends

Source: own elaboration from TRILOG project data (1999)

In the last decades the international transport and logistics activities have become increasingly complex due to several factors. Since the 80s many trade barriers have fallen, generating several key factors both from supply and demand sides boosting the growth of trade relationships between economic blocks and nations. In terms of economic blocks, we can identify the three present leading economic and trade regions: North America (NAFTA), Asia and

the Middle East, and Europe (EU). In terms of the global movement of goods, there is an effect worth noting: the growth of the value of international trade between 1989 and 1998 was of 190%, being substantially larger than the growth in global production value, up by 80%. In 2003, global merchandise production and merchandise exports recorded their highest annual growth in three years (see Figure 3). Merchandise trade increased by 4.5%, significantly faster than world merchandise production, which recovered by nearly 3%. However, the average annual growth of trade and output in 2003 was still below the average expansion recorded in the second half of the 90s.



Source: WTO, World Trade Organisation, 2005

Figure 3: Value of World Merchandise Trade 1997-2004 (annual percentage change)

This global market context is characterised by complex trading networks that have evolved for exploiting labour cost differentials and the availability of raw materials in particular countries. Those developments and increasing complexity has been facilitated by major regulatory and technological trends. Leaving aside intra-block liberalisation issues (such as the creation on the unified market or the monetary union in the EU), inter-blocks trade liberalisation, particularly between the EU and NAFTA, has reduced transport costs related to cross-border movements of goods or "trade barrier costs". Technology has accompanied (and in a certain way, also fed and amplified) this trends through advances in telecommunications and information technology that give companies the means to manage the physical movement of their products over longer and more complex trade circuits.

The combination of the above referred factors (trade liberalisation, increase on the value of trade, trade specialisation and technology advances) results in a series of logistics trends more or less relevant according to the geographical scale where markets companies operate. In 1999 the REDEFINE project (European Com-mission, DG TREN) addressed the link between logistics practices and the demand for road freight transport.

For that analysis, the REDEFINE project synthesised the taxonomy of logistics and supply chain trends, al-ready studied in previous studies, and condensed those findings into 4 groups of decisions concerning logis-tics processes:

- The structure of the supply chain: the location and size of production or processing plants, storage sites;
- The alignment of the supply chain: the breakdown of the chain into different processing segments, the number and location of supplies and ultimate destination of the product;
- The scheduling of the product flow: the frequency of delivery, the mode of ordering and delivery;
- The management of logistics resources: the size of vehicles used, types of handling and storage sys-tem and their effectiveness of use.

Another trend can be added, as presented by the TRILOG-Europe project (1999, OECD): product configuration, as changes in the design of goods transported can mean a change in the relationship between the value of a product and its weight due to technological or consumer influences. Also TRILOG-Europe provides a more detailed subdivision of the 5 trends in more specific effects, presented in Table 3. The description of the 5 groups and correspondent trends is undertaken in the following pages.

Table 3: Taxonomy of logistics and supply chain trends

Level of logistical decision making	Trend
Restructuring of logistics systems	Spatial concentration of production and inventory
	Development of break-bulk / transhipment systems
	Creation of hub-satellite networks
Realignment of supply chains	Concentration of international trade on hub ports
	Rationalisation of the supply base
	Vertical disintegration of production
	Wider geographical sourcing of supplies
	Wider distribution of finished products
	Postponement / local customisation
	Increased direct delivery
Rescheduling of product flows	Time-compression principles applied in retail and manufacturing
	Increase in retailers' control over supply chain
	Growth of 'nominated day' deliveries and timed delivery systems
Management of distribution	Changes in freight modal split
	Reduction in international transport costs
	Impact of legislation and regulation
	Increased use of information and communications technology
	Developments in vehicle and handling technology
Changes in product design	Complexity, Packaging, Modularity
	Globalisation, growth of E-commerce and dematerialisation of freight

Source: TRILOG project (1999)

2.1 Restructuring of logistical systems

2.1.1 Spatial concentration of production and inventory

There is a clear tendency between manufacturers to concentrate production in fewer locations, both as a result of a reduction in the total number of factories or greater plant specialization, tendencies based on the intensive use of economies of scale. This means that the traditional system of nationally-based production, where a factory would manufacture a range of products for the local market has been replaced in many sectors by a "focused manufacturing" where the entire production of a particular product for a continent (or in some cases for the whole world market) is based at a single location. This means that companies can maximize economies of scale and thus reduce production costs, but at the same time making the logistical system more transport-intensive, adding transport cost to the final product price and lengthening lead-time to customers. In macroeconomic terms, this means the specialization and reduction of number commercial partner. For instance, according to TRILOG-Europe data, between 1989 and 1997 the number of countries providing 80% of imports into the EU15 in three categories considered decreased: raw materials from 19 to 16 countries, semi-finished products from 20 to 19 countries, and finished products from 17 to 15 countries. The larger reduction, and thus, specialization were observed in the raw materials group, a tendency that can be observed as well in global terms.

The centralization of inventory has been one of the most pronounced trends in logistics over the past thirty years. By reducing the number of stockholding point it can be optimized (i.e. reduced) the total amount of safety stock required to provide a given level of customer service. These combined savings usually far exceed any transport cost penalty associated with centralization, as shown by several examples of firms. Another important factor is the separation of stockholding and break-bulk operations, traditionally centralized in the same location. This means that stockholding is becoming more centralized and break-bulking remains decentralized, as this tendency has proved to be effective in terms of minimizing any additional transport cost from centralized stockholding. Within the EU, the development of the single European market means that inventory decentralization is now undertaking not at national level but at European level, as companies take advantage of the removal of frontiers, the deregulation of international road haulage and improvements to road and rail infrastructure.

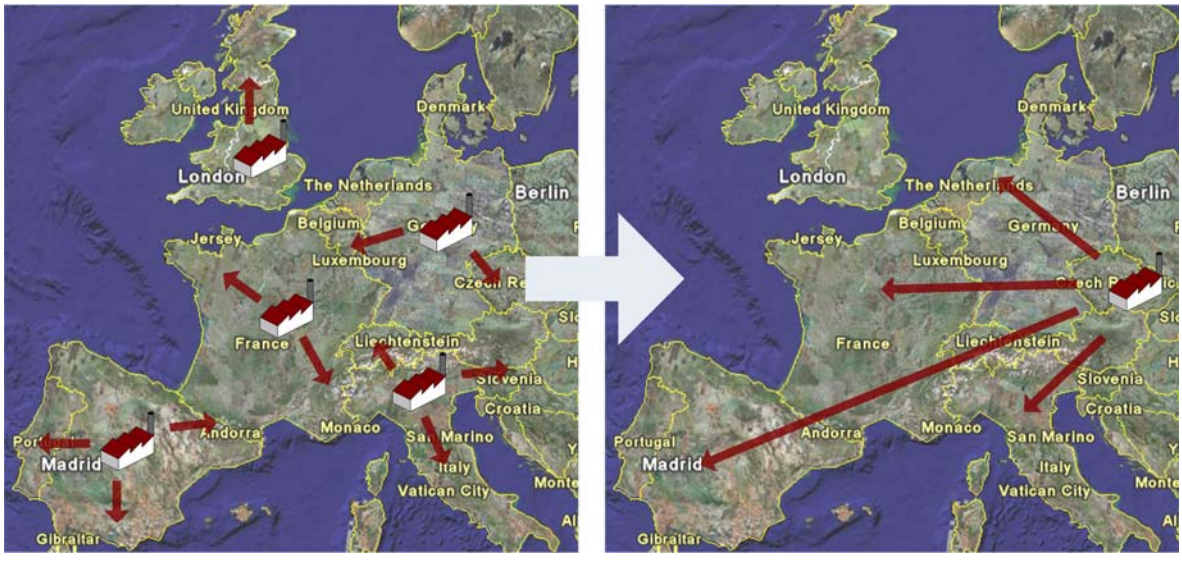
Moreover, the processing of the industrial organization has had an impact on the strategies of location of industrial sites when looking for necessary resources. These transformations have contributed to promoting geographical polarization of industrial and distribution activities. Geographical polarization strengthens the physical proximity between enterprises. Polarization in present modern societies is growing stronger for industrial and distribution activities. This tendency depends on the emergence of organizational proximity which optimizes supply chain effectiveness. Logistic systems are moving towards scope-economy. Agglomeration forces are taking part in a very pronounced single centre-periphery structure. Therefore, spatial disparity reinforcement has an impact on the growth of distances travelled.

The integration of space in the sites location strategies results from the evolution of transport system like location criterion. For different scales – local, regional, national, continental or world-wide – the attenuation of transport system in location characteristics has repercussions on the spatial dynamics of industrial structure. Physical distance travelled fades in aid of time-

space and cost-space. But the manufacturer and the person in charge of regional development continue to allow a large place for transport system because they know this remains a necessary condition for improving economic activity on a territory. Indeed, the offer of services now is more important than infrastructure or technique of transport. The importance of transport supply, which was before rare, does not participate in land-use planning.

Organizational proximity takes precedence often to the detriment of physical proximity especially due to information and communication technologies. Now, logistics is becoming more important than transport operation in the choice of industrial and distribution sites location. In fact, manufacturers want to subcontract their related transport operations. So we notice an intensification of the relation between manufacturers and carriers. Carriers become progressively supply chain managers. Now, the competitiveness of firms depends indeed on logistics. Cost, delivery times and quality of service are the three criteria of an efficient supply chain. This one participates in transforming the spatial dynamic of industrial and distribution sites. These thoughts are near those proposed by the fundamental theory of spatial analysis. However, the principal criterion in the strategies on location of firms is not transport system but logistics.

Physical distance and transport cost become obsolete after the progressive rise of added value on a product. Therefore, each firm wants to enlarge its market area from just one distribution point. The first aim is to minimize transport costs between factory and customer. The second consists of facilitating final production operations like industrial completion, packaging, stock management. The increase in mobility is an opportunity for an industrial site which wants to develop new organizational modes. But this evolution involves new relations with space. Therefore, the result of optimal location, making abstraction of physical distance, contributes to developing a new geographical organization of production in opposition to the objectives of sustainable mobility. In the medium or long term, it will be difficult to reverse the process which has permitted the development of geographical concentration.



Source: own elaboration

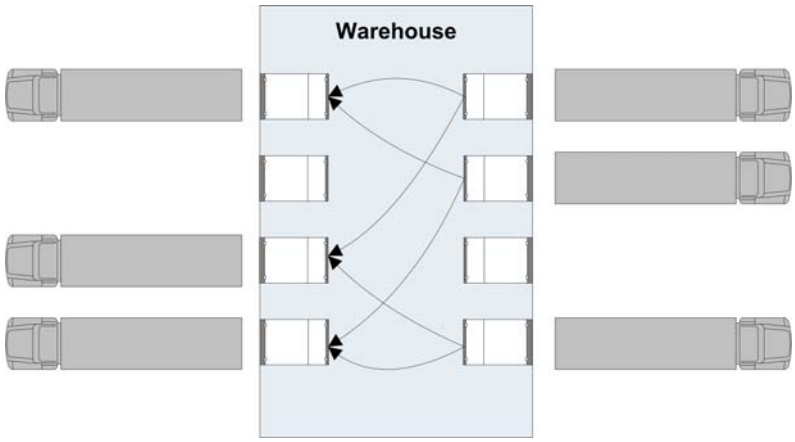
Figure 4: Representation of production and inventory concentration in Europe

The processes of concentration and centralization have been steadily increasing the average distance between manufacturers and regional distribution centres, and between regional distribution centres and shops. This will continue to be a significant contributor to road traffic growth over the next 10 years, although it will be less important than in the past because of the slow-down in network reconfiguration and the outsourcing of logistics to large companies which own or lease warehouses in many areas.

2.1.2 Development of break-bulk / transhipment systems

As already mentioned in the previous point, it can be found an increasing tendency for the separation of the stockholding and break-bulk functions. Many firms have separated both activities, centralising inventory while retaining a network of non-stockholding, break-bulk facilities to maintain the efficiency of their transport operation. This allows companies to save thanks to inventory concentration and reduction and, at the same time, minimising the delivery cost penalty associated with centralisation.

Distribution is currently shifting from traditional systems push to pull methods. In the push system, production plants are based on capabilities and capacities of the plant, and product is produced in the expectation that it will sell. When it is produced faster than it can be sold, it is stockpiled at plant warehouses. If sales cannot be accelerated, then the plant will be slowed down until supply moves into balance with demand. In this system, warehousing serves to absorb excess production. Today's pull system depends on information. It is based on a constant monitoring of demand. With a pull system, there is no need for a reservoir. Instead, the warehouses serve as a flow-through centre, offering improved service by positioning inventory closer to the customer. In supporting manufacturing operations, warehouses often play the important role of inbound consolidation points for the receipt of shipments from suppliers. A firm orders raw materials, parts, components or supplies from various suppliers, who ship truck-load or carload quantities to a transhipment facility located in the proximity to the plant, where the break-bulk is made. From a physical distribution or outbound perspective, warehouses can be used for product mixing, outbound consolidation or break-bulk. Product mixing often involves multiple plant location that ship products to a central transhipment facility. Each plant manufactures only a portion of the total product offering of a firm. Shipments are usually made in large quantities to the central warehouse, where customer orders for multiple products are combined or mixed for shipment. Therefore, break-bulk warehouses are facilities that receive large shipments of product from manufacturing plants. Several customer orders are combined into a single shipment from the plants to the break-bulk ware-house. When the shipment is received at the warehouse, it is broken into smaller less-than-truck-load shipments which are sent to customers in the geographical are served by the warehouse. For this purpose, cross-docking concepts are becoming the warehousing alternative of many firms. The warehouse serves primarily as a distribution mixing centre. Product arrives in bulk and is immediately broken down and mixed in the proper range and quantity of products for customer shipment. In essence, the product never enters the warehouse. Cross-docking is becoming popular among retailers, who can order truck-loads, then remix and immediately ship to individual store locations.



Source: own elaboration

Figure 5: Cross-docking Warehouse

2.1.3 Creation of Hub-Satellite systems

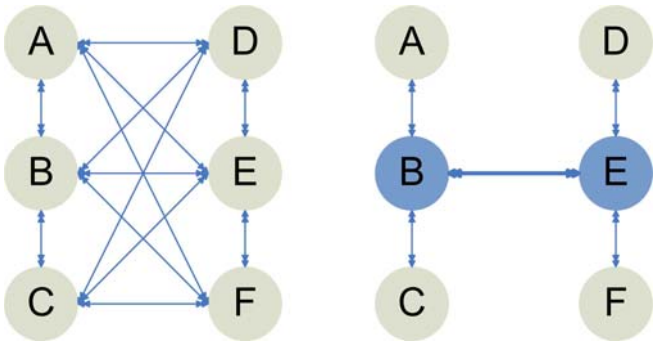
This is a particular trend in parcel and mail delivery systems (couriers which use air transport for long haul and road mode for the last mile distribution), a sector of growing importance in logistics. These firms differ from conventional distribution systems in three important respects:

- In parcel and mail systems freight has to be collected from numerous sources widely dispersed across a region or a country, which makes the operation more complicated than that of industrial and retail distribution, where freight originates at a small number of locations;
- Consignment size and weight are generally much smaller, turning the economics of parcel and mail systems very dependent of large and viable size loads, specially for trunk movements and operations;
- There is no inventory in parcel and mail systems, consignments are not stored.

Modern parcel and mail systems are configured in a hub and satellite system in which all but local traffic passes through a centralised sorting facility, the "hub" (in case of express carriers or couriers this hub is generally a "gateway" located within the proximity of an airport – ex.: UPS in Cologne/Bonn airport; or DHL, recently merged with Excel, announced the Leipzig-Halle airport expansion to become the European hub of its operations in 2008). Thus, the hub is the focus of the system from where radial routes depart to the different geographical areas covered by the system. This configuration responds to two factors: First, the use of mechanised handling systems is only economical where sorting facilities handle a large throughput, provoking a pressure for centralised operations and the subsequent facility-related benefits. And second, by concentrating facilities, trunk flows are also concentrated in a smaller number of radial routes, allowing the increase of vehicle sizes and load factors.

On one hand, hub-satellite systems have increased the volume of transport devoted to parcel and mail activities measured in tonne-kilometres, amplifying the effect of the steep growth in the parcel business within the transport system. On the other hand, in terms of vehicle-kms produced, the increase has been proportionally lower, due to the increase of vehicle sizes and

load factors. In overall terms, the impact of the evolution of parcel and mail systems on traffic levels may have been modest in the recent years.



Source: own elaboration

Figure 6: Direct freight services Vs national/regional hub and spoke network

With the move to just-in-time / quick response replenishment average order size has diminished. It is much more efficient to distribute small orders through hub-satellite networks than through conventional echelon systems, comprising several tiers of warehousing. There has been extensive development of hub-satellite networks for both parcels and pallet-loads. Pallets of products in less than truck loads are collected from several suppliers and aggregated at local 'satellite' depots. They are then forwarded to a central hub, where they are sorted for onward trunking to the local depot closest to their destination. The operator of this local depot arranges final delivery. The main advantages of this system lie in the speed and efficiency of centralised sortation at the hub and the high vehicle load factors achieved on the radial, trunk movements to and from the hub. Channelling products through hub-satellite networks, however, results in the addition of an node and link to the supply chain and more circuitous routing. This increases tonne-kms per tonne of product delivered. This increase in tonne-kms is not necessarily reflected in an increase in vehicle-kms, however, because the vehicles trunking the pallets to and from the hub achieve higher load factors than would be possible within the alternative echelon networks. No attempt has been made to compare the transport intensity of food distribution through hub-satellite and echelon networks with respect to tonne-kms and vehicle-kms. It is safe to say, however, that tonne-kms will be higher in hub-satellite networks. The effect on vehicle-kms is less clear.

2.2 Realignment of supply chains

2.2.1 Concentration of international trade on hub ports and airports

The economies of scale in terminal and vehicle operation have led to the concentration of international trade through a smaller number of hub ports and airports. For ports, the new transoceanic vessels (of increasing size) can only operate in the largest ports such as Rotterdam or Antwerp. Subsequently, these large ports are also the leading ports in transhipment activities, as nodal points of the container distribution networks.

Traffic concentration on large intermodal platforms and shipping alliances translate into fewer ports handling a more important share of world traffic: the first 10 containers ports

handled 31% of the world traffic in 1980, and close to 40% today. Simultaneously, the growth of transhipment activities complements the development of hub ports: container transhipment is believed to make 20% of total maritime container traffic today, and is growing.

Next to that, the growth in the volume of airfreight handled by 'all-cargo' aircraft (rather than in the belly holds of passenger aircraft) is creating a potential for the development of all cargo airports away from established airport locations, such as at Vatry in France. Such airports can also become nuclei for the development of high-tech manufacturing. For instance, the first of a proposed network of "Global Transparks" has been established at Raleigh, North Carolina. This network will link manufacturing complexes around the world on a JIT basis by dedicated airfreight services. Boeing (1997) predicted that, worldwide, airfreight traffic will grow at a rate of around 6.5% per annum over the next 20 years. A more recent study by Peters and Wright (1999) predicted a steady in increase in the proportion of airfreight handled by integrated express carriers, all of whom concentrate their sorting operations on hub airports.

Concentration of international trade on hub ports would mean that these hub ports will hold a higher share of total transhipment. Since the hub-and-spoke concept is mostly connected to the transport of containers, also the share of the harbours in the container-market is taken as an indicator.

In a hub and spoke system of containerized seaborne trade, cargo to a region is delivered first to a primary hub port and then transported to its final destination, whether by sea, rail, road or inland waterways. Similarly, exports from the region are collected in the primary hub, then transported to final destination. While these primary ports are often equipped to allow for a quick turnaround time of vessels, there are usually two primary characteristics that set them apart from other ports:

- Primary hubs tend to be geographically central to the region, often with a substantial hinterland. This is, it attracts a considerable amount of cargo that would in any case flow through that port);
- Primary hubs can accommodate larger vessels than other ports in the region.

Hub and spoke systems in containerized maritime transport often result in significant cost advantages, benefiting the various parties to the trade.

2.2.2 Rationalisation of the supply base

There is a general tendency in most industries to reduce the number of suppliers used to provide a particular product or part. By doing so, firms reduce their transaction costs and strengthen their negotiating position with respect to the chosen supplier. On the other hand, firms are exposed to greater vulnerability should their chosen supplier fail to deliver. This rationalisation of the supply base applies as well to the purchase of logistical services. Several surveys have confirmed that the average number of logistics service providers that companies

use has been declining[6]. This trend would lead also to a concentration of the imports in the EU, as there will be a smaller number of goods accounting for the majority of the imports volume[7].

Technologies such as Electronic Data Interchange (EDI) over the Internet and sales over the World Wide Web are emerging as an important medium for market transactions. Firms and individuals increasingly participate in electronic commerce as customers, suppliers or intermediaries. Commercial web sites are established for a variety of reasons, including appealing to potential customers to form new relationships and communicating with current customers to strengthen existing relationships.

Traditional physical markets are often brokered by intermediaries, or parties that facilitate market transactions by providing intermediation services. For instance, the owner of a shopping mall typically provides many intermediation services in the physical world, such as a physical infrastructure and management of the flow of customers visiting the mall. However, the value of these services may be reduced once the relationship moves to an electronic market. In particular, electronic markets do not require services related to the matching of customers and suppliers in the physical space. In fact, the information infrastructure may make it so easy to match customers and suppliers that the role of intermediaries may be reduced or even eliminated.

However, while some of the traditional roles of intermediaries may become less important as information technology facilitates communication between customers and suppliers, the need for intermediaries is not likely to be eliminated in the near future. Intermediaries in electronic markets are likely to assume important roles that will include aggregating information goods, providing trust relationships and ensuring the integrity of the market, matching customers and suppliers, and providing marketing information to suppliers. Differences in the nature of electronic markets will affect the role of intermediaries. In markets such as consumer markets, characterized by a large number of products and infrequent purchases, the matching role of intermediaries will be more important. Markets with fewer suppliers and customers and frequent purchases, such as industrial markets in the automotive industry, will have less need for matching intermediaries. While businesses often have high repetition and strong relationships with their suppliers, consumers are more likely to express dissatisfaction with suppliers through "exit" rather than "voice". As a result, intermediaries in consumer-oriented electronic markets may help reduce the search space and introduce users to "communities of interest" for peer recommendations. Finally, intermediaries can provide marketing information that allows suppliers to tailor their products based on their marketing strategy and on their customers' needs.

[6] Information from the Holland International Distribution Council (HIDC), cited by the TRILOG project.

[7] This tendency is remarked by TRILOG using US and Japan import data between 1989 and 1996. Both countries showed for that period a concentration in import partners (as the EU previously showed) and a concentration in the types of imported goods.

2.2.3 Vertical disintegration of production

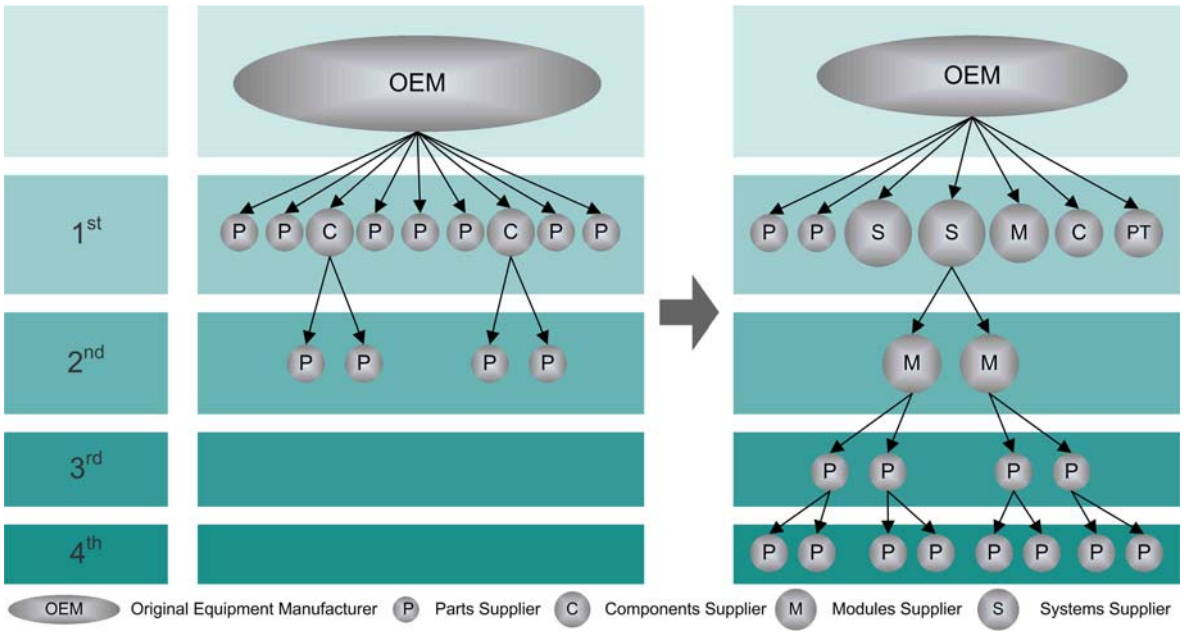
This is a trend related to the increasing concentration and specialisation of production, that reverses the practices of production concentration of the 60s and 70s. Activities of the same production chain are decentralised adding intermediate extra links to the transport chain and thus increasing the transport intensity of the production processes.

The rising integration of world markets has brought with it a disintegration of the production process, in which manufacturing or services activities done abroad are combined with those performed at home. Companies are now finding it profitable to outsource increasing amounts of the production process, a process which can happen either domestically or abroad. This represents a breakdown in the vertically-integrated mode of production[8] on which American manufacturing was built. A number of prominent researchers have referred to the importance of the idea that production occurs internationally: Bhagwati and Dehejia (1994) call this "kaleidoscope comparative advantage," as firms shift location quickly; Krugman (1996) uses the phrase "slicing the value chain"; Leamer (1996) prefers "delocalization;" while Antweiler and Trefler (1997) introduce "intra-mediate trade." There is no single measure that captures the full range of these activities, but I shall compare several different measures of foreign outsourcing, and argue that they have all increased since the 1970s.

There is an effect derived from this trend, which is the increase of tasks moving out of the main plants, more precisely tasks performed at the end of the production line, sometimes performed at distribution centres or by manufacturing sub-contractors. An example of such activities is customisation of products including re-labelling or re-packaging of goods, and even the configuration of items from standard modules.

The vertical disintegration of production trend (regarding the logistics chain) is mainly supported in the management decision to outsource non-core activities. This leads to the emergence of specialized companies that manage the logistics process, both in terms of materials as in terms of information flow. These companies that perform activities like: transportation management, warehousing, inventory management, customer management, customer order processing, logistics integration; are called Third Party Logistics Providers (3PLP). The 3PLP rely mostly on road transport although they can offer a wide range of services and transport options, nevertheless the most significant volume is carried by road. This the increasing dependence from road transport that allies speed, flexibility, door-to-door service and a modest cost, will become greater if the other modes do not increase their competitiveness, specially the railway transport that is nowadays still dominated by public operators.

[8] The so-called "Fordist" production organisation, exemplified by the automobile industry.



Source: own elaboration from SULOGTRA project data (2001)

Figure 7: Representation of vertical disintegration in supply networks

2.2.4 Wider geographical sourcing of supplies and wider distribution of finished products

As national boundaries become more permeable to economic activities and capital becomes more mobile, industry value chains are becoming increasingly international in their scope. This globalization of production entails substantial growth of international sourcing for both components and finished goods. In logistics terms, the length of the supply lines upstream and distribution channels downstream has been termed "logistics reach". The emergence of a new generation of high value manufactured products, more precisely in the electronics industry, and a general reduction in the density of consumer products, have contributed to an increase in average logistics reach.

Explanations of the location and extent of international sourcing have traditionally focused on two sets of factors, location-specific factors and what can be called "relational" factors. Location-specific factors pertain to the relative attractiveness of particular locations and include, inter alia, relative production costs, the availability of technology and resources, political and economic stability, and the attractiveness of the local market. "Relational" factors, by contrast, address the relationships, or linkages, between the activity being sourced and other activities in the value chain. These linkages comprise flows of goods, information and money. Relational factors are of particular importance because international sourcing involves the geographic dispersal of the value chain, creating a strong need for integration and coordination. International sourcing is thus consistent with the high-dispersion, high-coordination quadrant of Porter's typology of strategies.

It has been widely recognized that international sourcing is part of a strategy of global integration and therefore entails high levels of international coordination compared to multidomestic or pure export strategies. Several researchers have identified factors that make inter-

national dispersion and integration of the value chain particularly difficult, such as technological complexity, product immaturity and high transportation costs.

A key issue facing managers is deciding which activities in the value chain can successfully be sourced internationally, and which need to be conducted in geographical proximity to each other. The company's choice to import or localize supply is one that requires ongoing analysis and a willingness to adjust to emerging realities in the market. To become inflexible and static is to risk being overtaken by competitors with more responsive and current systems. A recurring sourcing process must weigh the business requirement's unique drivers to local, regional or global supply with the recognition that circumstances change over time. Current business periodicals headline the shift of business overseas to the Far- East, Eastern Europe and even Canada. The range of work includes assembled items (e.g. electronics from China and Malaysia), as well as chemicals and manufactured goods (toys, furniture, pharmaceutical intermediates). However, for the first time, services are also major components of the offshore buy, especially from India, Eastern Europe and Ghana, where data entry, software, call centers and engineering research are done long distance at low cost. However, not every commodity or service is suited for the long distance buy. It is critical to understand the geographical drivers of the company's spend and the dynamic nature of international sourcing during the sourcing market assessment process.

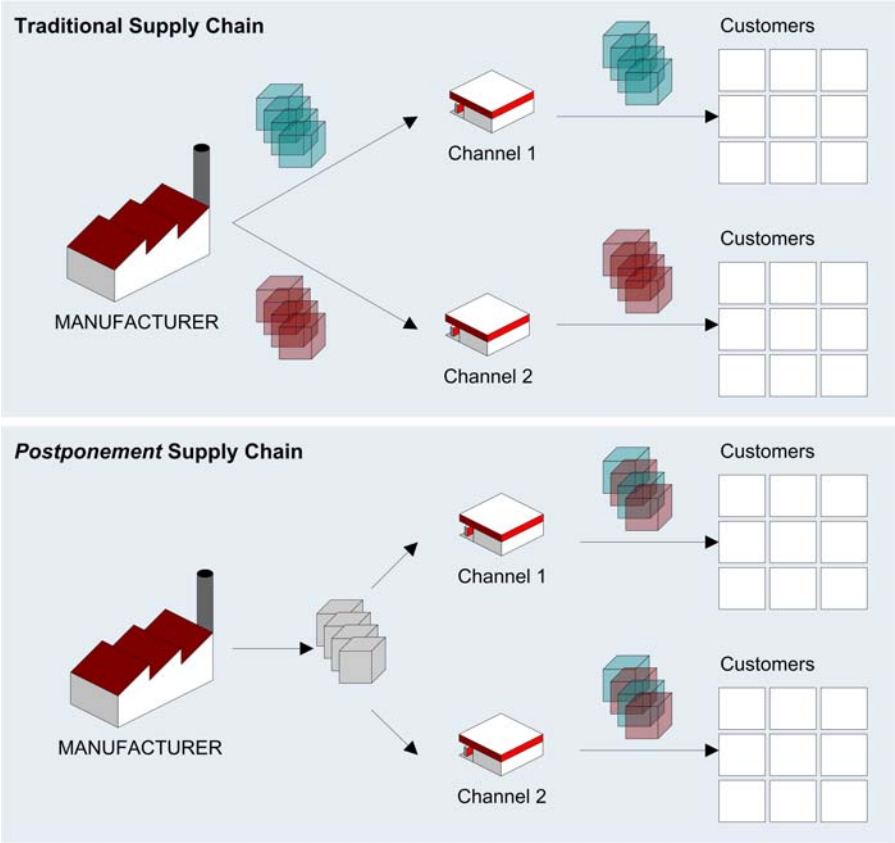
2.2.5 Postponement / deferred customisation

At the same time that manufacturing companies are following a centralisation path concerning production, are following a decentralised approach to product customisation. Production is often being centralised in low labour cost countries, while product customisation is undertaken when products reach the regional markets where will be distributed and commercialised. This procedure is an application of the "postponement principle" by which companies hold inventory in generic form as long as possible, deferring its final configuration until the demand for specific models is known, and minimising the number of stock units until the customisation facility. This enables a reduction of the inventory in the global supply chain and the risk of over- or under-supplying a particular market with a specific product. Good examples of these practices can be found at the electronics and industry, that centralise production leaving the final configuration to distributors and subcontracted logistics service providers. Actions such as packaging, inclusion of manuals, attachments and ancillary products are added close to the customer, minimising inventory risk and reducing lead-time.

This reduction of inventory costs is balanced by the increase of expenses derived from the inclusion of an additional extra node in the supply chain, mainly through increased facility costs. On the other hand, the effect on transport costs is limited.

As mentioned above, local customisation is increasingly being outsourced to logistics companies, many of which had their origins in transport or warehousing sectors but extended their services to include activities which were traditionally considered as manufacturing[9].

[9] For instance, Nedlloyd provides a European customisation service for IBM at a distribution centre in the Netherlands (example provided by TRILOG).



Source: own elaboration

Figure 8: Traditional supply chain Vs postponement based supply chain

2.2.6 Increase in direct delivery

The increase of direct delivery is a direct consequence of direct marketing, particularly through electronic media. E-commerce has boosted in recent years this practice, supported by with the centralisation of inventory (mentioned above) and leading to a process of "disintermediation" where manufacturers bypass conventional wholesale and retail channels and proceed to distribute directly their products to the end costumer. The "disintermediation" has also an important effect on transport patterns of freight flows, empowering the hub-satellite networks.

On the other hand the competitiveness and effectiveness of air freight carriers and package delivery companies in providing efficient ground delivery service has, in many cases, eliminated several links in traditional supply chains. Residential deliveries have reduced trips to retail establishments for many items from food to automobiles. Mail order companies ship many products directly from manufacturers and eliminate intermediate warehousing and distribution. The move to push/pull systems means that more firms are shipping products directly to customers, thus bypassing traditional supply chains. With more direct-to-consumer-business, many firms will need to adjust their transportation mode away from bulk shipments toward parcel shipments, creating an increase in demand for small package delivery as more consumers shop on the Internet.

A looming challenge for this trend is taming the "last mile" delivery costs, which remain unacceptably high even for the most efficient carriers in the marketplace. This has been evident in the failure of several high-profile dot-com companies that specialized in home delivery of small low-value packages, as well as the reluctance express carriers to provide universal home delivery to all addresses.

Several potential customer-direct distribution models are vying for success but at the moment no clear winner is apparent. The rise in customer-direct delivery is a function of consumer time-use decisions as well as inventory management principles. One possible distribution model has goods moving directly from a plant to a home delivery consolidation center or cross-dock center, and thence to residences. This approach eliminates several stages of handling from the traditional channel. As a version of the pull model, it could significantly reduce total logistics and transportation costs for consumers, by creating long haul lanes with concentrated volumes. Whatever system ultimately emerges, the implications for logistics patterns will be significant.

2.3 Rescheduling of product flows

2.3.1 Application of time compression principles in retailing and manufacturing

Several new management principles and approaches, such as just-in-time, quick response, lead-time management, time compression, lean logistics, agile logistics and efficient consumer response have been developed since the 80s to help firms optimising their logistical operations. Most of these concepts are directed to "compress" time devoted to logistic operations, supporting the much needed reduction in delivery times, especially in those situations with long transit times from distant factories or facilities.

The time that a product takes to be available for the consumers is called "order lead-time", and consist on the time elapsing from the placing of the order to the delivery of the goods at the requested place. The order lead-times has been reduced in the last decades throughout Europe: for instance, the average order lead-time within Europe was 27 days in 1987, turning 12 days in 1998[10]. By increasing the speed with which products flow through the production and distribution system, firms can obtain a range of benefits:

- Savings on inventory costs, typically accounted by several source to 30% of total logistics cost, that can be reduced through reduction in inventory levels;
- Reducing the risk of obsolescence, especially in those sector with an accelerate rate of product development and shortening product life cycle, such as electronics;
- More agile responses to changes in demand and reduce dependency on long term sales forecasts (that normally are less precise).

Time-based competition refers to ways of "taking time out" of operations. It could entail reducing the order cycle time, speeding up order placement or introducing new products to market more quickly. Furthermore, by switching from slower to faster modes and carriers firms can substantially reduce transit times. Time-based competition is receiving a great deal

[10] Average figures for Europe by AT Kearney data cited by TRILOG.

of attention as organizations have discovered that time really is money. Longer processes can cerate inefficiencies; require higher inventory levels, greater handling, and more monitoring; incur a greater possibility for error and obsolescence; and decrease the efficiency of the whole supply chain. Shorter lead-times may result in lower inventories for the customer, depending on the volatibility of sales and the degree of difficulty in forecasting.

2.3.2 Increase in retailers control over supply chain

This tendency is particularly important in the EU, were several large retailers have taken the responsibility for the supply chain from their suppliers to final purchase. In the late 90s the UK supermarket groups lead this tendency, reaching a 96% of supplies moved through distribution centres under their control. Having assumed responsibility for secondary distribution from warehouse to shop, many multiple retailers are now extending their control back along the supply chain in an effort to rationalise 'primary distribution' from factory to warehouse. This has promoted the consolidation of inbound supplies and the return loading of shop delivery vehicles with supplies ex-factory. The more progressive retailers are now trying to integrate their primary and secondary distribution operations, mainly to achieve greater utilization of their transport and warehousing assets.

Large retailers are also expected to increase their share of the national markets and, by a slightly increased margin, their share of the European market. International retailers (i.e. those with shops in more than one national market) are expected to benefit the most, with a strong increase in their share of the European market. To service this increasingly homogeneous European market, a marked increase in cross-border logistical systems is anticipated. This would suggest a change from the nationally based distribution systems that have developed to this point.

Changes to traditional distribution structures are likely to be further affected by the evolution of new distribution channels. Distribution direct to the home is forecast to massively increase its relative importance. In line with earlier observations, direct delivery from a national warehouse is expected to be more popular than home delivery from foreign companies with a supply base outside the national market. Conventional shopping is the loser, though retailers are expected to recover some ground by offering home deliveries from their outlets.

This increased importance of direct deliveries also sits uneasily with the anticipation that retailers will increase their control over the supply chain. In line with the consolidation trends identified earlier, the European level is believed to offers more scope for retailers to increase their control than the national level. It is, however, in apparent conflict with general trade, where the consignor (more often than not a manufacturer) is expected to take greater responsibility for the shipments of goods.

2.3.3 Growth of "nominated day" deliveries and timed deliveries

The "nominated day" deliveries defines the delivery systems where customers are in-formed that a vehicle will be visiting their area on a "nominated" day and that to receive a delivery on that day, they must submit their order a certain period in advance. The advertised order lead-time is thus conditional on the customer complying with the order schedule. By concentrating deliveries in particular areas on particular days, suppliers can achieve higher levels of load consolidation, drop density and vehicle utilisation. The resulting reductions in traffic lev-

els and increases in loading factors can be very important. The nominated day principle is now widely applied to distribution within countries, although not so widely spread in international distribution.

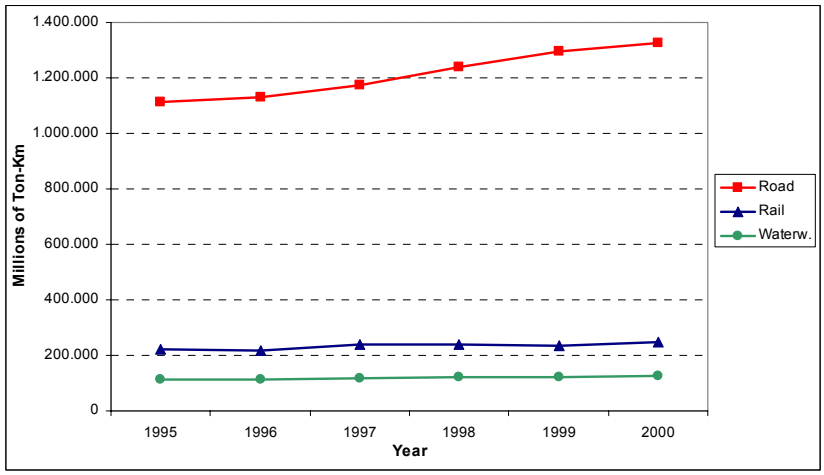
In some companies, the introduction of "nominated day deliveries" has been resisted by sale and marketing departments who fear loss of customer service. This trend clearly conflicts with the trend towards more flexible, quick-response distribution in many industrial sectors. However, by accelerating the transmission and processing of orders many firms operating the nominated day system have managed to reduce the lead-time between re-ceipt of an order and delivery day. This has relieved some of the earlier worries about customer service and widened the acceptability of this practice.

In addition to nominated day delivery, the introduction of that concept at factories, warehouses and shops has become the scheduling of freight movement more disciplined. Many production or warehousing facilities operate booking-in systems which confine de-liveries to narrow time-windows, typically of 30 minutes duration. Failure to adhere to these schedules can result in vehicles having to wait for long periods or, in extreme cases, being turned away and required to make a new appointment. Timed-delivery has been introduced not only to co-ordinate deliveries with internal Just-in-Time / Quick Response schedules, feeding product onto the production or order picking line as it is required, but also to alleviate the problem of 'backdoor congestion', which has been exacerbated by the increase in delivery frequency associated with Just-in-Time / Quick Response. Finally, this concept as also contributes to improve the productivity of goods reception operations at industrial and distribution premises.

2.4 Management of distribution (transport and warehousing)

2.4.1 Changes in freight modal split

In the last decades all transport modes have enjoyed reductions in unit costs due to improvements in vehicle design, vehicle production processes, lower maintenance requirements, better fuel consumption etc. In general terms, those improvements have favoured road haulage over the other modes as reflected in its increasing share of the freight market. Figure 9 presents the evolution of the inland transport modes in recent years.

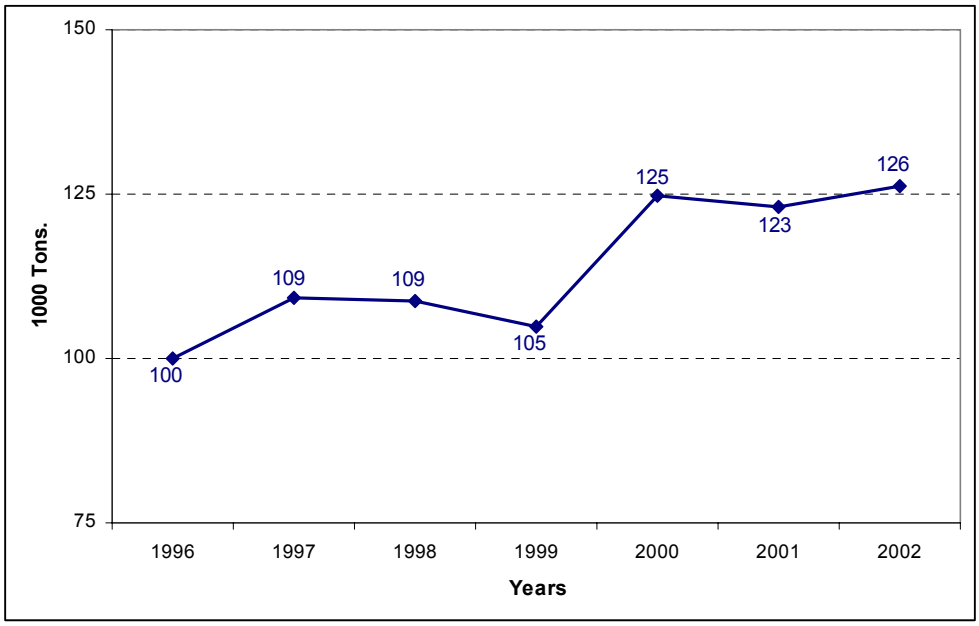


Source: own elaboration from Eurostat data

Figure 9: Evolution of inland freight transport in the EU15 (road, rail and waterways)

Albeit this dominance of road freight, air freight has experienced an increase in the recent years (although with a somehow erratic pattern) as shown by Figure 10. Since 1996 the total transported tonnage has grown by 26%, even experiencing some decreases in 1999 and 2001. However, the absolute value of air freight is still low compared to that the other modes, with less than 10 millions of tonnes in 2002.

Focusing on the New Member States and other Eastern European countries, the tendency since the 90s is of a fast growth of road transport, as shown by several studies. Rail transport situation (obsolete) does not provide an alternative to road and air freight is yet in primary stages of development.



Source: own elaboration from Eurostat data

Figure 10: Evolution of air freight in the EU15 (total tonnes transported), index 1996 = 100

In parallel, all modes of transport have experienced an increase in the average distance over which freight is moved. For road transport, for example, there has been an increase in average distance travelled of around 1.5% pa, compared with growth of around 2.3% pa in the tonnage transported. The railways have had a sharp decline in the tonnage carried (over 30% between 1984 and 1994 alone) combined with an increase in distance travelled which has been only slightly slower than for road. On the inland waterways there has been a very small decline in tonnage terms combined with a very small increase in average distance. One of the most significant changes has been in the commodity composition of the traffic, with the decline in bulks offset by new container traffic, particularly on the Rhine. The figures for the increase in average distance travelled are almost certainly under-estimates because of the exclusion of international traffic. This comprises around 5% of total European traffic in tonnage terms (perhaps double that share in ton-km), but is growing more rapidly than domestic freight. The last important statistic relates to the distribution of journey distances for freight. Around 57% of goods by weight move less than 50km , although these account for only 11% of total transport demand when this is expressed in ton-km. The high proportion of

total transport demand (ton-km) accounted for by journeys of 150-500 km (44%) suggests that there is a large potential market for intermodal transport services.

2.4.2 Reduction in international transport costs

Trade costs, broadly defined, include not only transport costs but all costs incurred in getting a good to the final user, minus the marginal costs of production: policy barriers (tariffs and non-tariff barriers), information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs and local distribution costs (wholesale and retail). Transport costs are not only freight but also time costs.

For a long time it was believed that trade costs other than policy barriers would be of minor importance for the volume and structure of international trade. Recently, it has been acknowledged that trade costs are large and varied. A rough overall estimate of the tax equivalent of representative trade costs for industrialised countries is 170 per cent. It breaks down into 21 per cent transport costs, 44 per cent border-related trade barriers, and 55 per cent retail and wholesale distribution costs . The 21 per cent transport costs estimate includes directly measured freight costs and a 9 per cent tax equivalent of the time value for goods in transit.

The cost per ton of international freight movement has been declining as the carrying capacity of ships and aircraft has expanded and transport operators took advantage of greater economies of scale. Another factor of price reduction has been the competitive environment of shipping industry by the end of the 90s. For instance, in terms of container transport, newest vessels carry over 7.000 TEUs (twenty-feet equivalent units), with an average weight of 25 tonnes each. These factors lead to a tendency of international transport cost reduction per transported tonne.

The side impact of this cost development is that the transport costs generally represent a small fraction of the difference in production costs that exists between West Europe and the Far East for manufactured goods, such that competition between far away production locations may increase by cheap transport cost.

2.4.3 Regulation and legislation

There are growing concerns for congestion and environmental protection in Europe, that have led in past years to continuous legislation improvements in the matter, mainly concerning urban areas and main freight routes. The regulatory trends point to moving freight off the road, to more environmentally friendly modes such as rail and maritime. However, this political and regulatory pressure must be accompanied by improved performance of the non-road modes, in order to smoothly accommodate the freight volumes with the adequate quality service standards. This will be of critical importance for intermodal transport solutions.

Europe has seen the liberalisation of road, maritime and inland waterways services, while rail liberalisation will soon become a reality. This has increased the options for transport users for a variety of competitive intermodal services, which has been balanced by appropriate harmonisation measures, most of them originally unimodal but affecting intermodality. For instance, common technical standards widely accepted by manufacturers and operators are important in order to make intermodal transport and related logistics more efficient. In this

context the Commission proposed in 2003 a way towards developing common European Standards for intermodal loading units.

While the EC's 2001 White paper "European Transport Policy for 2010: Time to Decide" strategy was to gradually break the link between constant transport growth and economic growth, a recent consultation paper on Logistics for Promoting Freight Intermodality , argues that "logistic choices can help decouple transport growth in Europe from the production of harmful external effects of transport (such as harmful emissions, accidents and congestion)". The mid-term review of the White Paper will examine further ways to enhance cooperation between transport modes and shift road freight onto other transport modes.~

2.4.4 Increased use of Information and Communication Technology (ICT)

As mentioned in section previously, information and communication technology (ICT) has played, and will continue to play, a key role in transforming logistics and supply chain planning. Advances in this field have supported the improved performance of the logistics and supply chain management activities, and is expected to increase its importance in the near future. Thus, it is expected a larger impact in terms of ICT use in logistics, and thus, transport activities.

In this context, new logistics concepts are being developed in order to cope with the growing complexity of supply chains. Customer demands are more outspoken, trade is liberalized and takes a global form thus leading to the need for integration of activities and close co-operation between firms. The co-ordination of activities requires the exchange of information between the partners in a supply chain.

The use of ICT has several consequences for the development of supply chains and the way companies co-operate in these chains. One of the major contributions of ICT to SCM is the fact that information exchange can significantly improve in terms of lead-time and transparency. This can take place in all stages of the product life-cycle:

- Data sharing by means of product data interchange and product data management the time to develop a new product can decrease;
- Information transfer by means of electronic data interchange, order cycles can be shortened, thus leading to potentially lower stock and preventing the Forrester/Bullwhip effect at chain level;
- Operations planning at supply chain level by giving partners insight into production schedules (via the Internet) and by giving real-time status information with tracking and tracing devices.

Changes in the performance and structure of supply chains are of interest to policy makers because these changes have an impact on the spatial patterns and locations of industries, on the size, composition and direction of goods flows and finally on traffic patterns and demand for infrastructure. Furthermore, ICT may also be an area for the development of policies to support the performance of supply chain management capabilities of Europe.

2.4.5 Developments in vehicle and handling technology

The economic and social costs associated with traffic congestion, air pollution and global warming are posing questions in relation to the future viability of motor vehicles as a transport mode. In order to minimise such costs, a range of new technologies are being explored. These technologies could alter the design of future road vehicles and the way in which road traffic is managed. They could also have an impact on the future structure of the global motor vehicle industry. The surge in oil prices combined with increasing concern about the environment led to a wave of motivations impacting on the design of the motor vehicle. New materials, aerodynamic styling, improved braking, suspension and transmission systems have been adopted. Electronics has become an essential feature of vehicles and plays a key role in improving engine efficiency and overall performance.

New developments in these areas offer the potential to change the operating costs of different modes of freight transport and bring about a change in the pattern of traffic flows. For instance, the use of fast ferries on short sea routes within Europe, with shorter turnarounds times at ports, is opening up competition to established long-distance truck services following these routes enabling the practical concept of the Motorways of the Sea to take form in a large scale. Such developments are themselves the product of numerous trends in fuel, engine and materials technologies.

Improving energy efficiency in the freight sector rests largely on measures related to trucks: the introduction of new, more energy-efficient trucks, retrofit technology for the existing truck fleet, changes in operations to reduce waste, increase linkages with other transport modes, and shifting to other transport modes. There is considerable potential for improved truck energy efficiency from using commercially available and new technologies: incentives may be needed to encourage purchase of the most efficient vehicles and to reduce the age of the fleet average truck fleet. Regulatory or fiscal policies will need to be established to encourage energy efficiency in commercial and road transport because of the great variety of truck types and cargo. It should be noted that currently available technology will not allow automakers to improve light-truck fuel economy to the same extent that they improve passenger vehicles. Load carrying requirements impose structural and power needs that are more of a function of the payload weight than the body weight of the truck, yielding fewer flowthrough benefits from weight reductions. Open cargo beds for pickups and large ground clearance limit potential for aerodynamic improvements. Additional safety and emission requirements would create penalties for fuel economy.

The trend of ever larger vehicles and vessels primarily concerns the biggest units for each mode, but there are strong tendencies that also the average size for each mode increases. However, due to the modal split towards road transport, the average size of all vehicles and vessels are rather decreasing. Reasons for increasing vehicle sizes clearly involve economies of distance and scale. The unit cost of moving a shipment follows a concave curve with decreasing marginal costs with larger vehicles and vessels while there is no strict theoretical proof that marginal costs decrease by distance although this is the usual empirical result. For obvious operative and market reasons, any increase of vehicle size must be matched against departure frequency and transhipment productivity gains.

Each period of time has a dominant traffic mode offering spatial or network coverage while other modes offer high capacity and low unit costs at densely trafficked routes over relatively long distances. Such improvements in the late product life cycle are often explained by the sailing ship effect, referring to the 50 years after the introduction of the steam ship, when sailing ships improved more than they did in the previous 300 years. Accepting that road has the network carrying function of most societies today, larger vehicles and vessels mostly relate to rail, sea and air. On rail there is a trend towards longer and heavier trains for transportation of commodities in order to better utilise economies of scale. Here signalling systems, weight capacity of the tracks and length of meeting tracks limit the sizes. The fact that ECT with inferior load factor increases its importance at the expense of conventional wagon load transport, however, points in a direction of lower average payload of trains. Container vessels have grown significantly in recent years after leaving the panamax era. Hapag-Lloyd's Hamburg Express Class carry over 7500 TEUs and their partner OOCL operate the OOCL Shenzhen at 8000 TEUs. The future promises even larger vessels since shipping lines tend to invest in over-sized vessels to have low marginal costs for price wars and to meet future rather than current demand. To facilitate for larger vessels, ports' fairways and handling equipment must be enlarged accordingly and port calls must not be prolonged significantly.

Also aeroplane sizes increase. Most significant are the 250-tonne freighter Antonov AN225 "Mriya" that entered commercial service in 2002 and the Airbus A388F carrying 150 tonnes that will enter service in 2008. For road that is strictly limited by the parameters set by the infrastructure, the expansion mostly refers to the length of articulated lorries and semi-trailer combinations on long-distance routes. After a period of harmonisation within the EU implying increases in most countries, the vehicle length is now believed to stay at 18,75 m for several years, although 25,25 m is allowed in Sweden and Finland and might be allowed on the European core highway network like the interstate regulations in the USA. Height and width will probably be slightly adjusted upwards. Increases not resulting in more pallet places are less important. The maximum length of semi-trailers will most probably remain at 13.60 metres.

2.5 Changes in product design

2.5.1 Complexity, modularity and packaging

Modularity in product design impacts every stage of the product life-cycle. Supply chain factors influencing modularity include outsourcing strategy and postponed differentiation. Manufacturing considerations address assembly efficiency and component complexity. Modularity also affects serviceability and recyclability in terms of disassembly, separation, repair, and reprocessing.

The increase of the product complexity and sophistication leads to a rise of the value added per unit of freight, which is especially the case of final products. This may imply that transport cost per unit of output decrease in importance because their share of the production costs decline.

Common technical standards widely accepted by manufacturers and operators are the key to making transport and related logistics more efficient. In this context the Commission proposed a way towards developing common European standards for loading units (Proposal for

a Directive of the European Parliament and of the Council on Intermodal Loading Units, COM (2003) 155 Final as amended by COM (2004) final). This proposal arises from the multitude of configurations of these units which increase friction costs and delays in handling operations between modes. Moreover, swap bodies are generally not stackable and, therefore, not suitable for all modes. On the other hand, standard containers do not often fully utilise the allowable dimensions in European road transport. European industry needs a better system of loading units to reduce transport costs and improve competitiveness. The proposed voluntary standard of a European Intermodal Loading Unit (EILU) would combine stackability with the cargo space of a swap body. Furthermore, in the same was as swap body, the EILU would not be used in global trade but help save an estimate 0,5-1,5% of aggregate average logistics costs in intra-European trade (ICF consulting, 2003).

2.5.2 Globalisation, growth of E-commerce and dematerialisation of freight

E-commerce is having a key role as a factor affecting logistics. For instance, the direct delivery of CDs, DVDs, books, videos and software is being transformed by their "dematerialisation" and distribution via the Internet. There is a residual effect of transport reduction due to the electronic distribution of "info-products" (downloadable music, books, etc) but it would be far compensated by the increase in transport from internet trading, also contributing to globalisation of trade. Moreover, the increase of electronic trade in business-to-business relations will most likely lead to more global sourcing, increasing the average haulage distance.

For the case of B2C ecommerce freight transport may increase in ton volume terms (due to increased market transparency and a one-off positive effect on demand), while spatial patterns may alter due to shifts in consumption patterns (international web purchases in stead of a store around the corner), and also, if not particularly, due to enhanced service requirements. From a B2B perspective, the e-extended supply chain connects suppliers directly with sales and stock levels of clients throughout a chain. Hence, it is possible to be constantly updated on the level and phasing of orders. This need not lead to more and smaller shipments, if and when there is scope for logistic consolidation, which largely depends on organizational advancements such as outsourcing of logistics to specialists and co-operation between the latter (such as in the case of the Foodnet/ Govera initiative in the Netherlands). E-business thus stimulates advancements in logistic and transport technology, but also organization, while the decentralization and sub-urbanization of distribution systems also help to contain explosive increases in freight transport due to e-commerce. These mitigating effects originating from the logistic sector may be spatially differentiated, e.g. because of concentration of demand in urban areas and associated effects. Hence, the potential for countervailing measures may be largest where the problems are largest. It will depend on the extent to which e-commerce induced freight traffic complements or substitutes other freight transport, whether the net effects is an increase in freight transport in volume, tonne-kilometre and vehicle-kilometre terms, despite ICT-enabled logistic innovations and decentralisation of downstream distribution in urban areas.

2.6 Expected impacts of logistics per transport mode

After the introduction of the logistic trends identified by the literature, we present the methodology for the assessment of the impacts on the different transport modes derived from them. In general terms, the approach adopted was based on three core ideas:

- The identification of the effects per mode in the state of the art literature (this has already been undertaken partly in the previous sections);
- The definition of a set of transport indicators aimed at presenting the information for all the modes in a standardised approach;
- A supplementary analysis of the indicators and effects per mode based on expert opinion within the COMPETE consortium.

The approach proposed is based on the experience of the REDEFINE project. REDEFINE studied the evolution of 14 groups of goods transported by road for the period 1985-1995, for 5 EU economies (France, Germany, the Netherlands, Sweden and the United Kingdom) trying to establish which part of the road haulage increase was due to mere economic growth and which to the modern logistic trends. To evaluate the latter, REDEFINE characterised the logistic effects and presented a series of indicators of the road transport activity such as evolution of modal share, evolution of length of haul, evolution of loading factors, etc. The final objective was to present in a synthetic manner the expected qualitative impacts and evolution of road haulage due to each one of the logistic trends identified.

In similar terms, we propose to extend this qualitative analysis methodology to all the relevant modes: road, rail, air and maritime. The indicators proposed for analysis are the following:

- Modal share;
- Load factor;
- Vehicle size;
- Use of intermodal loading units;
- Length of haul;
- Tonnes-kilometres.

The qualitative impacts per indicator will be classified as follows:

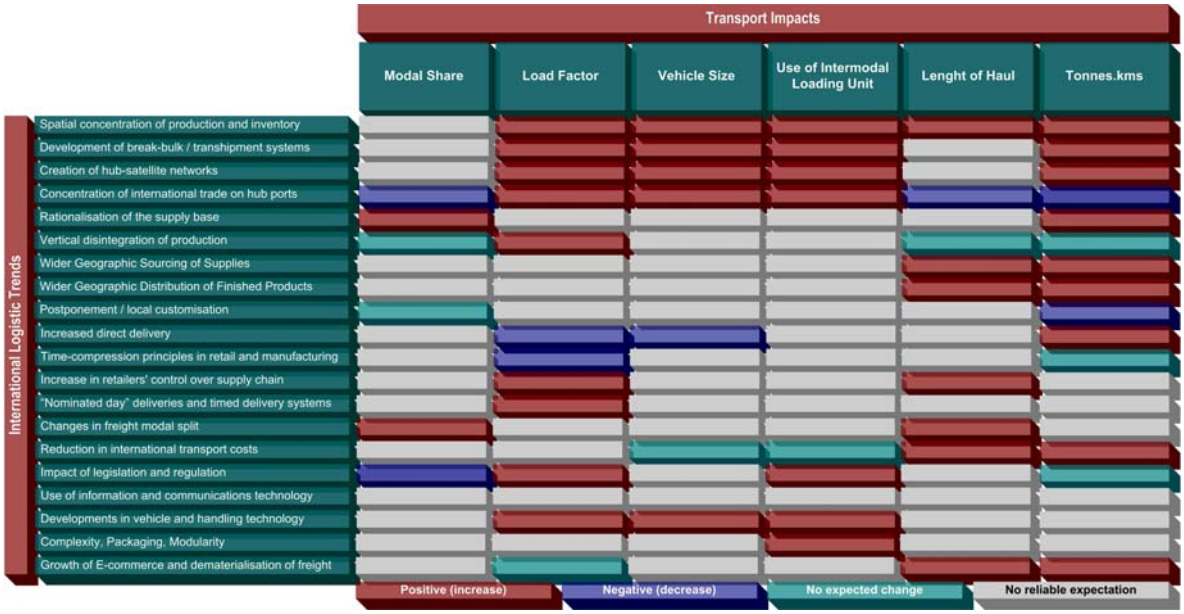
- Positive impact: the indicator will most likely increase;
- Negative impact: the indicator will most likely decrease;
- Neutral: the indicator will most likely not suffer significant changes.

In the next pages matrixes per transport mode will be presented depicting the results of the expect impacts derived from the international logistics trends in each transport mode. As stated, this process started will the work developed in previous projects, and was updated and refined based on the research carried out throughout the COMPETE project. This would provide a simple, straightforward and synthetic presentation layout for the effects.

2.6.1 Road transport

In what concerns road transport (see Table 4), it can observe that most of the expected effects are "positive", which does not necessary correspond to a more efficient transport system, since the "positive" impact, for instance, in terms of length of haul, i.e. the increase of the average trip distance, means that there will also occur an increase of the associated externalities[11]. On the other hand, it is also important to refer that there are a large number of unforeseeable effects (grey cells) which means that certain logistics trends may imply effects which are not evident in a medium and long term horizon.

Table 4: Road haulage logistical qualitative effects matrix



Source: own elaboration

Specifically, road modal share will be positively affected by the "rationalisation of the supply base" and by the "changes in freight modal split". On the other hand, one can expect that the "concentration of international trade in hub ports" and the "impact of legislation and regulation" will contribute to the reduction of road modal share. The overall balance of these opposite effects is not clear and is largely dependent upon technological and political factors[12]. In parallel, the road vehicles load factor will suffer many positive influences by nine of the twenty logistics trends studied, while only two of these trends will contribute to decrease this indicator. In this sense, it is reasonable to expect that the medium/ long term result will be a positive one, i.e. there will be an increase in the road freight transport vehicles load fac-

[11] Such as increase of pollutant emissions, higher energy consumption, etc.

[12] The current rate of increase of the modal share of road freight transport is 4.7 per cent per year on average in the EU15 (Source: http://www.iccr-international.org/ consulted on the 23rd of June of 2006). According to a survey published by this organisation, more than 80% of the sample expects this value to be the same or higher in the short-term. 50% of the interviewed sample states that this value will be the same or higher in the medium-term, and; 30% expects this value to be the same or higher in the long-run.

tor. In terms of road fleet vehicle size, it is also reasonably clear that there will be an increase of this indicator in the coming years, since five logistic trends will positively affect it, and only one will contribute to its reduction. Attention should be paid to the fact that this indicator will probably rise within the legal limitations already imposed and that no changes to these restrictions are expected. The use of intermodal loading units is also going to increase. Seven of the logistic trends will influence positively this change, while none will contradict it. Apparently, also the indicator "tonnes-kilometres" will increase in the future, as long as the trends related with:

- The spatial concentration of production;
- Transhipment systems; and,
- Hub-satellite networks, that also maintain its evolution.

However, this presupposition is highly dependent upon political and technological progress, namely in what concerns energy alternatives. The organisation of production systems since the early 80s was largely influenced by two major factors: the relative low prices of oil and the absence of internalisation of external costs associated with transport. However, at this moment, both factors seem to be following a path for change. Concerning the internalisation of external transport costs, the issue has been in the political agenda during the last decade, especially in the European Union. Important efforts have been done to calculate the real costs of each transport mode and internalise them in order to reveal the "true modal cost" and reflect it in the transport prices (with a potential effect for modal change, due to the expected changes in prices). Concerning the low prices of oil, after the recent increase in oil prices, all forecasts reveal sustained higher prices than the previous decades, with variable trends to be followed in the future, depending on the source. The United States Energy Information Administration (EIA) provided a forecast in June 2006 for the time horizon of 2030, in which the increase in prices is quite constant, varying prices between near the 60$ per barrel[13].

In this context, it is quite likely that this decade will see some developments in logistics. If transport is not any more a cheap leg of the logistic chain, several trends that have dominated logistics since the 80s could reverse. For instance, the spatial concentration of production in the low labour cost countries of Asia could stop due to the large increase of the overall production price including transport to the markets in Europe and the US. This could mean that factories would "relocate back" to Europe (strong candidates are the NMSs and the Candidate Countries) or to some locations outside Europe with lower salaries but nearer the consumption countries. The dimension of this undoing of the logistics trends prevailing for the last 20 years will depend after all on the capacity of the logistic and transport system to adapt the current energy prices trend.

[13] Source: US Energy Information Administration (2006): International Energy Outlook 2006.

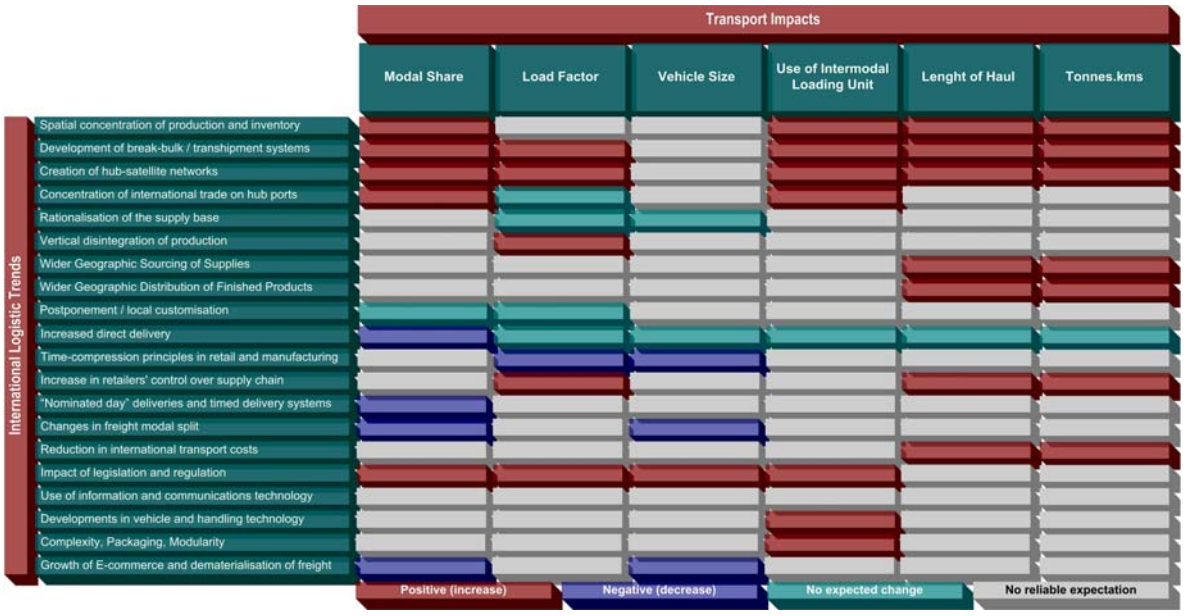
2.6.2 Rail transport

The effects identified for rail transport, as for the case of road transport, are more often than not "positive". Also the existence of a large number of unforeseeable effects can be detected (see Table 5).

The modal share indicator is balanced by five positive influences and four negative. The overall balance will largely depend upon the strength of the "impacts of legislation and regulation". However, it can be argued that most European countries which will modernise their rail infra-structures and adapt their institutional frameworks will, most likely, register an increase in this indicator.

No clear estimations can be drawn concerning the final results in the medium and long run concerning the indicators load factor and vehicle size, which are very much dependent upon the evolution of the previously indicator. It is also import to put in perspective the importance of the indicator load factor in this particular transport mode. In fact, the size of freight trains is easily changeable according to the load volumes to transport; therefore the second indicator ("vehicle size") is more useful. The use of intermodal load units is also expected to increase in rail transport, as well as the length of haul and the Tonnes-kilometres.

Table 5: Rail transport logistical qualitative effects matrix



Source: own elaboration

2.6.3 Air transport

In what concerns air transport (see Table 6), it can expected a potential increase in the modal share. The separation between passengers and cargo, not only operational but also institutional, has contribute to the better performance of the air freight sector. On the other hand, time to market is an increasingly important variable in most logistic chains. Particularly, freight with a high value and low volume will have significant potential to be transported by air. No reliable forecast can be made regarding the effects of logistic trends in the indicators load factor and vehicle size. The high use of intermodal units is already a reality, especially in

"belly" transport. On the other hand, the length of haul and the indicator tonnes-kilometre will most likely increase in the air freight transport during the coming years.

2.6.4 *Maritime transport*

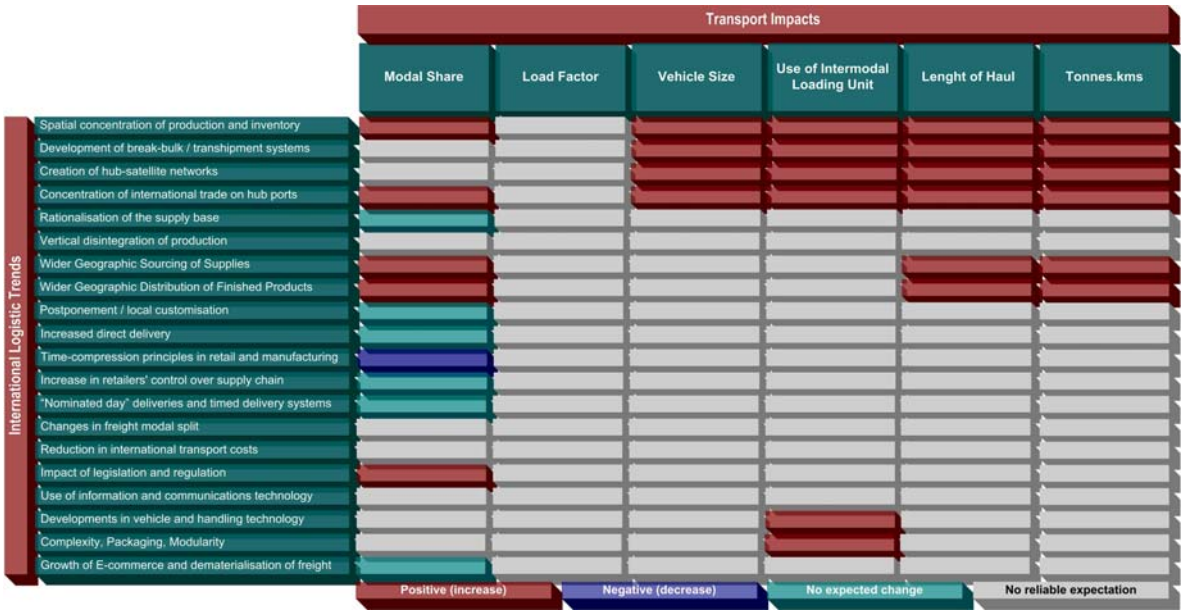
Finally, in maritime transport (see Table 7), although five logistic trends will contribute positively to increase the modal share of this transport mode, the overall final result is not totally clear, and will depend upon the trade agreements evolution and the configuration of the international logistic chains[14]. The load factor associated with maritime vessels will most likely not suffer any significant change in the coming years, due to the international logistic trends. However, it can be expected an increase concerning indicators vehicle size, use of intermodal loading units, length of haul and tonnes-kilometre.

Table 6: Air transport logistical qualitative effects matrix

Source: own elaboration

[14] This, as mentioned previously, will also depend largely on the evolution of the oil prices.

Table 7: Maritime transport logistical qualitative effects matrix



Source: own elaboration

2.7 Logistic Trends of Specific Sectors

2.7.1 Food

In recent years, the global food industry has witnessed a startling level of corporate activity. Multinational companies have continued to strengthen their positions, driven by the desire to reach new customers in developing markets, as well as achieving economies of scale. As the global presence of the food industry's major players has increased, so has the number of brands now familiar to consumers across the world. This trend appears set to continue, at least for the foreseeable future. The leading manufacturers of food and drink represent some of the most powerful companies in the world[15].

At the time-being the food industry is extremely fragmented, broker intensive, has seasonal peaks of production and they are very perishable. Additionally, it uses a highly fragmented truck transportation system for most of its shipments[16]. In parallel, out-of-stock products cost the food industry a significant sum of money[17].

One should note that any business is driven by today's Internet and customer-centric market. Specifically, smaller and more frequent shipments are necessary with fulfilment focused on value add handling rather than warehouse storage. On the other hand, efficient and on-time

[15] The world's largest food and drink manufacturer is the Swiss conglomerate Nestlé. In the year ending December 2001, the company's overall turnover reached almost US$50 billion, of which food and drink products accounted for around US$46.6 billion (over 93%); Source: Thomas, Jonathan (Leatherhead Food Research Association).

[16] In the US nearly 80% of food related shipments are transported by truck (Source: http://logistics.about.com consulted on the 25th of June of 2006).

[17] Approximately, from 7 to 12 billion US $ per year (Source: Accenture).

order fulfilment is the crucial business requirement. Moreover, reliable orders, on time, accurate, and complete, must become any business's most important performance indicator. Neglecting this logic may imply the inevitable loss of customers and market share. This paradigm is compounded by the fact that any food related business is comprised of a disparate network of trading partners (i.e. service providers, distributors, suppliers, contract manufacturers and retailers). This means that the search for efficient orders will most likely become a collaborative effort.

This chain stakeholders, like retailers, manufacturers and supply chain logistics providers are all consolidating so that sufficient scale is achieve to become global players. In order to compete with the biggest organizations the survivor food companies must all look to grow worldwide through merger while also seeking to reduce investment in hard assets and orienting their resources on areas where they have a core capacity. In what concerns supply chain technology many companies in the food industry are looking to outsource to asset where many of the food companies do not have core competencies. The trend towards joint ventures and partnership agreements looks set to continue. However, it is worth noting that not all have been successful[18].

In the future, it is expected that the major global players become supply chain and channel managers for an entire supply chain. These outsource suppliers will then base the logistics management of supply chains through the use of their technology.

The leading food manufacturers and retailers are putting significant effort in integrating information and communication systems with their business partners using both EDI and web based internet systems or e-market hubs/exchanges. They are aware that improved information sharing enables visibility and, consequently more opportunity for exception event management or supply chain monitoring. Although consuming a high amount of money on Web-based demand planning and forecasting tools last year, companies are still trying to develop more accurate data systems to manage their inventories.

More often than not trading partners implement pilots for collaborative planning, forecasting and replenishment (CPFR). These pilots have demonstrated that significant increases in sales can be achieved through collaboration and sharing of information between. This results in improved inventory turns, reducing out of stock situations, increasing customer satisfaction and reducing inventory and cycle times. However, they have not yet demonstrated that the pilots will scale and that a company can utilize the concept across multiple supply chains with competing trading partners. Companies have also put considerable efforts in getting transport operators to share shipping requirements in order to achieve better utilization of the trucking resource through less-than-truckload to truckload consolidation, less empty backhaul and more continuous move transportation.

[18] Coca-Cola and Procter & Gamble abandoned plans to create a stand-alone juice drinks and snacks company during 2001. This joint venture would have incorporated some of the two companies' largest brands, and annual sales in excess of US$4 billion were initially forecast. However, the move was abandoned as a result of resistance from shareholders (Source: http://www.touchbriefings.com consulted on the 26th of June of 2006).

As supply chains increasingly implement collaboration efforts across all of their product lines, it is expected that, in the future, the ability to optimize one supply chain among a supply web of supply chains will become more difficult. Companies will focus on synchronizing their supply chains rather than optimizing particular product forecasting and planning and will move to sub-optimize in the supply chain in order to create the greatest benefit/profit for their internal organization.

Taking into consideration the recent merger and acquisition trend, future consolidation of the industry seems inevitable. As the large multinational companies increase in size and strength, they become more powerful and reach rising numbers of consumers across the world. However, it should be highlighted that certain niche markets will continue to exist in the global food industry, and the domination of major brands is unlikely to become complete. It is important to note that regulatory clearance remains an obstacle as far as mergers and acquisitions are concerned[19].

2.7.2 Automobiles

In 2002, the global production of motor vehicles (including not only passenger vehicles but also light and heavy trucks) was over 59 million units. The main worldwide vehicle producing areas are Asia-Pacific, including Japan and Korea (19.3 million), Western Europe (17.4 million) and North America (16.8 million). In the same year, these areas are also the largest markets with sales of 14.2, 16.7 and 19.9 million respectively[20].

Many factors have been affecting decisions taken in the automotive sector. On the one hand, consumer preferences influence the performance standards, styles and reliability of vehicles. On the other hand, government regulations - related with trade, safety, and environment - establish requirements and incentives for modernization in production or de-sign. Finally, corporate strategies and competitive rivalries provide important impetus for research, design innovations, and changes in the manufacturing process.

In short, all automakers are always under pressure to identify consumer preferences, national biases, and new market niches where they can sell vehicles and conquer market share. In a certain extent, their ability to be flexible enough to quickly respond to all these pressures is determining their future in the industry.

In this context and in order to respond to the dynamic market trends and demands, automakers are following a set of strategies that are more or less common among major companies.

Firstly, the adoption of a global perspective in their operations has been of the main strategies followed. In fact, until the end of the eighties (although with some minor over-seas presence) competition among Original Equipment Manufacturers (OEMs) was still within regional brands. Basically, American producers dominated the US market, Japanese dominated

[19] The European Competition Network or the US Federal Trade Commission can block takeovers when companies are perceived to be gaining too much power, or when consumer choice is threatened.

[20] Source: European Foundation for the Improvement of Living and Working Conditions, 2004.

the Asian market and European automakers their regional market. During the nineties, this situation changed completely. An increase of transplants in the beginning of the nineties conducted to a presence of all competitors in almost every region of the globe. This becomes especially important in emerging markets, where all OEMs are disputing market shares. Consequently, automakers are now designing their operations on a global scale, with new models being launched simultaneously in different geographic locations and with similar standards. Firms are also trying to replicate supply chain structures, through new investments, demanding suppliers to be present in the new regions where they are present, often near their plants.

The second important strategy producers have been pursuing is the reorganization of their vehicle collection around product platforms and car modules and systems. Declining sales per vehicle and short product life-cycles were hardening automakers and suppliers from reaching economies of scale in both design and manufacturing, with an important impact on cost. Furthermore, new car models had to be available all over the world while reacting to regulatory and consumer demands. Moreover, OEMs are able to make faster and lower cost deployment of new solutions across the whole product range, by focusing on common platforms and interchangeable modules, while tailoring vehicles to a multitude of preferences of consumers. In fact, they can assure enough differentiation between products to cope with proliferation while maintaining scale efficiency and a proper management of brand equity.

The increasing role of suppliers in the automotive industry is affecting their structure. Traditionally, the industry supply chain was organized in tiers. OEMs would then plan and assemble the car. First tier would manufacture components and supply directly to the automaker. Second tiers would produce some of the simpler individual parts that would be included in a component manufactured by a first tier, and third and fourth tiers would mostly supply raw materials. However, this simple configuration no longer fits the present structure of the industry. The new direct suppliers are becoming large global firms, which are specialized in complex systems or integrators of several subsystems. In this context, they are expected to have a substantial responsibility in the design and engineering of these systems and in coordinating the supply chain necessary for their manufacturing and assembly.

The overall growth pattern of automotive industry in Europe follows the general trend of stagnation found in other members of the triad. Assembly climbed from 14 million cars in 1976 to 20 million in 1998, roughly a 1.2% a composite year average growth during the period. However, there have been certain changes in the composition of the sales across countries. During the sixties, European assembly was aimed at assuring market access. Severe import restrictions across nations made local investment the only option to firms, if they wished to tap into growing demands for cars. This pattern included developed and developing nations on all continents, although larger markets with indigenous industry such as Germany and France attracted more investment. Therefore, in seventies, these larger sales markets hosted most of the assembly lines in Europe. Eastern Europe was then a closed area, and had its own car assemblers, that represented a minor share of all production in the Continent.

India, with a population of one billion, is very attractive for future markets in the auto industry. However, the market itself is very small, due to the very low incomes of the population

(the number of passenger cars sold in the country is only 600.000 units per year). On one hand, new vehicle sales in India are unlikely to exceed 2 million units a year by 2010, meaning that the market will be smaller than in France or the UK nowadays. On the other hand, the Indian market is also protected from foreign participation. The government has considered the automotive industry a major sector for the country's development; therefore, it developed industrial policies that include high tariffs, restrictions to vehicle and components imports, as well as limits to foreign investment. In short, small size and strong protection have kept foreign OEMs at large, which have overlooked investment in the region.

China, in 1999, produced 1.7 million cars and trucks, 3 million agricultural vehicles, and 8.3 million motorcycles. Domestic production may reach 5 million units, by 2010 (not including motorcycles) making China one of the largest automobile markets. The industry is made of nearly 100 vehicle manufacturers, approximately 800 refitted and special-purpose vehicle manufacturers and over 1.800 auto parts and components enterprises, where nearly 150 of which are joint ventures. These firms employ 1.85 million workers. And the total industrial output value was 40 billions of US $, a 16% increase over 1998 figures and total profit and tax was US$ 1.1 billion, a 50% increase compared with 1998[21].

2.7.3 Chemicals

Recently, the structural change in the chemical industry and related sectors has continued to take place. This is due to the fact that the competition is increasing, as companies focus on expanding their businesses and the cost pressure remains high. Due to the rapid growth of production in Asia, the global market share of the European chemical sector continues to decline. Consequently the European industry is now intensifying its efforts to find new ways of improving its efficiency and reducing costs.

In the chemical and pharmaceutical industry, logistics and supply chain costs make up 8 to 12% of the revenue[22], a significant percentage of the production costs that allows potential cost savings. Efficient logistics processes specifically designed to a company's production and process requirements offer the largest potential. Taking into account that the possibilities of increasing the efficiency of production processes are exhausted, the efforts of the industry's cost saving strategies has moved towards the supply chain itself. This shifting also affects corporate sourcing strategies and logistics activities, namely by reducing the procurement costs has a direct impact on the margin of a company: a 5% cost reduction in purchasing has the same effect on the profit and loss calculation as a revenue increase of 30%[23].

In this context, it is no surprise that companies seek to buy the most economical raw materials and goods, optimize procurement processes, and show flexibility in adapting their operative business to changing market conditions. In the recent past, companies were primarily focusing on optimizing their purchasing in one country or one region – now internationalization has also entered the realm of purchasing. With several manufacturing facili-

[21] Source: MIT, Massachusetts Institute of Technology, 2000.

[22] Source: Society for Chemical Engineering and Biotechnology, at: http://www.dechema.de/About_the_DECHEMA-lang-en.html.

[23] Source: US National Association of Purchasing Professionals.

ties overseas and sales activities around the world, both logistics and purchasing has to be managed across regions and national borders.

At the time being companies in the chemical sector view the worldwide coordination of purchasing processes as critical success factors. The standardizing of specifications (which potentially generates synergies), allows generating purchasing cost advantages. However, the globalization of purchasing implies certain challenges. In addition to geo-graphical distances, also the cultural differences have to be taken into consideration. Companies should be able to implement a strategic purchasing management that is related with the corporate leadership. Global sourcing demands for the ability to think differently, realign the procurement, and implement pro-active management.

To use the potential of procurement in low-cost countries (LCCs), purchasing has to follow the Total Costs of Ownership approach. Cost savings cannot be achieved only with low supplier prices from overseas, since additional costs for risk surcharges and customs may arise, together with costs for the fulfilment of quality standards (because they often differ from the European standards). On the other hand, there are also costs for the monitoring and processing of logistics, which are particularly high in fields with high transportation needs, such as the purchasing of raw materials. These costs must also be taken into consideration.

Logistics activities make an important contribution to the all supply chain and play a major role in supporting companies in their efforts to realize cost savings potential in the purchasing process. This explains why the trend of rapprochement of purchasing and logistics continues to be adopted. For chemical companies competing on the global market, efficiently running logistics activities are increasingly more important and are evolving into a topic of strategic relevance.

However, one should note that both purchasing and logistics are highly complex fields. Due to the changes in the chemical industry since the 1990s and the resulting global corporate structures, the efforts that a company has to carry out in order to coordinate its processes have largely increased in recent years. Moreover, working with external service providers offers chemical producers the opportunity to reduce this complexity. Further-more, while there is a high trend towards outsourcing in purchasing and logistics today, finding the right partner is extremely important, since this partner should not only provide the required services in a reliable way, but also at marketable prices.

In parallel, a convenient outsourcing partner needs to be able to handle complex processes. In purchasing and logistics it is already a general rule that companies benefit most if they outsource the entire process chain to an external partner (Business Process Out-sourcing, BPO), than if they just hand over an individual process. Long-term industry experience of the service provider is an indispensable prerequisite for successful logistics cooperation, where comprehensive process knowledge and know-how in the handling of hazardous goods is of particular importance.

In recent years, several solutions were developed, however none of them was sustainable in the long term, for many reasons. Recently new approaches have been implemented to create practicable and low-cost tools for real-time management. They are offered in combination with centralized procurement platforms and other purchasing tools.

To deal with these new challenges, experience in the outsourcing of complete procurement processes or a supply chain is of fathomless importance. Until now, only very few chemical companies have purchasing teams that meet the challenge. What companies will need in the future in order to build a flexible, strong, and competitive corporate purchasing force, is purchasing specialists who can handle entire supply chains managing all production levels.

3 Changes of trade patterns and trade flows of the EU and US

The following section presents the analysis of the main commercial flows, their evolution through time and types of transported goods traded, for the countries selected for analysis throughout the COMPETE project. The overall objective of the analysis is to provide insights of the evolution of the external sector of the national economies and the implications in the transport sector. In more detail, the technical objectives of the analysis are the following:

- To investigate the evolution and changes in commercial partnerships and associated trade flows in order to check changes in transport flows and transport modes handling them;
- To point out the qualitative effects from the changes in the use of the available modes and freight transport shares and forecast the future sign of potential qualitative changes in the use of the available freight modes;
- Provide conclusions concerning the modes, networks or geographic areas with a potential for congestion or with present or future bottlenecks for transport and logistics in the EU.

All data used in the analysis concerning the trade flows are figures from the STAN Bilateral Trade Database (BTD) statistics from the OECD. The time period considered for analysis varies across countries, according to the availability of the STAN data: all the EU15 Member States have data between 1988 and 2004, the NMSs between 1993 and 2004, and the US between 1990 and 2004. The STAN data are presented in current prices (millions of US $) and were deflated to constant prices of the series base year (1988, 1990 or 1993 depending on the country) using an OECD time series of the Consumer Price Index for each country[24]. The CPI was used as the best available proxy, as the OECD has not a Gross Domestic Product deflator series for all the countries under analysis.

All the data concerning transport figures in Europe (market shares, transported tonnes, etc) were extracted from the Eurostat database. All the data concerning transport figures in North America were extracted from the North American Transportation Statistics web site.

[24] The difference in the base year between countries is not a problem for the analysis, as our objective is to provide insights per country, not comparison or measures of figures concerning trade across countries.

3.1 Denmark

The Danish commercial flows present a very high degree of stability, with most of the Top10 positions of exports and imports occupied by EU Member States. Germany, Sweden and the UK have been since 1988 the main commercial partners of Denmark, both for imports and exports. The three altogether sum up around 40% of imports and exports (see Figure 11 and Figure 12), having Germany 20% of the total share both in exports and imports. Table 8 presents the ranking of the Top10 Danish commercial partners.

The stability in terms of partnerships is verified not only in the first positions, but also in the rest of the ranking. In general terms, the most relevant changes between 1988 and 2004 is the fall of Japan out of the Top10 both in exports and imports.

In terms of traded goods, the composition of both imports and exports is also very stable through time. The manufacturing goods during the 1988-2004 period sum up to 86% of the exports and 92% of the imports[25]. The fact that there are no relevant changes in the nature of imported or exported goods is a sign of no relevant structural changes is the Danish economy in the period under study.

Table 8: Top10 Danish commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	**1988**	**2004**	**Rank**	**1988**	**2004**
1	Germany	Germany	**1**	Germany	Germany
2	Sweden	Sweden	**2**	Sweden	Sweden
3	United Kingdom	United Kingdom	**3**	United Kingdom	Netherlands
4	Norway	Norway	**4**	USA	United Kingdom
5	USA	Netherlands	**5**	Netherlands	Norway
6	France	USA	**6**	France	France
7	Italy	France	**7**	Japan	China
8	Japan	Italy	**8**	Norway	Italy
9	Netherlands	Spain	**9**	Italy	USA
10	Finland	Finland	**10**	Bel-Lux.	Bel-Lux.

Source: own elaboration from OECD, BTD data

Concerning imports, the rising of China during the period with the third largest increase in value together with the Netherlands (see Figure 13). Other countries with relevant increases of the value of imported goods are those of the first positions of the ranking (Germany, Sweden and the UK) plus Norway and the aggregate Belgium-Luxemburg. It is also worth noting the slight increase in the value of imports from the USA, which provoked its fall in the ranking (as the value of imports from other countries had far larger increases). As mentioned previously, the fall of Japan out of the Top10 importers is very significant, being the country with the largest reduction in terms of value of commerce.

Concerning exports, the ranking is even more stable than for imports: positions 1 to 6 are the same in 1988 and 2004. The most relevant movements are the fall of Japan out of the Top10 and the entry of Spain in the 10th position. In terms of export value changes (see Figure 14) the largest increases correspond to the main commercial partners, Germany, Sweden and the Netherlands. There is also a tendency for the reduction of the share of the Top5 buyers of

[25] This number has been growing slowly since 1988, as that year manufacturing goods were 88% of total imports.

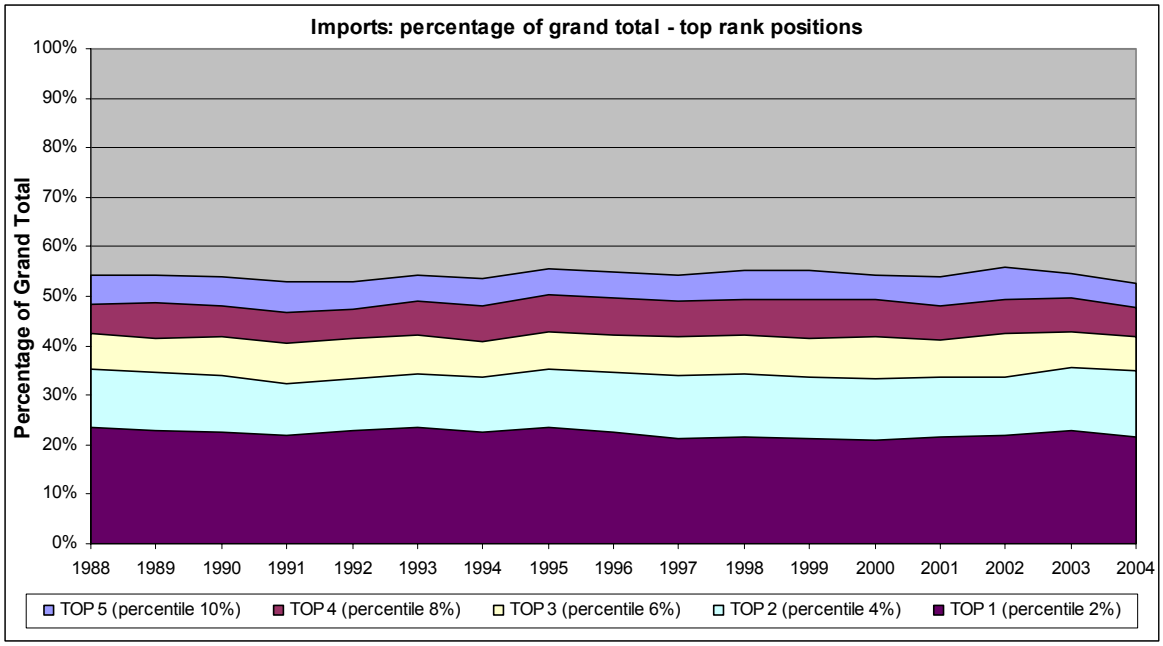
Danish exports. This can be due to the large numbers of countries with significant increases in terms of Finish exports purchased since 1988.

The composition of Danish imports and exports is also very stable throughout the period, being the manufactured good the base of both figures. Imports total value, imports from the EU15 and from the EU25 present similar percentage of manufactured goods: between 88% and 92% for the total value of imports, and between 92% and 94% for imports from the EU15 and EU25 (OECD, BTD data).

The effect of the evolution of the commercial flows in the Danish transport system can be resumed as of more intensive use of the main modes since 1988, as the flows and partnerships are almost the same in qualitative terms during the period, but with significant increases in quantitative terms. Also the stability of the economy and the high level of development of logistics and its implication with the transport networks suggests that there will be few important changes in the near future. The most relevant expected effects can be resumed as follows:

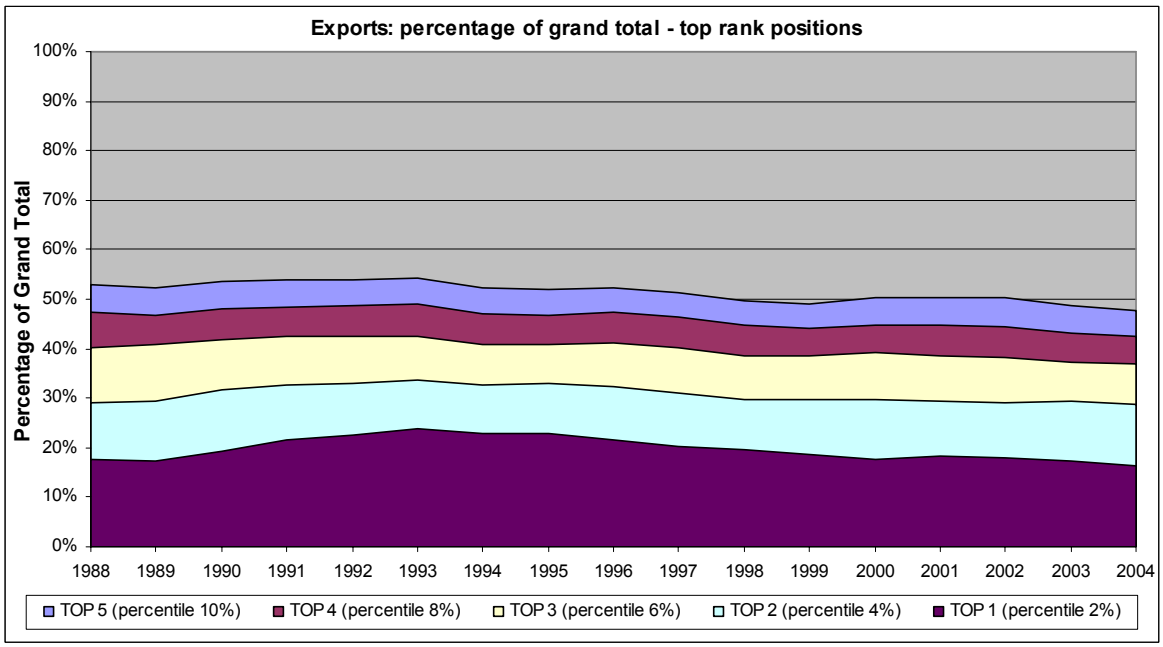
- Intensive use of the land based modes due to the high commerce volumes between Denmark and Germany (complemented with flows to and from France, Italy and Spain), with a potential future tendency to increase;
- In theory, it is expected a more intensive use of the maritime transport, due to the geographical configuration of Denmark and the list of its preferential partnerships: the Netherlands, Sweden, Norway, Finland, UK, USA and China;
- In fact, according to Eurostat data for 2002, almost 92% of the extra-EU Danish trade is done through maritime transport, which corresponds mainly to trade flows from China, USA and Norway.

The comparison between the two tendencies above presented can be done using goods transport figures. Those data present a reduction of the total volume of transported goods using maritime transport since 1996, from 124 to 100 millions of tonnes in 2004 (Eurostat data). The reduction can be a consequence of the concentration of trade flows in European hub ports near Denmark, more precisely the main German ports, as Hamburg and Bremen. The implications of this potential entry of Danish imports (and exit of Danish exports) through German ports would be the increase in the use of land modes, rail and road, with the subsequent potential problems of congestion of such modes.



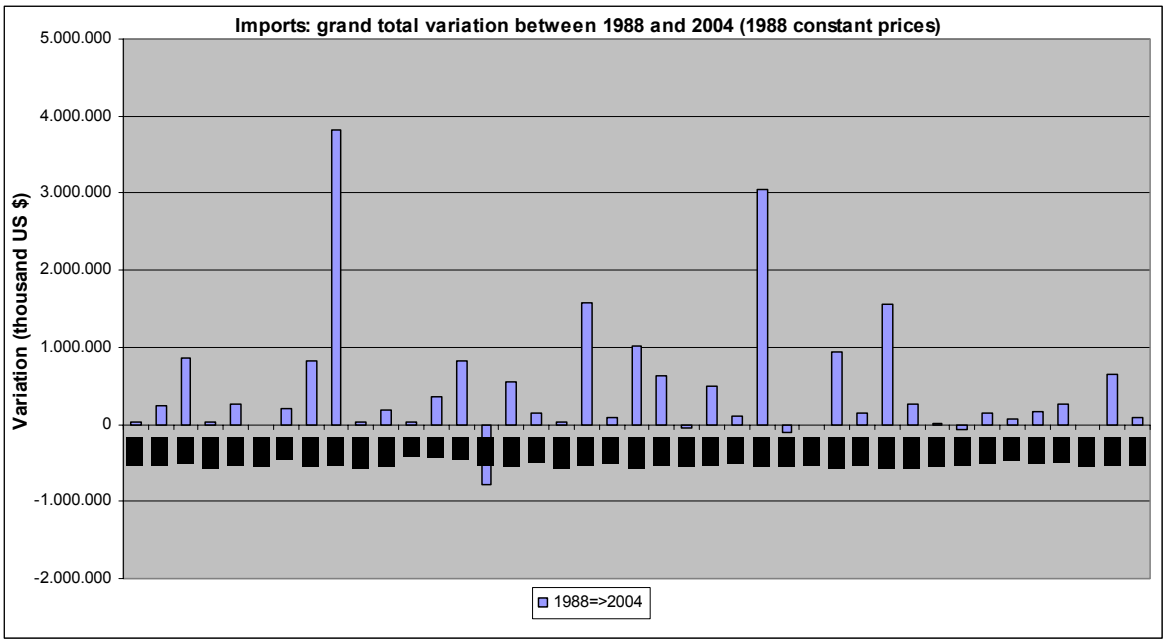
Source: own elaboration from OECD, BTD data

Figure 11: Percentage of total Danish imports from the Top5 commercial partners (1988 constant prices)



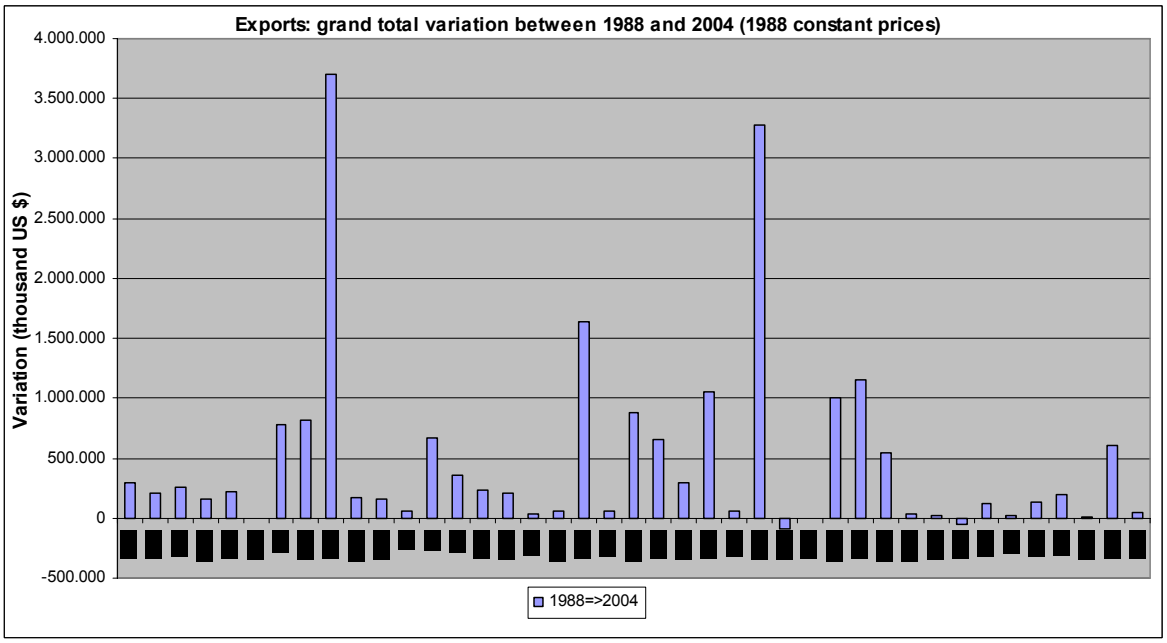
Source: own elaboration from OECD, BTD data

Figure 12: Percentage of total Danish **exports** absorbed by the Top5 commercial partners (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 13: Variation of Danish **imports** per commercial partner (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 14: Variation of Danish **exports** per commercial partner (1988 constant prices)

3.2 Finland

The Finish trade flows are composed of a mixture of regional, intra-EU and overseas partnerships. In aggregated terms, both imports and exports are quite stable in terms of preferential partners, being the most relevant change the rise of the Russian Federation in the Top10 since 1993[26]. It can be said that, in general terms, the commercial partnerships within the EU have gained strength though the period (the value of imports and exports from/to all EU Member States has grown during the period in different quantities) and this has been complemented with a growing commercial activity with the Russian Federation.

The structure of the Finish imports presents a reduction of the weight of manufactured goods and a rise of the mining products. Since 1988, the shares have changed from 86% and 8% respectively, to 80% and 12% respectively. Apart from the potential implications in structural terms for the Finish economy, the increase in the mining imports is related to the increase of the imports from the Russian Federation: in 1992 this country was amongst the first places of the imports ranking (seventh in the Top10, see Table 9) mainly due to imports of the mining category and the medium and low value manufactured goods. In 2004 the Russian Federation reached the third place in the Top10, mainly due to the large increase in the amount of mining imports, that reached the 53% of the total imports from that country. Concerning the total Finish imports of the mining and quarrying category, the Russian Federation was in 2004 Finland's first supplier with a market share of more than 60%. The Russian Federation was also in 2004 the main partner of the category electricity, gas and water supply, with more than 80% of the total share of this category of imports, but the absolute value was less significant than the mining category.

The main Finish import partners can be classified in three groups, as mentioned above:

- Regional partners, with the Russian Federation as main importer;
- Intra-EU partners, with Germany and Sweden in the first places of the Top10 for 2004[27];
- Overseas partners, China, USA and Japan.

The total share of the Top5 partners has been very stable through time, varying very little since 1988, being in 2004 slightly under the 50% of the total value of imports (see Figure 15). The main increases in terms of the value of the trade flows in the period under study (see Figure 17) came from the Russian Federation, Germany, Sweden and China.

The structure of the Finish exports is very similar to the imports, in terms of preferential partners. Again, the main Finish import partners can be classified in three groups (see Table 9):

- Regional partners, with the Russian Federation and Norway in the Top10;

[26] 1993 is the first year with data for imports and exports from/to the Russian Federation in the OECD statistics. This forces us to present our analysis starting in that year, given the important of the Russian Federation as commercial partner.

[27] Although a regional partner, Sweden is considered as an intra-EU partner.

- Intra-EU partners, with Sweden and Germany in the first places, and the UK in fourth place of the Top10 for 2004;
- Overseas partners, China and the USA.

Table 9: Top10 Finish commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	1993	2004	Rank	1993	2004
1	Germany	Sweden	1	Germany	Germany
2	Sweden	Germany	2	Sweden	Russian Fed.
3	United Kingdom	Russian Fed.	3	United Kingdom	Sweden
4	USA	United Kingdom	4	Russian Fed.	China
5	France	USA	5	USA	USA
6	Netherlands	Netherlands	6	Japan	France
7	Russian Fed.	China	7	Norway	United Kingdom
8	Denmark	France	8	France	Netherlands
9	Norway	Norway	9	Italy	Japan
10	Italy	Italy	10	Netherlands	Italy

Source: own elaboration from OECD, BTD data

The share of the Top5 partners in the total value of the exports has been also quite stable through time, with a slight trend to reduction, being in 2004 around 42%.This tendency can be derived from the significant increases in the exports volume to a quite large number of countries. Apart the main increases of exports to the Russian Federation, Sweden and Germany, other countries had increases in the value of goods purchased from Finland: China, USA, UK, Netherlands and Estonia (see Figure 18).

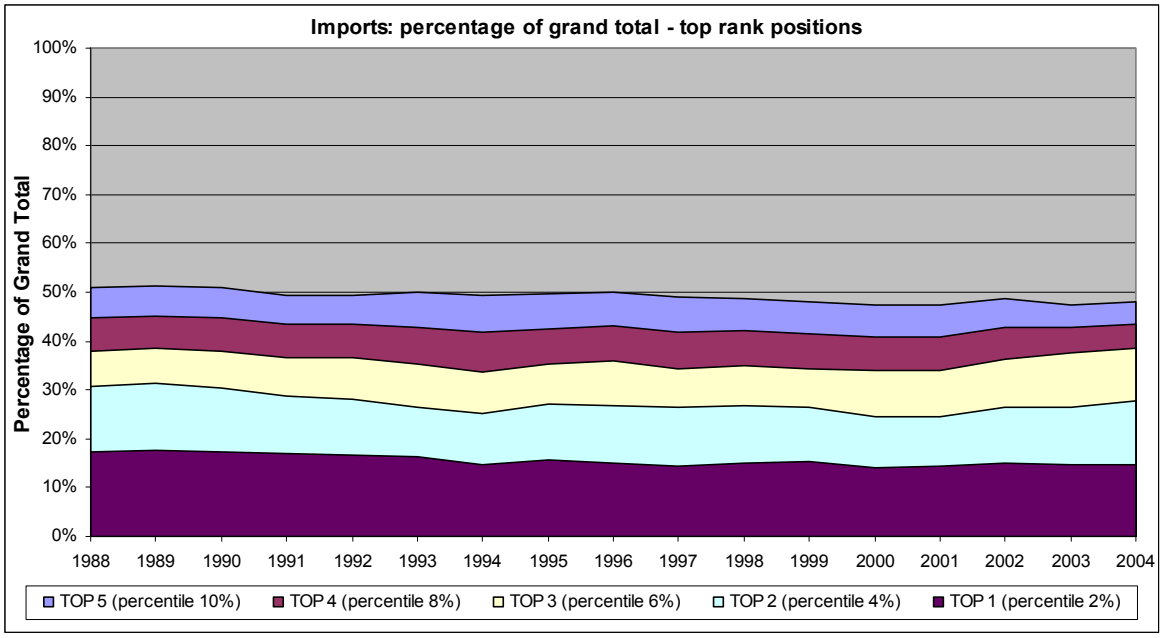
The main effects of the trade flows presented and the implication for the transport sector are the following:

- The potential effect of the changes in the commercial flows on the transport sector can be attributed mainly to the increases of the export and imports to the regional partners, and specially to the Russian Federation, in two ways: through the increase of value (and volume) of the flow, that implies a more intensive use of the land based modes, and through the increase of importance of the mining imports, that might provoke a more intensive use of the railways (mineral bulks with lower value per volume unit). However, these potential effects on transport are not supported by the evolution of the transport figures. The modal share Eurostat figures for inland based modes for Finland do not show any specific change since 1993. Moreover, the railways share has been decreasing slowly since 1993 (27%) until 2004 (24%);
- Concerning maritime transport, the total transported tonnage has been growing since the mid 90s, according to Eurostat figures. The increase of the total transported tonnes between 1996 and 2002 approximately of 32%. The explanation of such increase can be found in the geographical configuration of Finland, that makes maritime transport the most likely way of trade with its commercial partners, even with some regional ones such as the Baltic Republics. Maritime transport is also the most likely mode for trade exchanges with the rest of the EU Member States, including Sweden[28].

[28] Although there is a railway link between Sweden and Finland, the long distances of the railway network and maritime transport figures suggest that most of the

In terms extra-EU trade, maritime transport has a quite high share, almost 62% (2002 Eurostat data). In this share it is included the total sum of all overseas Finish partners and a large piece of the total imports and exports from the Russian Federation. This is mainly due to the slight reduction of the railways share in Finland since the 90s, which implies that the increase in those trade flows must have been absorbed during the last decade by the maritime transport. The road share of Finish extra-EU trade is low, around 10% (2002 Eurostat data), corresponding to trade with Norway and the Russian Federation. It is expected a continuous growth of the maritime transport and port system intensive use, due to the concentration of intra and extra-EU, with a potential for congestion;

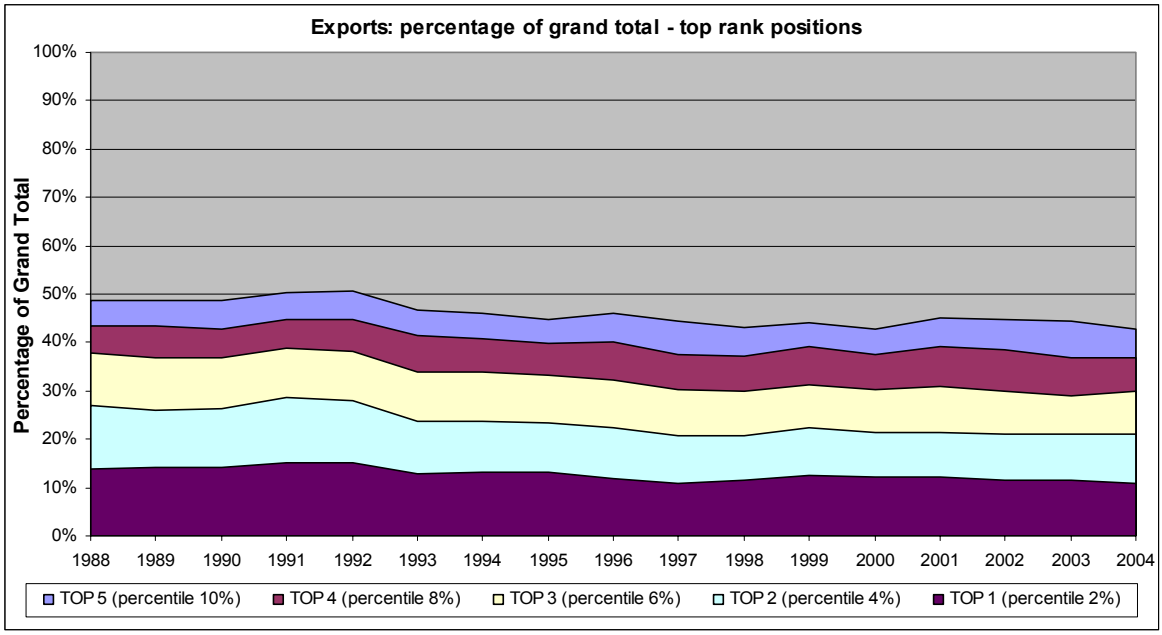
- Continuous reduction of the rail freight share, unless actions are taken in order to increase its attractiveness[29]. The increase of the road freight as preferential mode puts more pressure and increases potential congestion in the road links with Germany (and German roads in general as well), as all trade using roads passes through German territory.



Source: own elaboration from OECD, BTD data

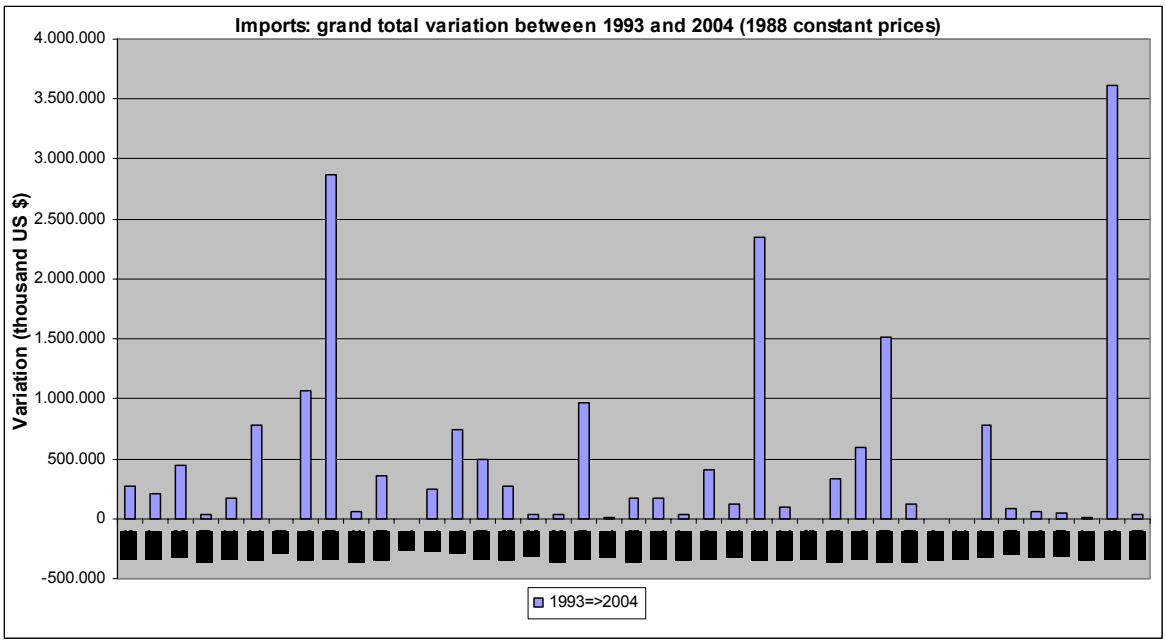
Figure 15: Percentage of total Finish **imports** from the Top5 commercial partners (1988 constant prices)

[29] The European Commission has included in the list of the "30 Priority Axes and Project" of the Trans-European Networks the "Nordic Triangle Railway/Road Axis" that upgrades the road and rail links between the southern coast of Finland and the Russian Federation frontier. It is expected that this project has a modal shift mainly to the railway, including flows from the Russian Federation and other Eastern European Countries as Belarus.



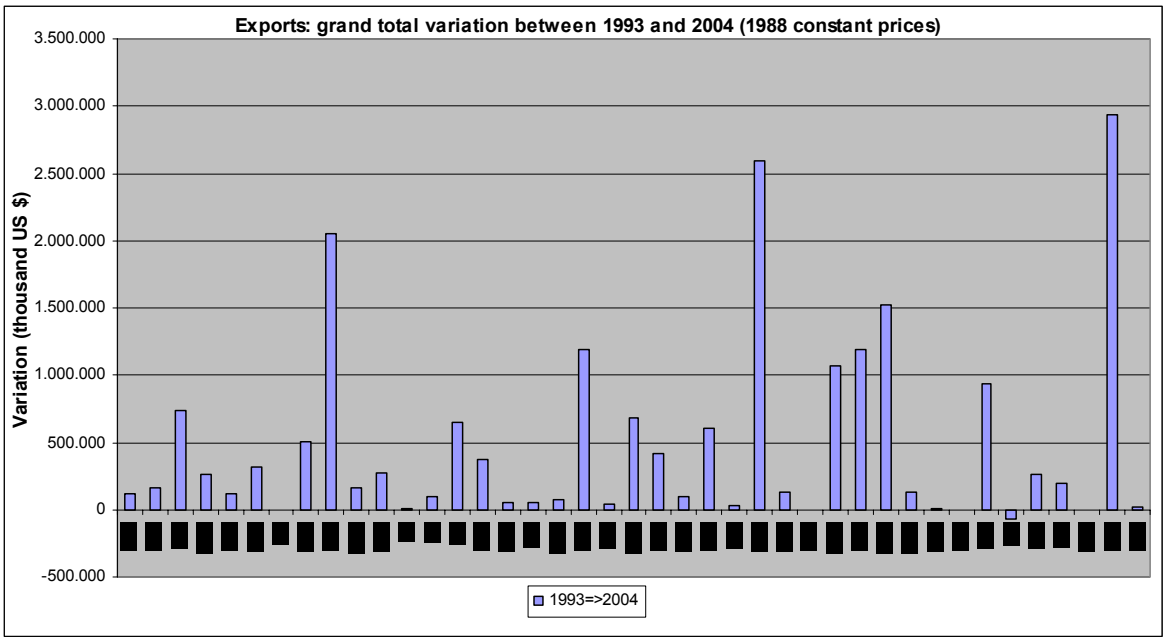
Source: own elaboration from OECD, BTD data

Figure 16: Percentage of total Finish **exports** absorbed by the Top5 commercial partners (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 17: Variation of Finish **imports** per commercial partner (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 18: Variation of Finish **exports** per commercial partner (1988 constant prices)

3.3 France

The most relevant issue concerning the French trade flows is the high degree of stability concerning the commercial partnerships and the composition of the trade flows associated. For both imports and exports, the groups of main partners are common and fairly stable, and organised in two groups of EU neighbour Member States and overseas partners. Since 1988, both for imports and exports, the tendency of having as main partner Member States of the EU has been reinforced, being the 5 main partners Member States in both Top10 rankings for 2004, as presented on Table 10.

Moreover, all those Member Countries are neighbour countries of France. From this we can extract a first conclusion concerning transport effects: it is expected a high intensity in the use of inland modes, rail and road (as in fact happens). In terms of growth of imports and exports, Figure 21 and Figure 22, respectively present the variation on the commercial volumes per country. These two figures show the huge increase in trade activity, mainly in those belonging to the Top5 commercial partners. It is worth to mention the variation that Spain presents: in terms of imports, is largest absolute growth, being also the first in terms of exports. In transport terms, this means a very important growth of transport flows, mainly covered by road haulage which is by far the most used transport mode for freight purposes in Spain, both for national and international flows. In the last 20 years, the Pyrenees have become one of the most important bottlenecks in the south of Europe. For bilateral relationship, railway is not an option at this moment, due to interoperability problem derived from the different railway gauge used in Spain.

Table 10: Top10 French commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	1988	2004	Rank	1988	2004
1	Germany	Germany	1	Germany	Germany
2	Italy	Spain	2	Italy	Italy
3	United Kingdom	United Kingdom	3	Bel-Lux.	Bel-Lux.
4	Bel-Lux.	Italy	4	USA	Spain
5	USA	Bel-Lux.	5	United Kingdom	United Kingdom
6	Netherlands	USA	6	Netherlands	USA
7	Spain	Netherlands	7	Spain	China
8	Switzerland	Switzerland	8	Japan	Netherlands
9	Japan	Japan	9	Switzerland	Japan
10	Sweden	China	10	Sweden	Switzerland

Source: own elaboration from OECD, BTD data

In general terms, the clear trend to concentrate EU Member States (and neighbour) in the Top10 of the commercial relationship, mean in transport terms more congestion for the European networks in the near future, if nothing is done. In other words, most of these commercial flows are handled by road haulage and, despite of the efforts made by the EC and several intermodal operators, the road share is still growing.

An interesting tendency is shown by Figure 20 regarding exports. That figure shows the percentage of exports directed to the Top5 partners in cumulative terms. In 2003, 5 countries received almost 60% of all French export. However, the total share of the Top5 was higher in 1990, and has been decreasing slightly since then. Still, this result is even more important if compared with the share of the Top5 French import partners, shown in Figure 19.

The aggregated share of the Top5 import partners has decreased in less than 20 years roundly by 10%. This can be due to the extension and consolidation of the EU Internal Market and subsequent expansion process in the last decades. It can be generalised that the loss of share of the Top5 suppliers of the French economy derives from the expansion on the number of countries with commercial relationships with France and/or from the general increase in the value of goods imported by France from other countries (not the Top5). Figure 21 presents the increases in value of the imported goods of France by partner. It shows a large increase of the top partner, Germany, but also from Spain, China, the Russian Federation, USA and a quite large group of EU Member States with significant variations (Belgium and Luxemburg, Italy, UK, Ireland, etc).

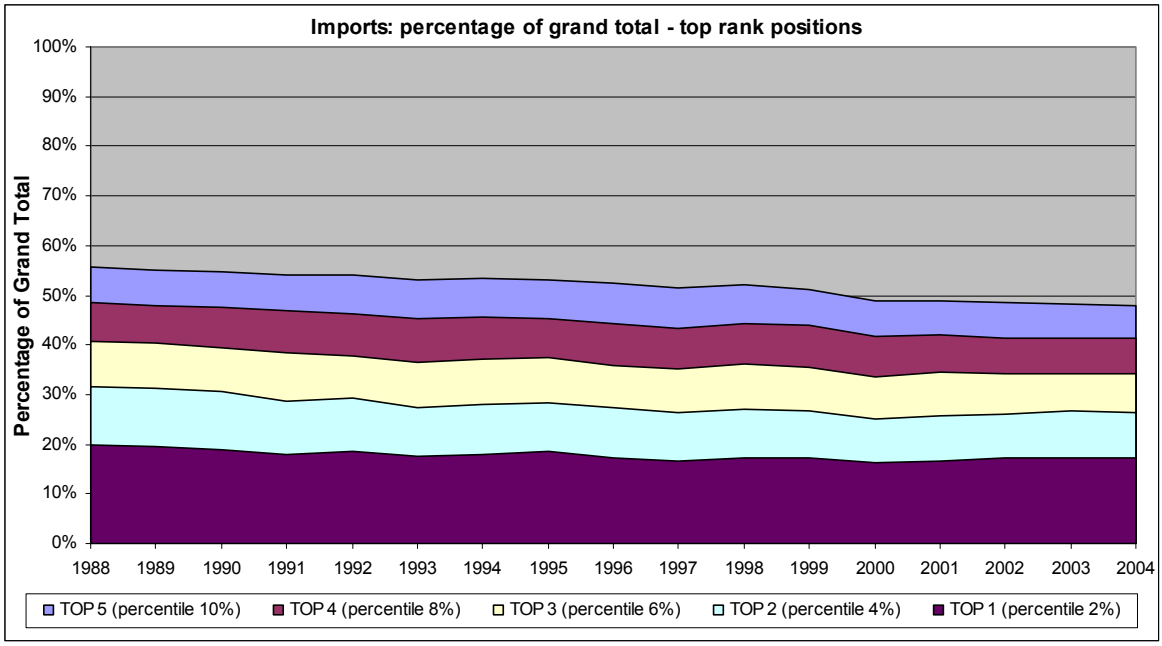
The composition and markets of the French exports is quite similar to the imports. Figure 22 presents the variations in the value of exported goods per partner, being the main increases those from Spain, Germany, the UK, Belgium and Luxemburg, the USA and Italy. Again, as in the imports, there is a clear tendency for strengthening the commercial relationships with the neighbour countries, apart from the USA. The type of goods exported has followed a trend for increasing the value of goods, changing the proportion of medium and high technology good from 56.2% in 1988 to 64.9% in 2004. Over the total value of exports, manufactured goods had an increase on their share from 90.9% in 1988 to 94.7% in 2004, with a reduction for those years of the agricultural goods exported from 6.7% to 3.12% respectively (more than a 50% reduction).

The expected effects of the changes and composition of the French trade flows on the transport sector are the following:

- As a resume, it can be said that the French case is a quite stable one in terms of traded goods (both imports and exports) and origins and destinations of the flows. In such environment, the main transport impacts worth mentioning are those derived from the increasing congestion of the main European networks since the 80s, as the main French partners are former EU15 members. No major changes in the logistic and transport sectors are expected, probably more pressure in the existing modes, giving the high level of modernisation of logistics and transport in France;
- Most commercial flows are concentrated in the neighbour countries: Germany, Spain, Italy and Belgium. This means that any increase in the intensity of these flows will put more pressure in the existing land based transport modes. Road freight has increased his share over the total tonnes transported by the land based modes in the period under study: in 1988 it was 75.3% and in 2004 80%, having rail freight a reduction of its share, from 21% in 1988 to 17% in 2004[30]. The short distances and the increase in the value of imported and exported goods can favour a more intense use of the road haulage;
- The French port sector moved in 2004 more than 334 millions of tonnes of cargo. Maritime transport is the main mode for French extra-EU commerce, with 66.6% of all

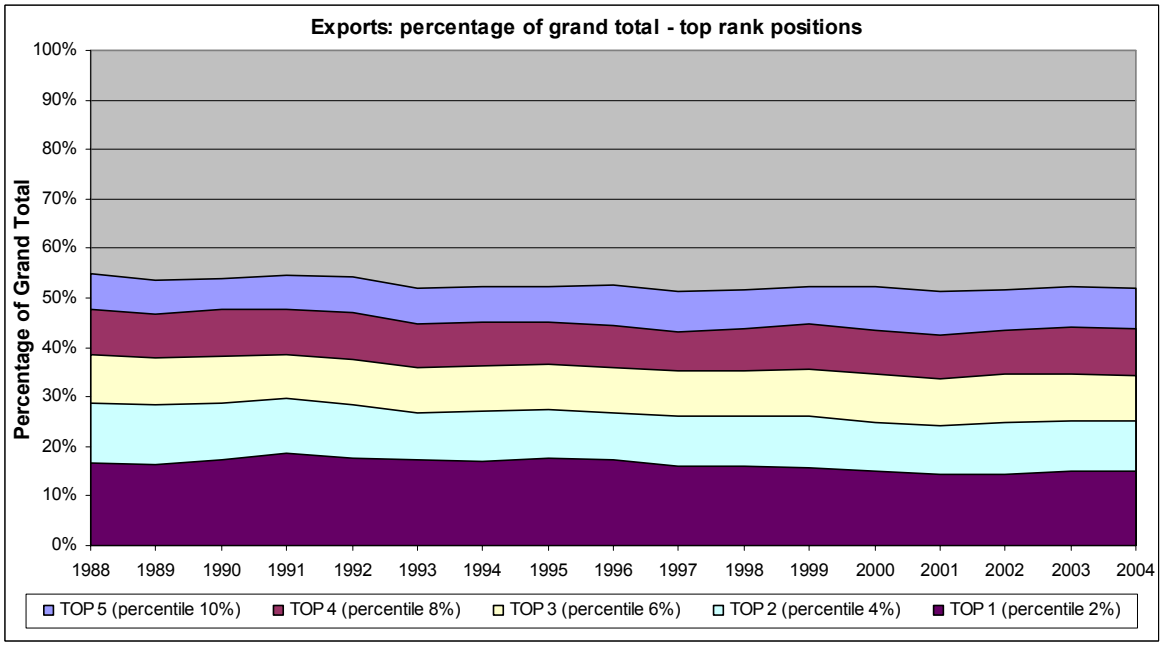
[30] The inland waterways transport has a significant and quite stable share in France, that moved from 3.7% in 1988 to 3.1% in 2004.

imports and exports transported. The rest of that trade is handled by the road and rail freight. The port sector handles also a large amount of intra-EU trade, mainly in long routes (Baltic, Mediterranean, etc). It is expected an increase in the maritime traffic, if the tendency in increasing trade with China is verified in the near future.



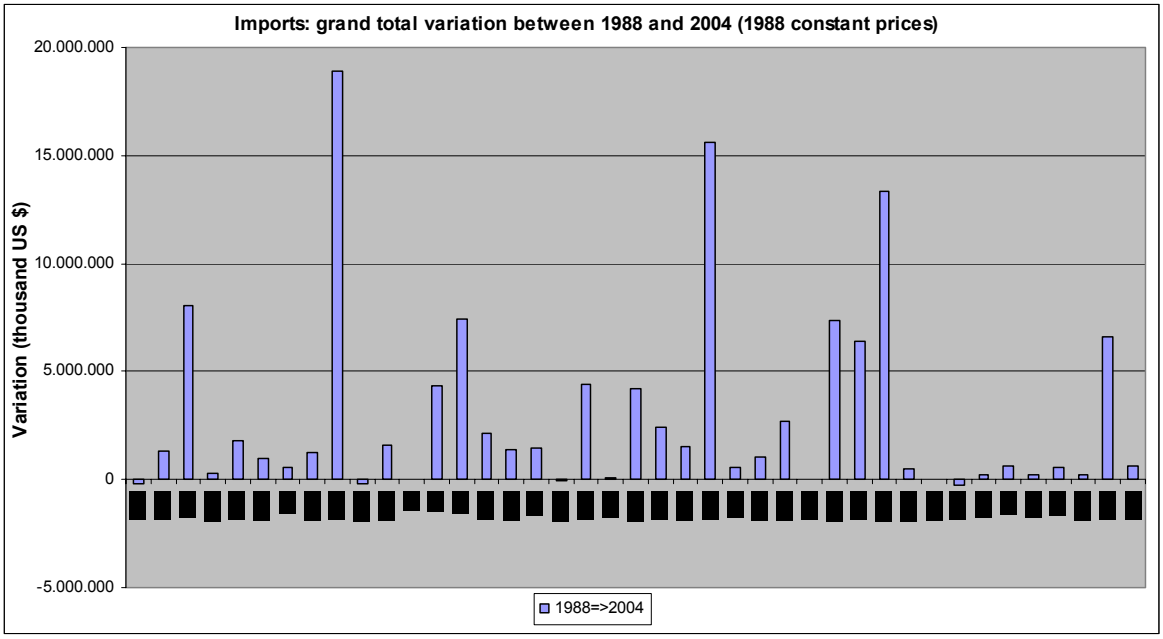
Source: own elaboration from OECD, BTD data

Figure 19: Percentage of total French **imports** from the Top5 commercial partners (1988 constant prices)



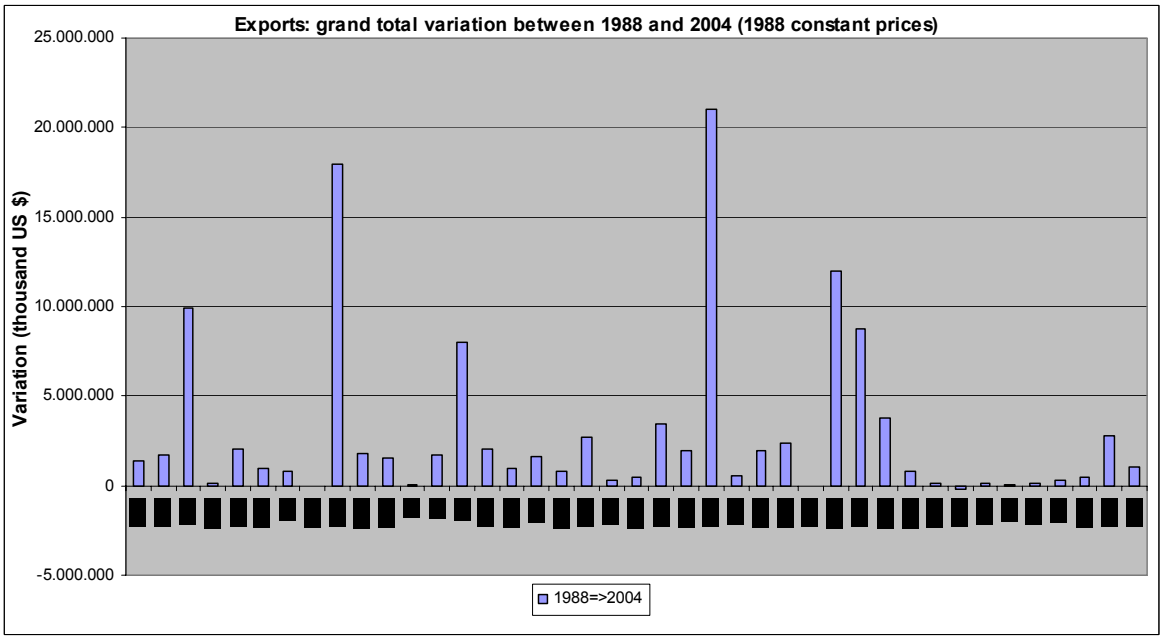
Source: own elaboration from OECD, BTD data

Figure 20: Percentage of total French **exports** absorbed by the Top5 commercial partners (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 21: Variation of French **imports** per commercial partner (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 22: Variation of French **exports** per commercial partner (1988 constant prices)

3.4 Germany

In general terms, the most relevant issues concerning the German commercial flows are, on one hand the large increase in trade since 1988, and on the other hand the stability in partnerships, being the only exceptions the fall of Sweden of the Top10 rankings of both imports and exports and its substitution by China (see Table 11). Another interesting characteristic of

the German trade flows is the extension of the base of commercial partners which has provoked a reduction of the Top5 partners share.

The German imports have a very stable structure in the period under analysis, corresponding to the structure of a very mature production system. Since 1988, there is a clear trend for the reduction in the share of the Top5 importers, which was around 45% during the early 90s and in 2004 was slightly over 35% (see Figure 25), the lowest share of the Top5 in all countries analysed. Figure 25 presents very important changes in the value of imports per partner for a quite large number of countries. This means that the German economy has extended its base of suppliers in the period under study, having the Top5 partners less than 10% of share each. The main variations correspond to two overseas partners (USA and China) being the rest EU Member States (France, Netherlands, UK, Czech Republic, Poland, Ireland, Spain, Hungary, Italy, etc) or neighbour countries (Switzerland). It is also worth mentioning the large increase of imports from the Russian Federation, with an increase over 10 billion of US $, measured in 1988 constant prices.

Table 11: Top10 German commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	1988	2004	Rank	1988	2004
1	France	France	1	France	France
2	United Kingdom	USA	2	Netherlands	Netherlands
3	Italy	United Kingdom	3	Italy	USA
4	Netherlands	Italy	4	Bel-Lux.	Italy
5	USA	Bel-Lux.	5	United Kingdom	United Kingdom
6	Bel-Lux.	Netherlands	6	Japan	China
7	Switzerland	Austria	7	USA	Bel-Lux.
8	Austria	Spain	8	Switzerland	Austria
9	Spain	Switzerland	9	Austria	Japan
10	Sweden	China	10	Sweden	Switzerland

Source: own elaboration from OECD, BTD data

The structure of the German exports is characterised for the high share of high value products, as almost 75% of total exports are medium and high technology products. As in the case of imports, the base of the Top10 partners is very stable through time, with the only variation introduced by the entry of China substituting Sweden in the ranking. In terms of the share of the Top5 buyers (see Figure 24), it shows that since 1988 there has been a reduction of the share, that was around 46%in 1988 and slightly superior to 40% in 2004. This figures combined with those provided by Figure 26, show that the base of countries buying German exports has been expanding in the period under analysis, as well as the value of the trade. Almost all countries listed in the OECD statistics show significant growths in the value of goods bought to Germany. The largest increase in the one of the USA, followed by several EU Member States: France, UK, Spain Italy, Austria, Belgium and Luxemburg, Czech Republic, Netherlands and Poland. China and the Russian Federation present also important growths, around 15 billions of US $ (1988 constant prices).

In terms of the effects of the commercial flows in the transport, the central situation of Germany within the EU (especially in the EU25) and its label of "engine of the European economy" are two factors that determine largely the situation of the sector. On one hand, the intense German commercial flows (both imports and exports) with all its neighbour countries and other EU Member States, an on the other the flows between neighbour countries pass-

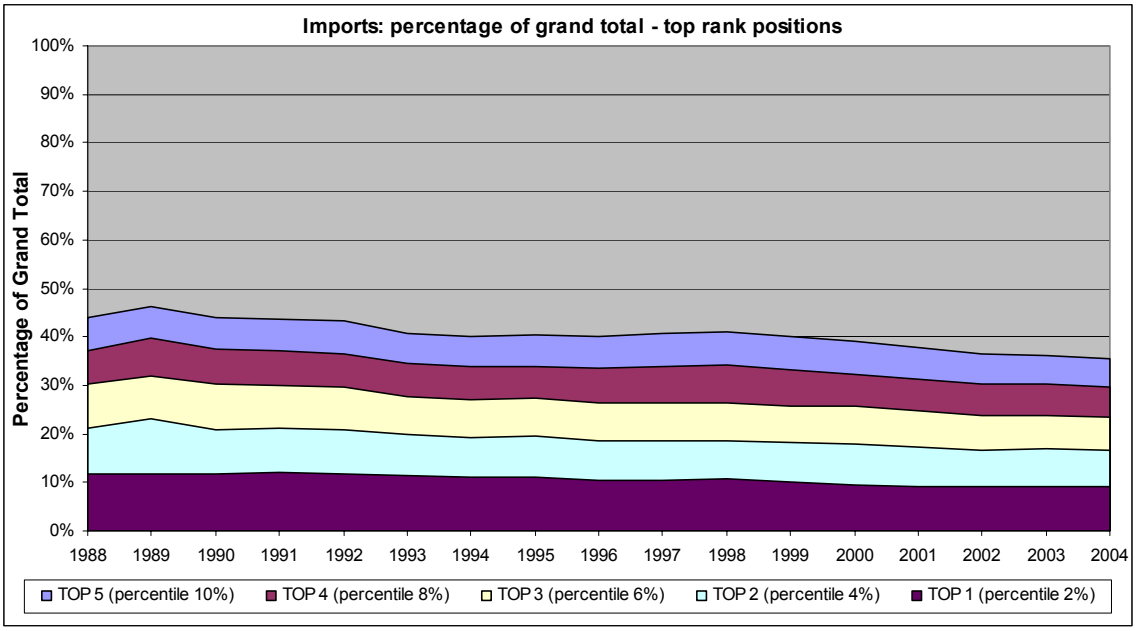
ing through German territory determine a high use of the land based modes, that is being tackled by the German authorities and the European Commission with several types of measures. In this context, the share of road freight over the total tonnes transported by land based modes has grown since the early 90s, with a slight decrease in 2004[31], from 61.8% in 1993 to 67.8% in 2003 (Eurostat figures). At the same time, the rather high (for the average number of the EU) railway share, that decreased in the late 90s, started to grow in 2001 back to levels of the early 90s, over 19%.

The expected main effects of Germany's external trade flows in the transport sector in the present and in the near future are the following:

- The increase in the commercial relationships with the new EU Member States has increased the use of the land based modes, especially road, as rail presents more difficulties due to the state of the railways in those countries and problems derived of interoperability issues. This means more pressure in the German roads and another potential factor to rise congestion problems;
- Railways are recovering its share of freight, mainly due to the efforts directed to turn rail haulage the main mode in long intermodal freight chains. This is being supported by increased efforts for improving interoperability by infrastructure managers and operators (both public and private). However, these efforts are centred in the EU15 Member States, and the situation of railways in the EU10 New Member States must be as well improved;
- Maritime transport is the main mode for the extra-EU German relationships; it has had a positive evolution since the end of the 90s, both for intra-EU commerce as well as German external commerce, according to Eurostat data. Only trade flows with Switzerland and the Russian Federation are transported by land based modes[32]. This means that further growth in Germany's overseas trade will put additional pressure on its port system and land access networks. This is reinforced by the fact that, between 1988 and 2004, USA was buyer with the highest growth in the value of German exports purchased, and China the seller with the highest growth in the value of imports to Germany;
- The German transport networks are also used by the trade of other EU Member States: intra-EU North-South commercial flows use the land networks and the port system (specially Baltic area trade), intra-EU East-West flows use the land networks as well, and an important proportion of the EU's overseas trade passes through the German port system. This means that further strengthening of the intra-EU trade, more precisely of those flows passing through Germany to and from some of the NMS like Poland or the Czech Republic will increase the pressure on the German transport networks and increase the potential for congestion.

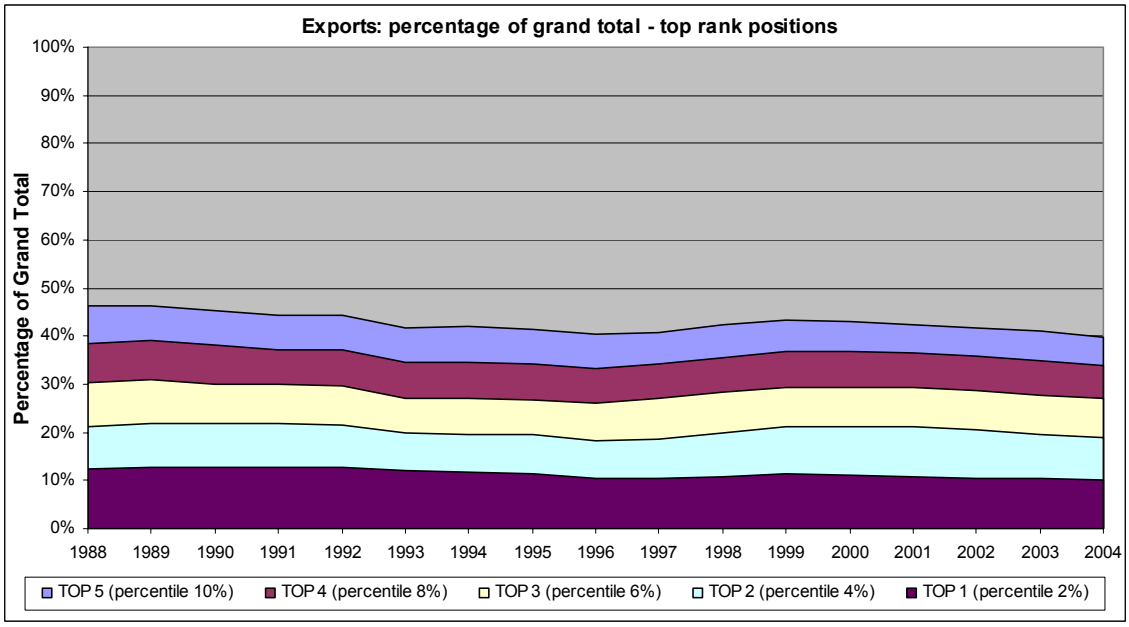
[31] It is not clear if this is the beginning of the reduction of the road haulage due to the effects of the measures implemented, or just a temporary figure.

[32] These two countries are mentioned as being two of the most important German trade partners: Switzerland is in the Top10 and the Russian Federation has had an important growth both as importer and exporter.



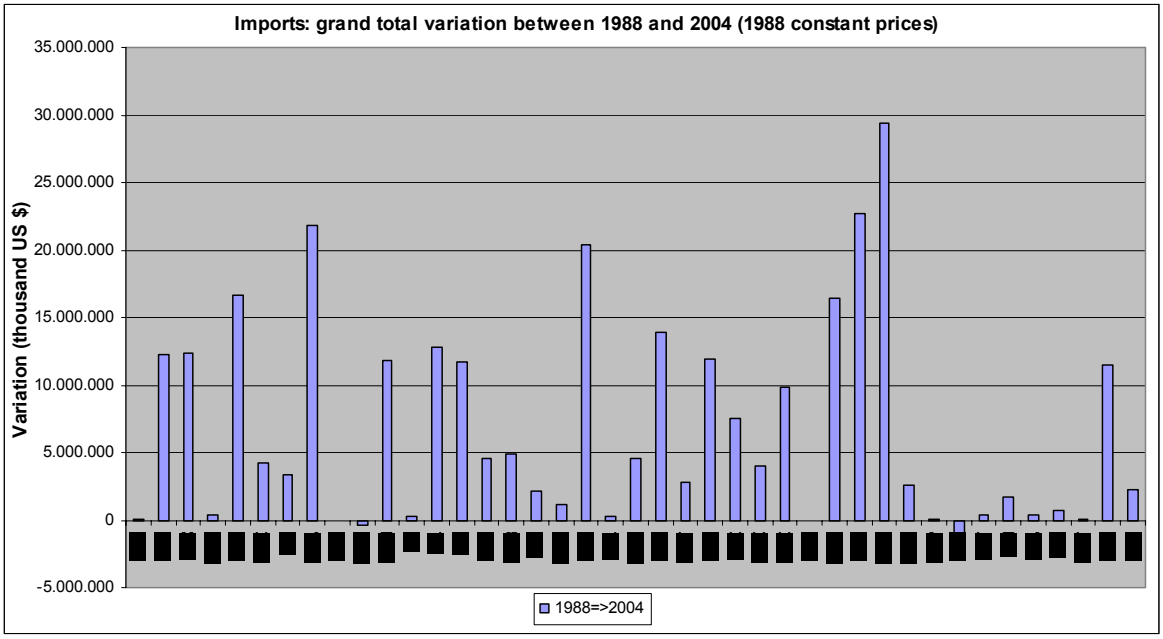
Source: own elaboration from OECD, BTD data

Figure 23: Percentage of total German **imports** from the Top5 commercial partners (1988 constant prices)



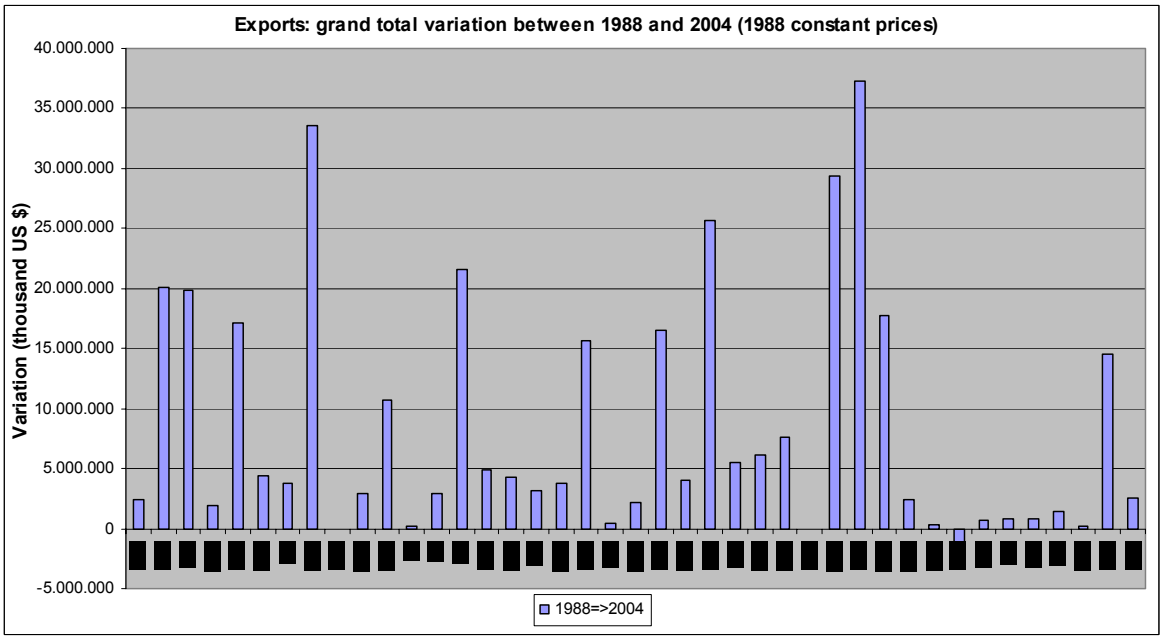
Source: own elaboration from OECD, BTD data

Figure 24: Percentage of total German **exports** absorbed by the Top5 commercial partners (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 25: Variation of German **imports** per commercial partner (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 26: Variation of German **exports** per commercial partner (1988 constant prices)

3.5 Netherlands

In general terms it can be said that the Dutch commercial relationships are characterised by two different tendencies regarding imports and exports: exports flows are very EU oriented, having imports a more "global" orientation.

The evolution of the Dutch imports is characterised by a process of globalisation since the late 80s. In 1988 the Top10 importers to the Netherlands were mostly EU Member States or at least European countries (Switzerland), being the USA the only overseas country in the Top10 (see Table 12). The trend since then has been an increase in trade with overseas partners with a very significant growth in the value of trade from the Far East, with China, Japan and Taiwan entering in the Top10. Concerning the variation of value of imports, Figure 29 shows large increase in trade value from China, the USA and Germany (first importer), followed by the UK, Belgium and Luxemburg and the Russian Federation (that enters also in the Top10 ranking of importers). The base of preferential importers has also expanded since 1988, with the subsequent loss of share of the Top5 partners (see Figure 27): the share was over 60% in 1988, being nowadays slightly over 50%, being France (one of the 1988 Top5) replaced by China in 2004 and gaining the USA more importance. Germany is still clearly the main importer to the Netherlands. However, its weight has also been reduced: in 1988 almost 28% of Dutch imports had a German origin, while in 2004 the German share decreased to 20%. Concerning the type of imported goods, there is an interesting trend since 1988 to reduce the share of medium-low technology imports, that was 49% that year, to 35% in 2004.

Table 12: Top10 Dutch commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	**1988**	**2004**	**Rank**	**1988**	**2004**
1	Germany	Germany	**1**	Germany	Germany
2	Bel-Lux.	Bel-Lux.	**2**	Bel-Lux.	Bel-Lux.
3	France	United Kingdom	**3**	United Kingdom	USA
4	United Kingdom	France	**4**	USA	China
5	Italy	Italy	**5**	France	United Kingdom
6	USA	USA	**6**	Italy	France
7	Switzerland	Spain	**7**	Japan	Japan
8	Spain	Sweden	**8**	Sweden	Russian Fed.
9	Sweden	Switzerland	**9**	Switzerland	Chinese Taipei
10	Denmark	Austria	**10**	Spain	Italy

Source: own elaboration from OECD, BTD data

The Dutch exports have a more European oriented than the imports, being the USA the only overseas partner in the Top10 (see Table 12). Like imports, the share of exports corresponding to the Top5 partners is following a slight descent trend, passing in the period under study from 65% to 60% of the total value of the exports. However, the main partner, Germany, didn't have a significant loss of share, fairly stable around 25%. Concerning the changes in the value of the exported goods per partner (see Figure 30), it is clear the trend since 1988 for a very oriented export sector in the Netherlands: the higher variation corresponds to Germany (firs commercial partner both in exports and imports) followed by Belgium and France, the UK, and with other significant increases by Spain, Italy and the USA (the only overseas partner present). This means that export flows will use mainly (with the exception of

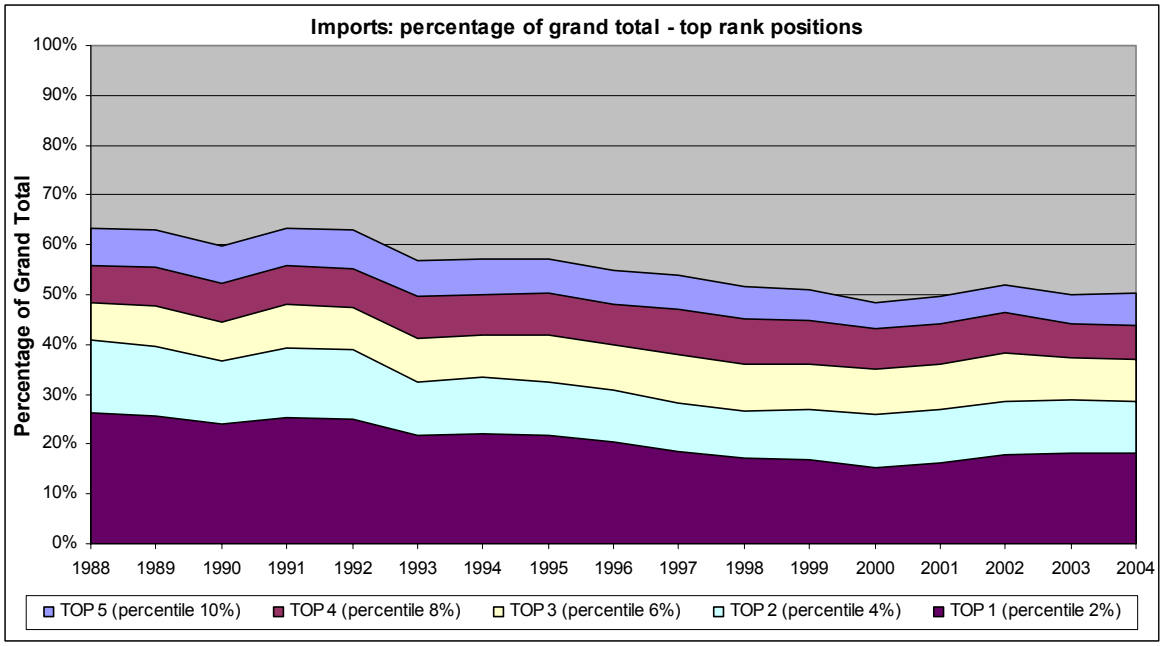
course of the UK and the USA) the land based transport modes, with the added pressure and potential for congestion.

The structural trend verified in the imports of increase in the share of medium and high goods can also be verified in the case of exports. In 1988 the share of medium and high technology exports was 47%, being almost 60% in 2004. Combined to the figures of the exports, and as already mentioned for Germany, these numbers are consistent with the structural trend of the more developed economies that area following a path of specialisation in the production of high value goods. This implies an increase in the share of medium and high technology exports, but also the value of imports is higher, as goods used as intermediate inputs for the production of such high value goods are also medium and high value goods[33].

The main effects of the trade flows in the Dutch transport systems and networks are the following:

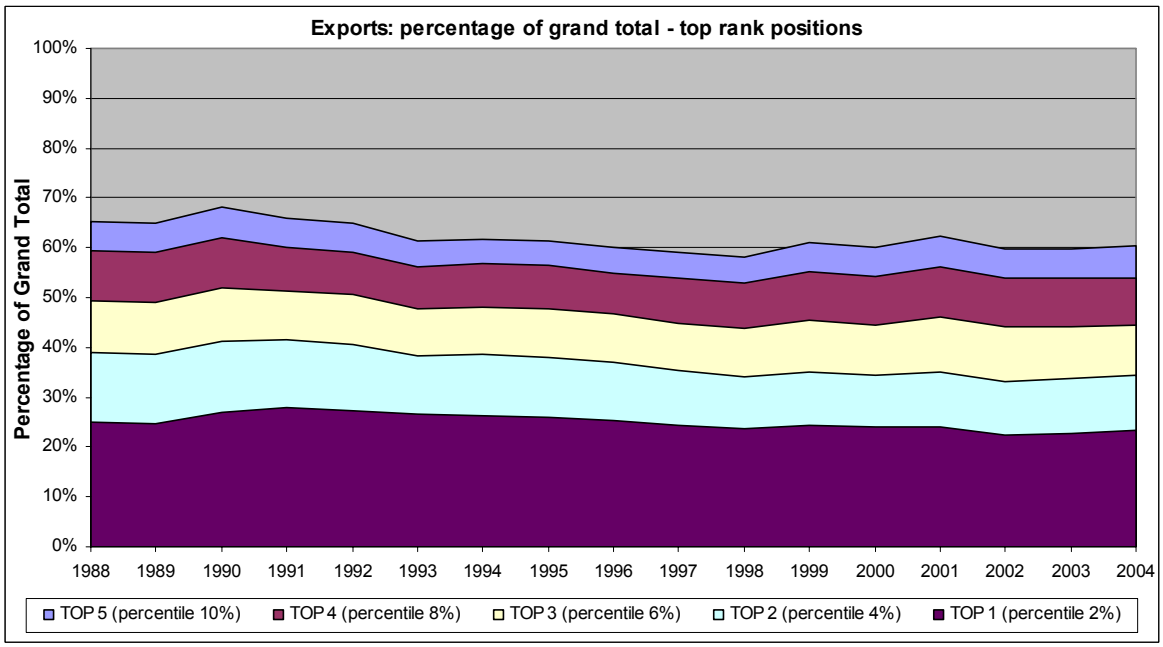
- In general, it can be said that there will be no major changes in the conformation of the logistic chains as the main commercial partnerships have been quite stable through the last decades and the logistics and transport operators have reached a high level of integration. It can be expected more pressure in the actually more used networks and modes;
- The strong links in terms of exports with most of the EU Member States mean more pressure in the land based modes and in the inland waterways. With the exception of the UK, the majority of the export will be transported through the land based networks, with special pressure on road for short distances such as Germany, France and Belgium;
- The port sector is crucial for the fluent relationships of the Dutch economy with partners overseas: almost 70% of the extra-EU was transported by sea in 2002 (Eurostat data). This is consistent with the current main partnerships of the Netherlands (especially the importers), far East countries (China, Taiwan and Japan) and the USA. This is an indicator of the path of increasing pressure on the maritime transport and port sector that the Netherlands will have in the future, in case the trend of reinforcing such partnership continues as it is now;
- The strong intra-EU relationships, especially concerning exports, will put more pressure in the land based modes. Since 1993 (according to Eurostat data) pressure of the logistic chains and the types of goods transported have meant little changes in the shares of the modes: in 1993 the road, railways and inland waterways were 2.8%, 64.1% and 33.1% respectively of all tonnes transported using land based modes. Those shares in 2004 where very similar, with slight reductions in the inland waterways share (31.2%) and increases in the road and railways shares (3.8% and 65% respectively).

[33] A clear example of this is the information technologies sector.



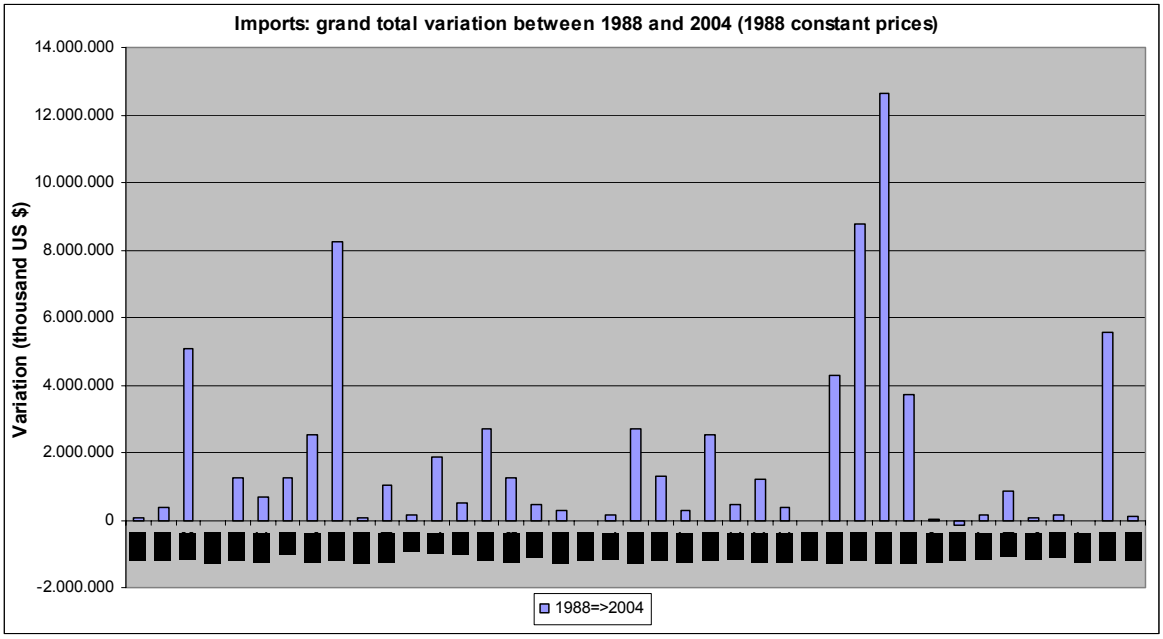
Source: own elaboration from OECD, BTD data

Figure 27: Percentage of total Dutch **imports** from the Top5 commercial partners (1988 constant prices)



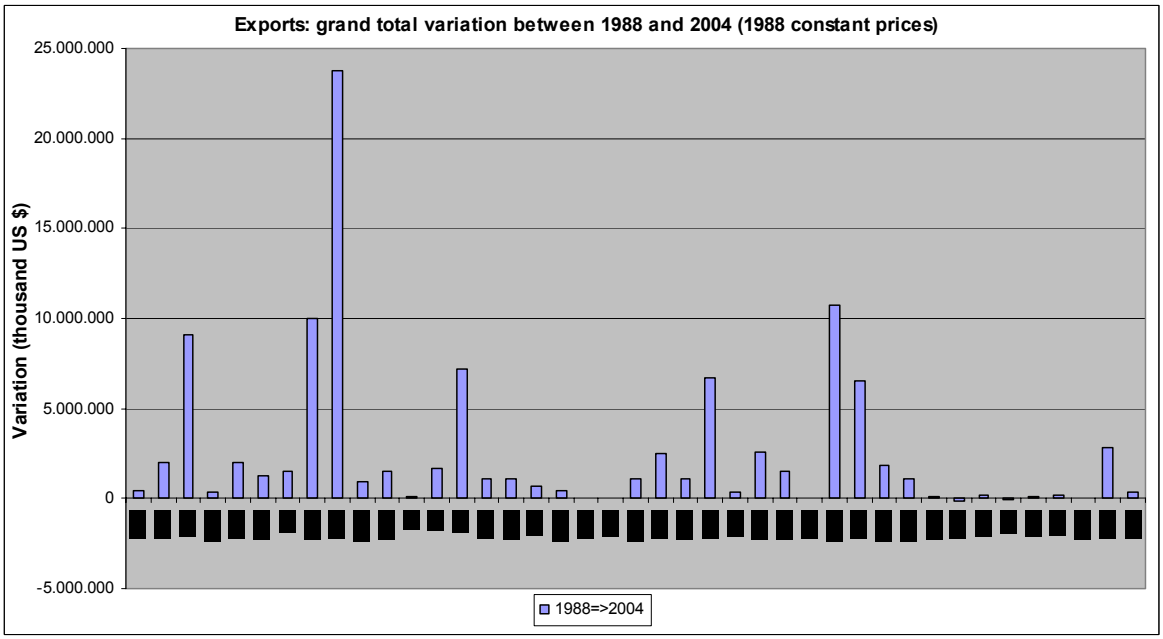
Source: own elaboration from OECD, BTD data

Figure 28: Percentage of total Dutch **exports** absorbed by the Top5 commercial partners (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 29: Variation of Dutch **imports** per commercial partner (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 30: Variation of Dutch **exports** per commercial partner (1988 constant prices)

3.6 Spain

The Spanish trade flows present, as well as the Netherlands, a characteristic of double integration: first, with the strengthening of the intra-EU partnerships; and second with the increasing integration in the global trade relationships following the present commercial trends.

The Spanish imports have evolved since 1988 in two directions, quite in line with the European and international contexts. On one hand, it is evident the increasing strengthening of the intra-EU relationships with EU Member States in the first places of the Top10 (see Table 13), being France, Germany and Italy the countries with larger increases in the total value of goods sold to Spain during the period (see Figure 33); other EU Member States having also significant increases, such as the UK, the Netherlands, Portugal and Belgium and Luxemburg. On the other hand, the tendency for globalisation is clear, with the emergence during the period of China as main importing partner (within the Top5 in 2004) and the Russian Federation, that although not in the Top10 for 2004 had a significant growth in the value of the goods sold to Spain (even higher than that of some EU Member States). Concerning the share of the main importers (see Figure 31), the trend is for a slight reduction (from 55% to 50%) although not for the Top2 partners, that maintain their shares during the period: Germany with roughly a 17% and France with 14%. This means that despite the large weight of Germany and France, there is a number of countries "pressing" the Top5 with significant (and increasing) commercial relationships with Spain.

Table 13: Top10 Spanish commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	1988	2004	Rank	1988	2004
1	France	France	1	Germany	Germany
2	Germany	Germany	2	France	France
3	United Kingdom	Portugal	3	Italy	Italy
4	Italy	Italy	4	USA	United Kingdom
5	USA	United Kingdom	5	United Kingdom	China
6	Portugal	USA	6	Japan	Netherlands
7	Netherlands	Netherlands	7	Netherlands	USA
8	Bel-Lux.	Bel-Lux.	8	Bel-Lux.	Portugal
9	Switzerland	Mexico	9	Portugal	Bel-Lux.
10	Japan	Greece	10	Sweden	Japan

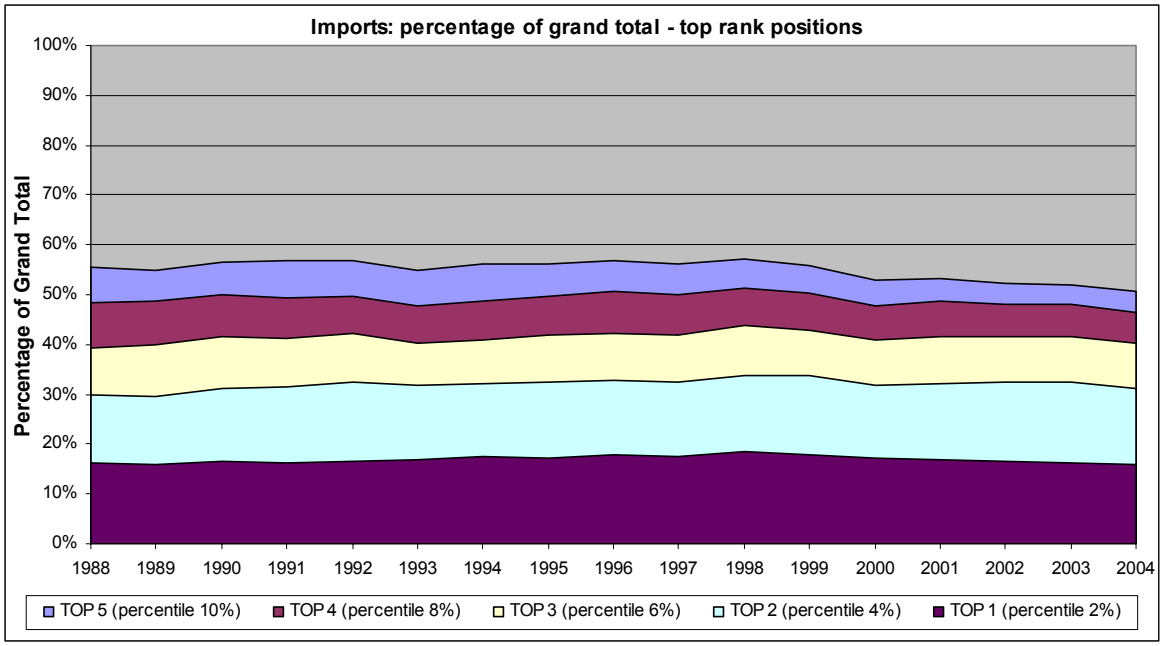
Source: own elaboration from OECD, BTD data

Concerning exports, the structure and evolution of partnerships is very similar to the imports. In the first place, the main export flows are maintained throughout the period (see Table 13) with significant movements upwards in the Top10 by Portugal, Greece and Mexico, and downwards by the UK, the USA, Switzerland and Japan (both out of the Top10 in 2004). The case of Mexico is quite interesting, as it is not a traditional country for commercial activity with EU Member States. Concerning the variations in exports value (see Figure 34), the most important to EU Member States: France, Portugal, Germany, Italy and the UK. It is important to remark that the two largest increases correspond to two neighbour countries, Portugal and France. This will determine largely the mode chosen for the transport of such goods. The percentage of exports absorbed by the Top5 partners (see Figure 32) has been stable during the period around 60%, with a large weight of the first partner, Germany, with almost 20% of the total exports purchased.

Spanish exports follow the trend of specialisation in medium and high technology goods of most developed economies. Since 1988 the share of medium and high technology exports has increased from 55% to 60%, which means an increase in the value of transported goods. The share of manufactured goods over total exports also rose in the period, from 89.3% to 91.5%, with reductions in the share of exports related to agriculture goods, from 9.4% to 6.1%. In terms of its technological level, the types of goods exported have also changed: in 1988 the majority of exports were medium and low technology goods (51.5% of the total exports), and in 2004 the majority were medium and high technology goods (almost 57% of the total exports).

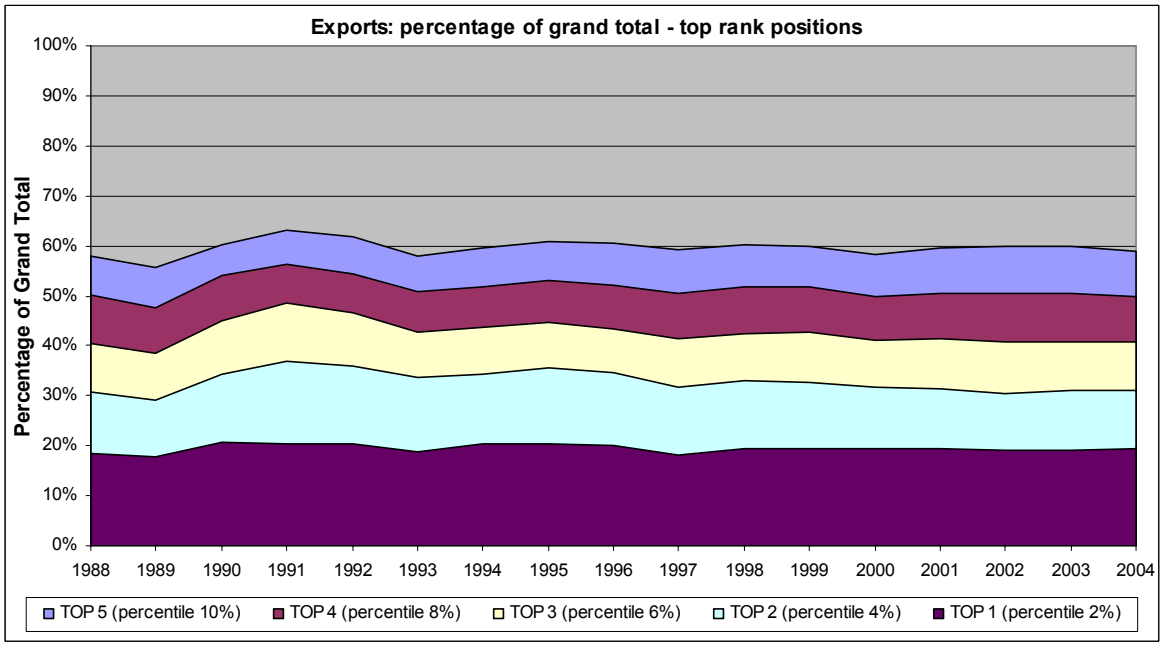
The effects on the transport networks and modes of the trade flows detected are the following:

- The Spanish railways have very important interoperability problems that hamper largely its capacity for offering reliable transport services. This factor, combined with the fact that two of the main export partnerships, France and Portugal, are neighbour countries (with quite large flows in both cases) determines the extremely high share of road transport in Spain. In 1993, the road freight had 92% of the total share, being 95% in 2004. This implies that any increase in the commercial relationship with France and Portugal, but also with any other EU Member State will be done through the road network and, for longer distances, by maritime transport;
- Subsequently, the Spanish numbers of road haulage between 1999 and 2004 are outstanding: while in other EU Member States the total tonnes transported by road haulage have been kept fairly stable (for instance, France, the Netherlands or Finland) or even decreased (Germany and Denmark), Spain has had an increase in the total transported tonnes of 143%, from over 827 millions of tonnes to 2.012 millions in 6 years. This is a result of the large investments placed in the Spanish highway and road network and the lack of a decided railway promotion and investment policy;
- The Spanish port sector has turned a key part of its commercial external relationships: in 2002, almost 94% of the extra-EU trade was done using maritime transport. This significant number is mainly due to the type of extra-EU partner both of imports and exports (Far East and America) and, of course, the geographical situation of Spain. Only a small proportion of such flows are not directed by sea, presumably some trade for European non EU-Member States (Switzerland, Russian Federation, etc). Thus, it is expected a higher growth of the importance of the maritime and port sector in the Spanish economy. At this moment (2004 Eurostat data), the whole Spanish port sector is the fourth of the EU in total tonnes handled.



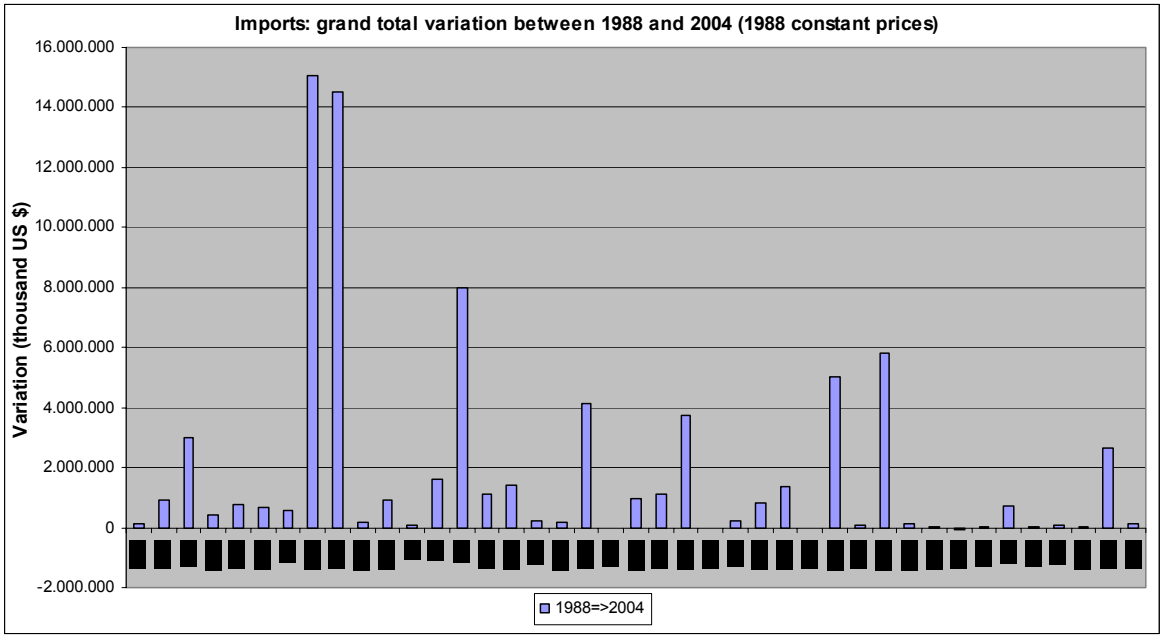
Source: own elaboration from OECD, BTD data

Figure 31: Percentage of total Spanish **imports** from the Top5 commercial partners (1988 constant prices)



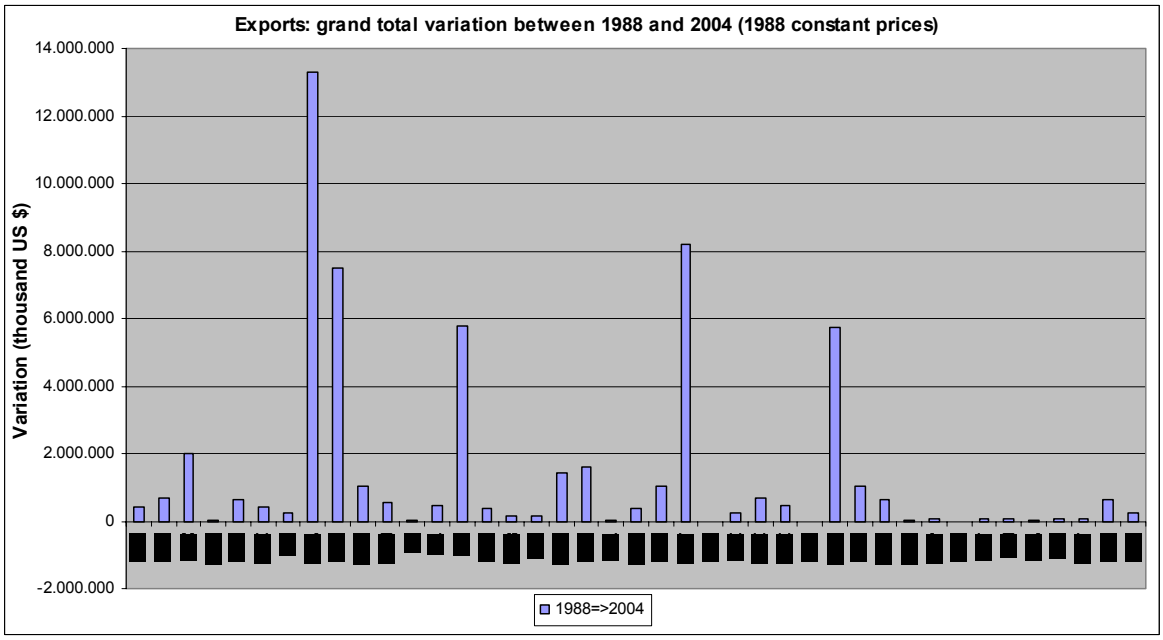
Source: own elaboration from OECD, BTD data

Figure 32: Percentage of total Spanish **exports** absorbed by the Top5 commercial partners (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 33: Variation of Spanish **imports** per commercial partner (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 34: Variation of Spanish **exports** per commercial partner (1988 constant prices)

3.7 UK

The UK trade flows are highly determined by its traditional relationships with the USA. Of all the European countries analysed, the UK is the one with the highest proportion of extra-EU trade over the total trade, due to this special relationship with the USA. Moreover, both imports and export have a very similar structure regarding the main partnerships.

The structure of the UK imports is characterised by a very high stability in partnerships since 1988. The only remarkable changes are the substitution of Japan by China as main Far East partner[34] and the fall of South Africa out of the Top10 (see Table 14). Interestingly, the Top4 partners are constant throughout the period, which indicated a very high stability in terms of types of goods imported and, more important, geographical flows of products. It is also important to highlight the entry of Spain en the Top10. The countries with the most important variations in the value of their goods sold to the UK (see Figure 37) are China with the largest increase, followed by Germany, the USA and several EU Member States (Netherlands, Belgium and Luxemburg, France, Spain, Ireland, etc). The share of the Top5 has been quite stable since 1988, with a slight tendency to decrease. However, the main seller, Germany, has kept its share practically unchanged since 1988 around 15% of total imports (see Figure 35).

Table 14: Top10 British commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	1988	2004	Rank	1988	2004
1	USA	USA	1	Germany	Germany
2	Germany	Germany	2	USA	USA
3	France	France	3	France	France
4	Netherlands	Ireland	4	Netherlands	Netherlands
5	Bel-Lux.	Netherlands	5	Japan	China
6	Italy	Bel-Lux.	6	Italy	Bel-Lux.
7	Ireland	Spain	7	South Africa	Italy
8	Spain	Italy	8	Bel-Lux.	Ireland
9	Sweden	Sweden	9	Ireland	Spain
10	Canada	Japan	10	Sweden	Norway

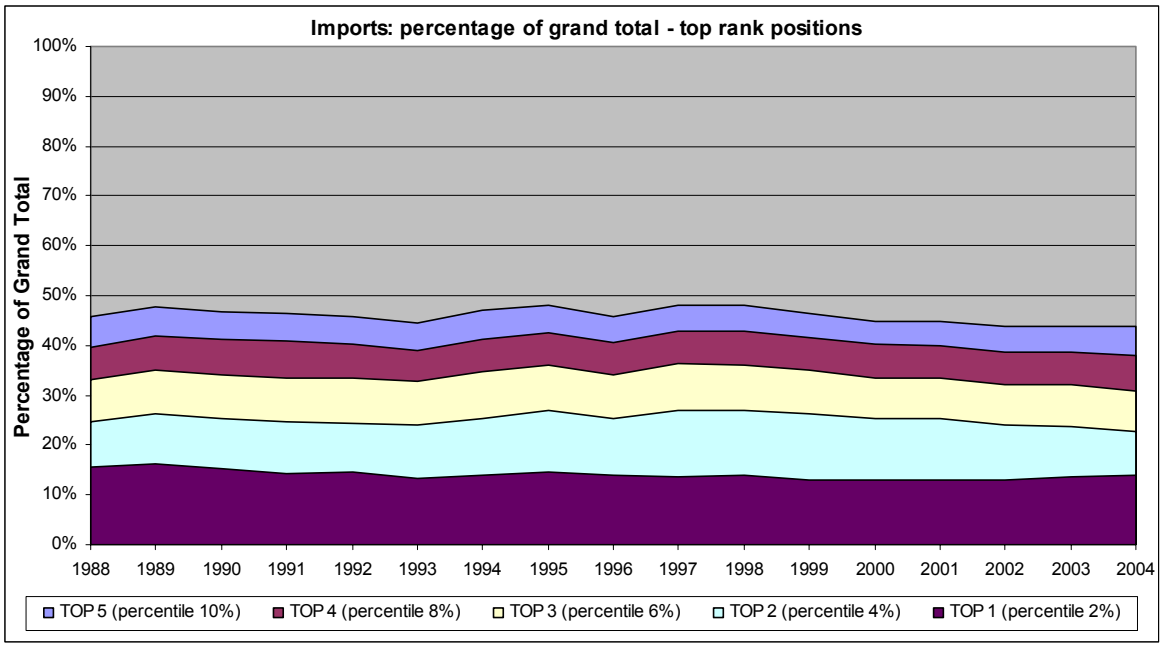
Source: own elaboration from OECD, BTD data

The structure and evolution of the exports is very similar to imports: USA is in the top places of the ranking of partners (is the top purchaser of UK's exports), being followed by a very stable group of countries in the Top10 (see Table 14), most of them EU Member States. The largest variation in the value of exports since 1988 (see Figure 38) corresponds to the USA, with almost double than the second, the one from Germany. The rest of the countries with the most significant variations are EU Member States: France, Ireland, Spain, the Netherlands, etc. The share of the Top5 partners (see Figure 36) has grown during the period from 42% to 52%, mainly due to the increase in the share of the top purchaser, the USA, that grew from 11% to 15% roughly. This tendency of increase of the share of the Top5 purchasers is only found in the case of the UK, as the most common trend is the stabilisation or the reduction of the share.

The main effects of the trade flows in the UK transport systems and networks are the following:

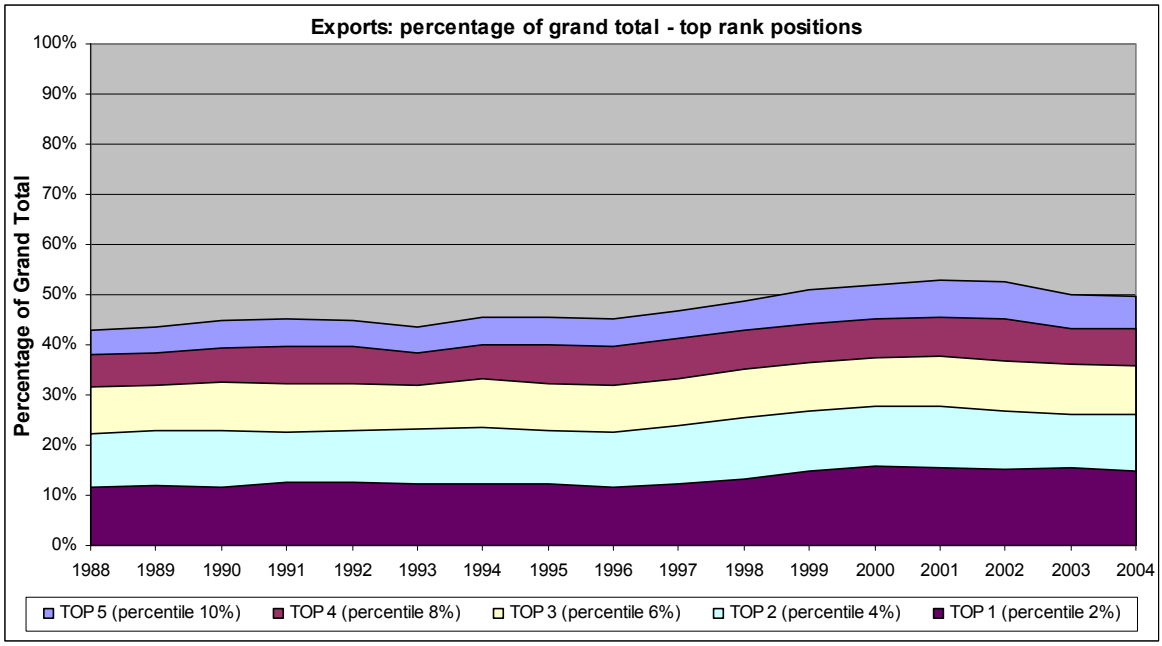
[34] This is a change that has been verified constantly in almost all the countries analysed.

- In general, it can be said that the expected changes in the conformation of the logistic and value of the trade flows are very few, given the high level of stability through time of the UK's commercial partnerships and the already high degree of integration of the logistic operators and the transport networks;
- Of course, the port sector is crucial in the British commercial interchanges. In terms of the total tonnes handled (Eurostat data), the UK national port system was the first in the ranking in 2004 with more than 570 millions of tonnes. It is evident that the pressure of further increases in imports and exports will put more pressure in the port sector and rise the potential for congestion;
- Concerning the land based modes, the UK has followed since the 90s an interesting trend of reduction of the road freight share over the total volume of transported tonnes using land based modes. According to Eurostat data, between 1993 and 2004 the rail freight share (total tonnes transported) change from 8.7% to 11.8%, changing the road share from 91.2% to 88.1%. This can be due to the process of liberalisation in the UK, more advanced than in any other EU Member State, and to the highly developed presence in the rail freight market of specialised private operators.



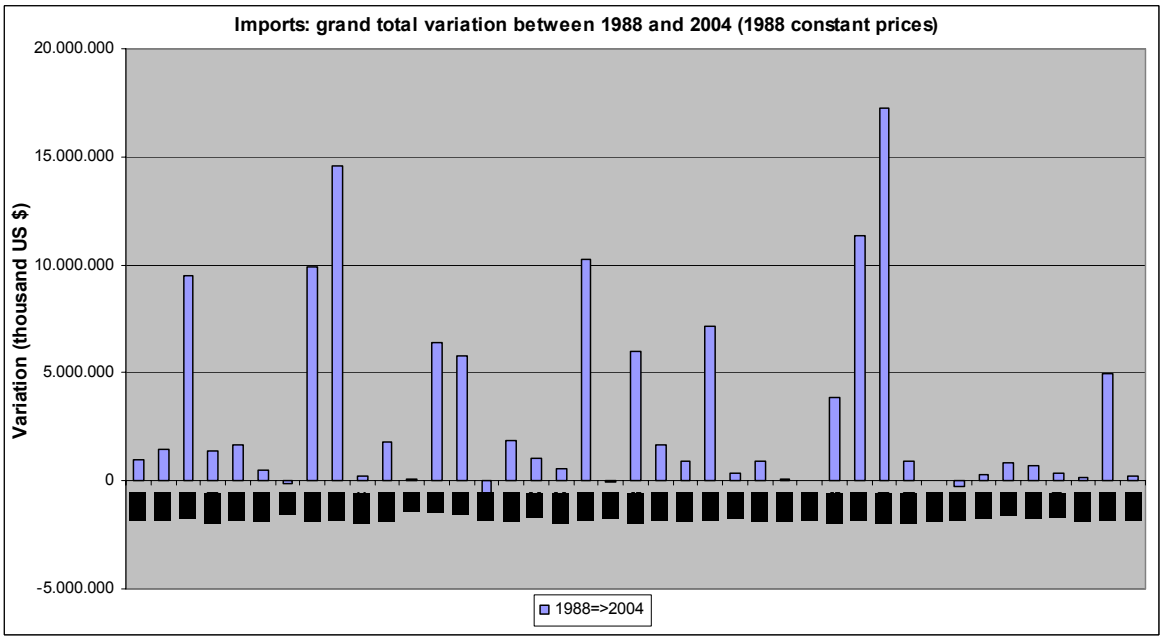
Source: own elaboration from OECD, BTD data

Figure 35: Percentage of total British **imports** from the Top5 commercial partners (1988 constant prices)



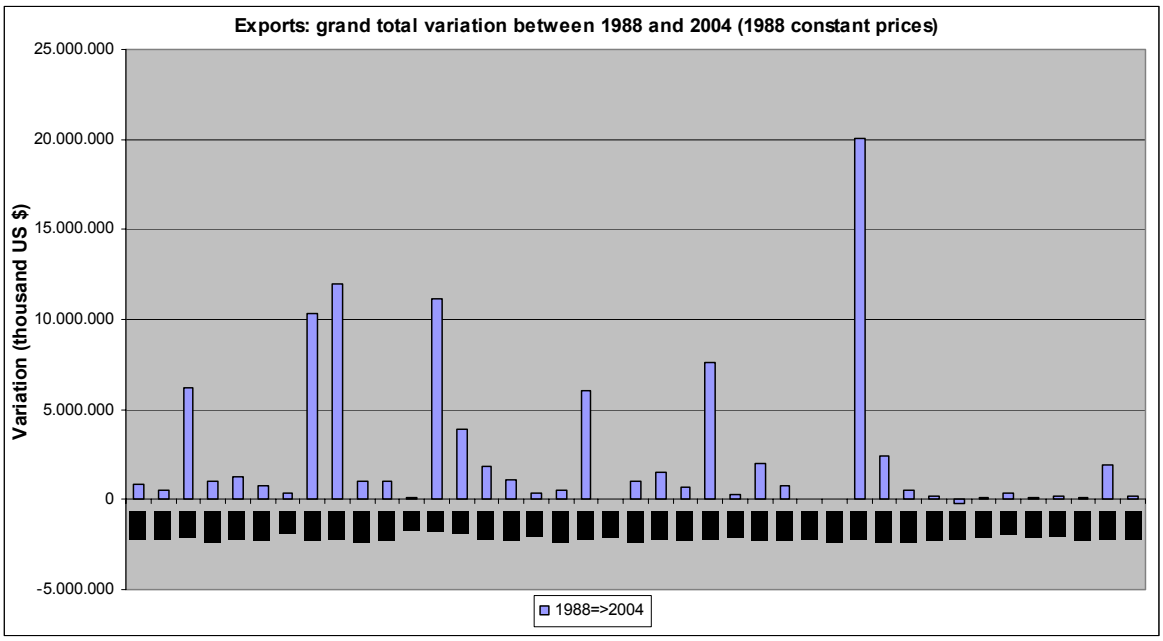
Source: own elaboration from OECD, BTD data

Figure 36: Percentage of total British **exports** absorbed by the Top5 commercial partners (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 37: Variation of British **imports** per commercial partner (1988 constant prices)



Source: own elaboration from OECD, BTD data

Figure 38: Variation of British **exports** per commercial partner (1988 constant prices)

3.8 Czech Republic

The Czech trade flows during the period are characterised by the strengthening of relationships with the EU15 Member States, specially with Germany, a trend that verifies also in Hungary and Poland. Of these three NMSs, the Czech Republic is the one with higher increases in trade and with the most focused commercial flows. However, the analysis of the three is hindered by the lack of data of the OECD databases prior to 1993. This would provide a better understanding of the initial evolution of the Czech's external trade since the fall of the "Iron Curtain".

The main characteristic of the Czech imports structure during the period was the strong links with its two neighbour countries, Germany and the Slovak Republic, the two main providers of the Czech imports (see Table 15). Other important changes in the Top10 ranking are the rise of Italy, Poland, Japan and China[35], and the fall of the Russian Federation, Austria and the USA. The proportion of the Top5 has followed a somehow erratic path with several ups and downs, possible derived form structural adjustments of the Czech economy and trade (see Figure 39). Since 1998 the Top5 share seems to be stabilised following a trend of slight reduction, currently over 50%, with a quite high share of Germany (first provider of imports) over 30% of the total. In terms of the variation on the value of the trade flows (see Figure 41), the largest variation is by far the German one (almost 10.000 millions of 1993 US $) followed by several countries with much smaller values: China (2.000 millions), Poland, Italia, France, Japan (all with increases under the 2.000 millions barrier), and several other EU Member States (UK, Spain, Netherlands).

[35] As seen before, China is one of the most important overseas partners of all EU Member States analysed.

Table 15: Top10 Czech commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	1993	2004	Rank	1993	2004
1	Germany	Germany	1	Germany	Germany
2	Slovak Republic	Slovak Republic	2	Slovak Republic	Slovak Republic
3	Austria	Austria	3	Russian Fed.	Italy
4	Italy	Poland	4	Austria	China
5	Russian Fed.	United Kingdom	5	Italy	Poland
6	United Kingdom	France	6	France	France
7	Poland	Italy	7	USA	Russian Fed.
8	Netherlands	Netherlands	8	Netherlands	Austria
9	Hungary	Hungary	9	United Kingdom	Japan
10	France	Bel-Lux.	10	Poland	USA

Source: own elaboration from OECD, BTD data

The structure of the exports is very similar to imports, with very similar partners and with the two main preferential partners on top: Germany and the Slovak Republic. The most important changes in the Top10 partnerships (see Table 15) are the fall out of the ranking of the Russian Federation and France, and the rises of Poland, France and Italy, all EU Member States, a tendency that confirms the integration of the Czech economy in the EU Internal Market. The share of the Top5 purchasers of Czech exports (see Figure 40) has followed since 1993 two distinctive periods: between 1993 and 1999, the trend was to increase the share of the Top5, with a significant rise of Germany (with a peak of 40% in 1999); and from 1999 on, with a stabilisation in the shares and a trend for slight reduction. The peak of the Top5 share was 67% in 1999, being 60% in 2004. As for imports, the largest variation in the value of the exports purchased comes from Germany (see Figure 42), being the rest much smaller. In these second group, it is remarkable the number of EU Member States present (Austria, France, Poland, UK, Netherlands, Italy, etc), which reinforces the path followed by the Czech economy of swift integration in the EU Internal Market.

The evolution of the structure of the types of goods imported and exported provides an interesting insight to the evolution of the Czech economy since 1993. First of all, the structure of imported goods has suffered some changes. Since 1993, the proportion of mining and quarrying products has fallen 50%, from 10% to 5% of the total imports. In the same period, the percentage of manufactured goods imported changed from 84% to 92%. Second, the structure of exports has not changed largely, as in 1993 almost 88% of the exports were manufactured goods and in 2004 this number rose up to 96%. The relevant change was the shift from medium and low to medium and high technology exports: in 1993, the figures were 40% and 60%, and in 2004 had changed to 60% and 40% respectively. The combination of the changes on imports and exports has a clear origin: the increase in the value of the produced goods by the Czech economy, derived of the changes on its national industry and the relocation of firms. The Czech economy is following an accelerated evolution towards modern production (and transport) structures[36].

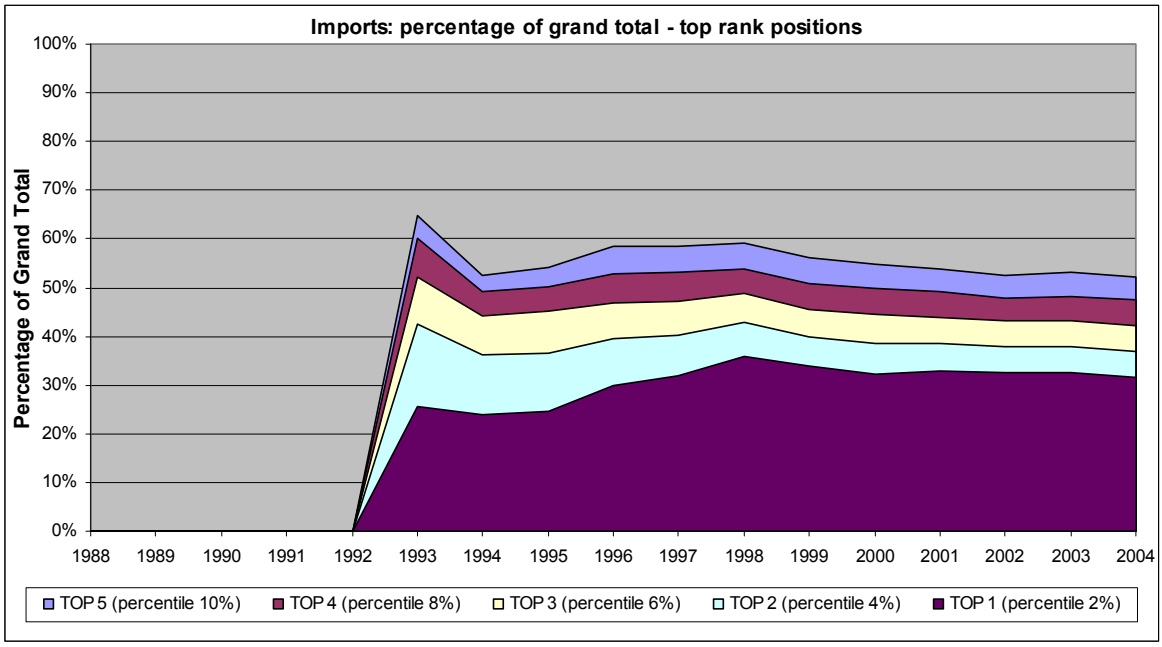
The effects on the transport sector of the trade flows analysed are the following:

- The preferential Czech trade partnerships determine the transport modes used for commerce: the flows are extremely intense, both imports and exports, with Germany

[36] All figures presented in this paragraph are OECD data.

(especially) and the Slovak Republic. Most of these commercial interchanges are performed using the road network: since 1994, the share of road haulage has risen from 50% to 75%. The trend followed by the Czech economy (increase in the average value of imports and exports) suggest further pressure on the road mode with a potential for more congestion;

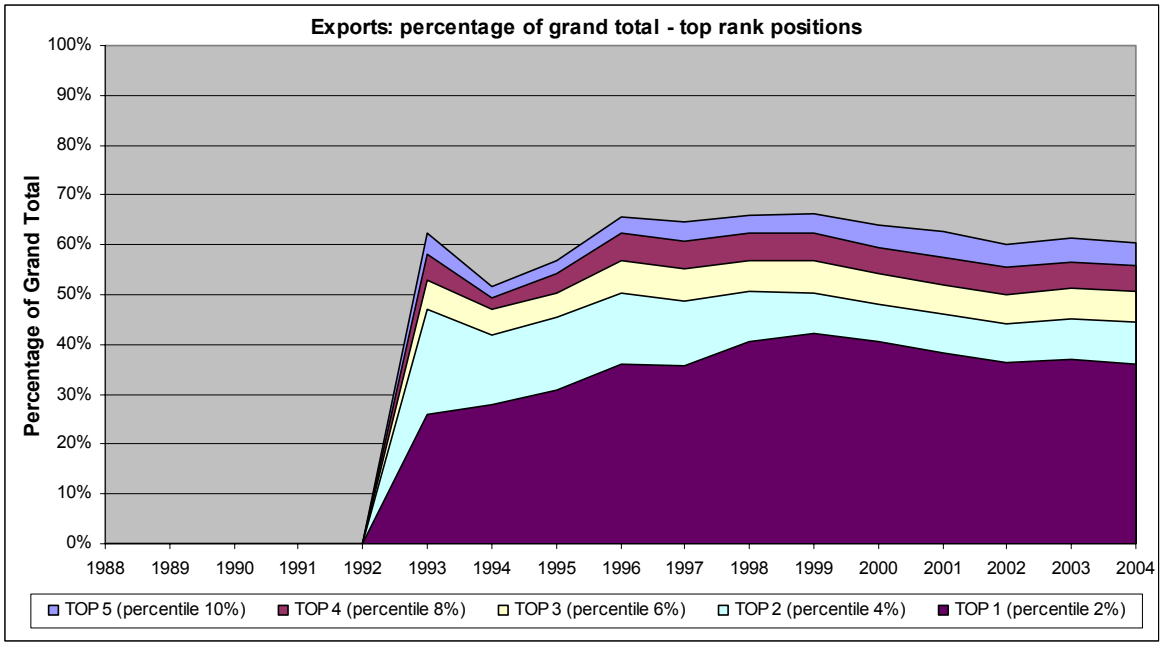
- The rise of the road share has been complemented with a fall of the rail freight share (from 50% in 1994 to 25% in 2004). This can be due to several reasons. First, the type of transported goods has changed: in 11 years the volume of mining and quarrying goods imported has fallen by 50% and the value of manufactured goods has increased due to the increase in exports of medium and high technology goods. In aggregated terms, this means that the volume of bulks transported has decreased and the volume of high value goods has risen, affecting the natural market of rail freight[37]. Second, the Czech rail network is lagging in terms of its ability to respond to the needs of the logistics operators, mainly due to its need of modernisation. And third, apart of the need for modernisation of the railways, the road has gained freight share (and most likely will continue to gain) as a very large proportion of the trade is performed in short and medium distances where road haulage is more competitive: Slovak Republic, Austria and Germany.



Source: own elaboration from OECD, BTD data

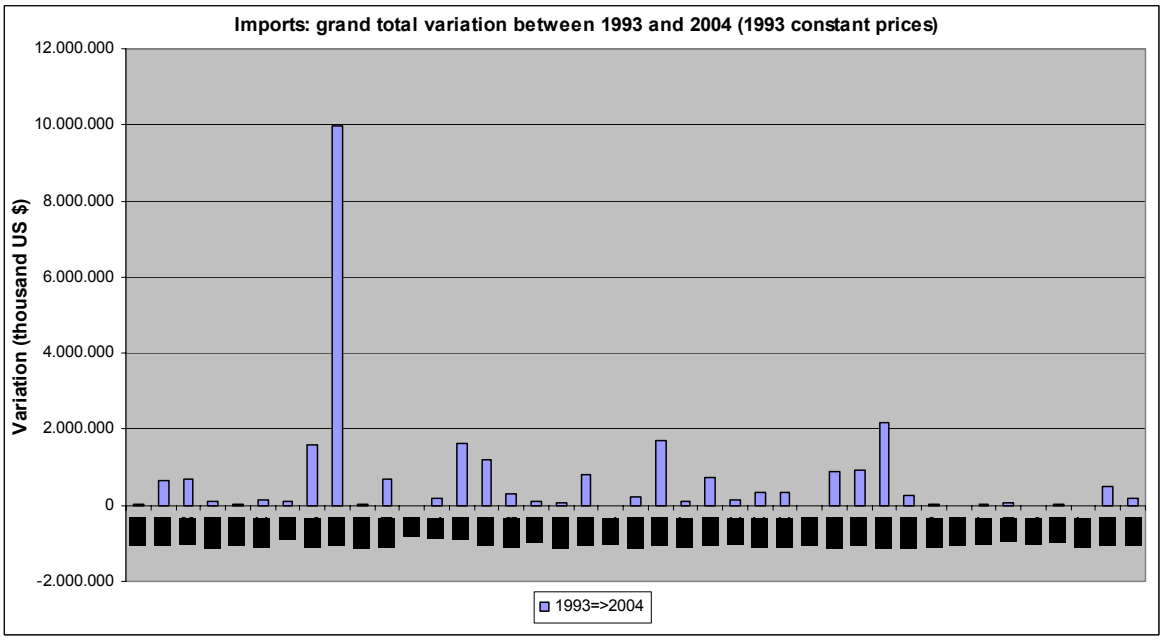
Figure 39: Percentage of total Czech **imports** from the Top5 commercial partners (1993 constant prices)

[37] The bulk transport is a natural market or rail freight, especially those rail networks and systems unable to adapt to the evolution of logistics.



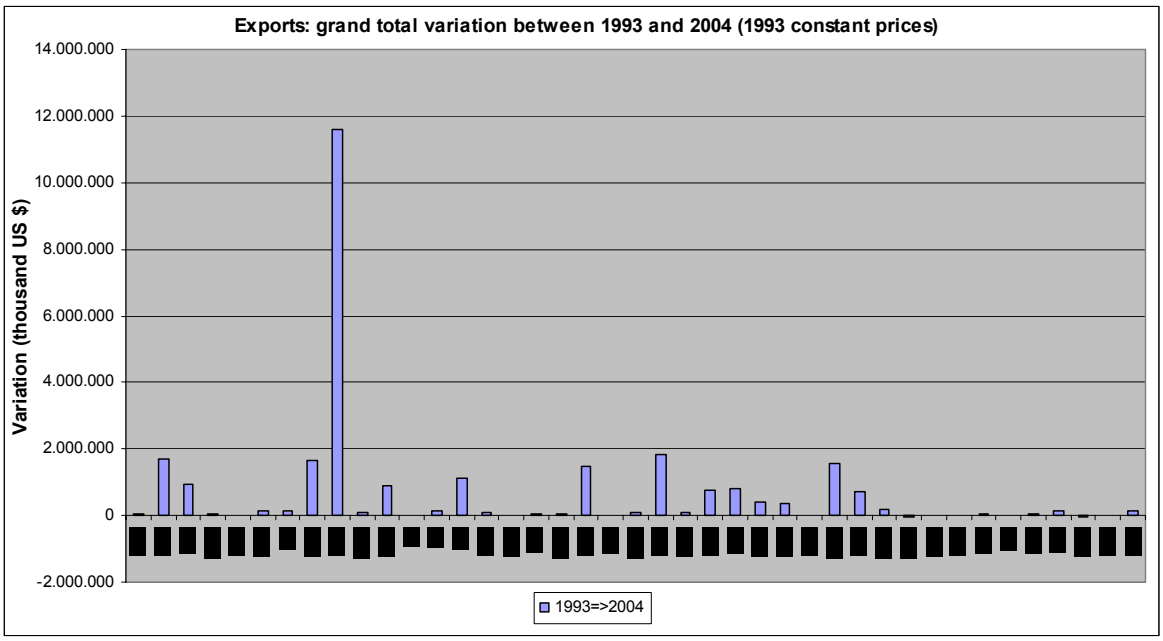
Source: own elaboration from OECD, BTD data

Figure 40: Percentage of total Czech **exports** absorbed by the Top5 commercial partners (1993 constant prices)



Source: own elaboration from OECD, BTD data

Figure 41: Variation of Czech **imports** per commercial partner (1993 constant prices)



Source: own elaboration from OECD, BTD data

Figure 42: Variation of Czech **exports** per commercial partner (1993 constant prices)

3.9 Hungary

The evolution of the Hungarian trade flows is very similar in several aspects to that of the Czech Republic: a common set of partners, a very similar evolution in the composition of imports and exports and a parallel evolution in the transport sectors.

The evolution of the set of main Hungarian commercial partners since 1993 is characterised by the increase in the weight of the EU partnerships and, thus, a larger implication of the Hungarian economy in the EU Internal Market. Between 1993 and 2004 (see Table 16) Germany reached the first place of the ranking, being accompanied in its way up by several UE Member States (Austria, France, Netherlands and Poland). The Russian Federation, Japan and especially the USA (leaves the ranking in 2004) are the partners with the most relevant falls. The share of the Top5 (see Figure 43) grew until 1997, mainly due to the large increase in German imports that reached a total of 30% over the total value. Since 1997 the Top5 share has stabilised, following a slight descent trend that left the share in 2004 over 50% of total value of imports, mainly due to the reduction of the shares of the second, third partners. Figure 45 presents the variation in value per partner, being Germany the one with the largest increase, more than 4 times higher than the second country, China. After these two partners there is a quite large group of EU Member States with significant increases (France, Netherlands, Poland, Austria, Italy, Finland, Belgium and Luxemburg, etc). It is also remarkable the large reduction on the value of total imports from the Russian Federation.

Table 16: Top10 Hungarian commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	1993	2004	Rank	1993	2004
1	Germany	Germany	1	Russian Fed.	Germany
2	Russian Fed.	Austria	2	Germany	Austria
3	Austria	United Kingdom	3	Austria	Russian Fed.
4	Italy	France	4	Italy	France
5	USA	Italy	5	USA	Italy
6	France	Netherlands	6	Japan	Netherlands
7	Netherlands	USA	7	Switzerland	China
8	United Kingdom	Poland	8	Netherlands	Poland
9	Czech Republic	Spain	9	United Kingdom	Japan
10	Switzerland	Czech Republic	10	France	United Kingdom

Source: own elaboration from OECD, BTD data

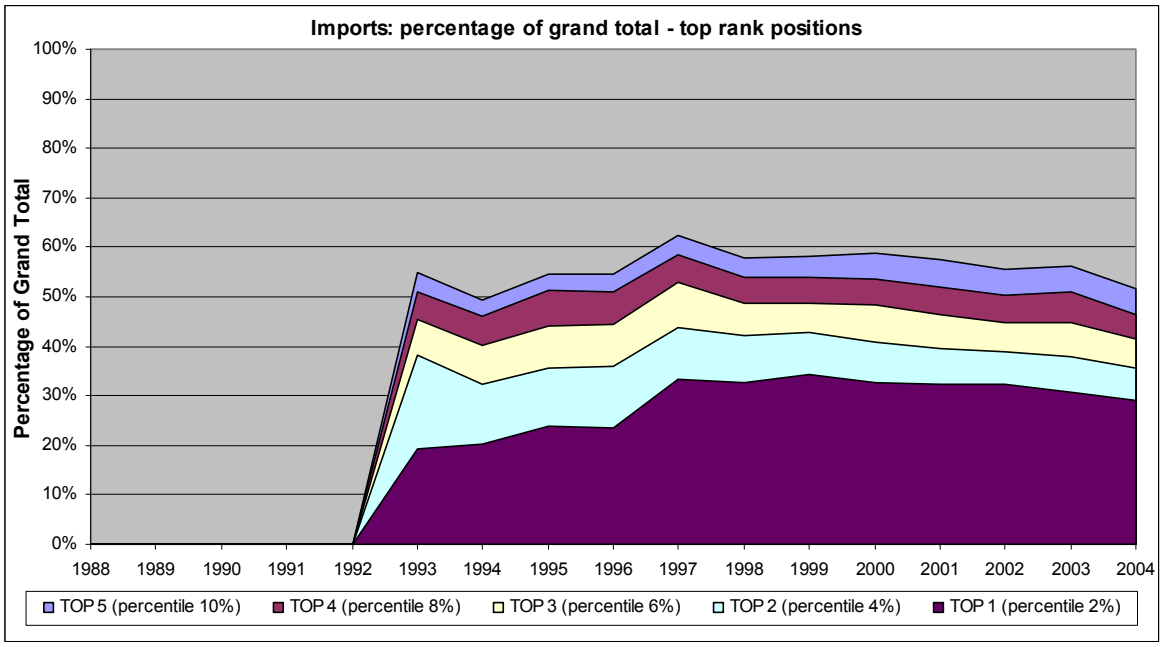
The evolution of the Hungarian exports is very similar to imports, with a background of further integration of the Hungarian economy within the EU Internal Market. As in the import case, since 1993 the main rises in the Top10 ranking (see Table 16) are from EU Member States (Austria, UK, France, Poland, Spain and the Czech Republic) and the main falls from the USA and the Russian Federation (that leaves the Top10). The share of the Top5 purchasers of Hungarian exports (see Figure 44) followed a trend for rising until 1999 mainly due to the large increase during the 90s of the exports to Germany, and a trend to a slight reduction following the stabilisation of the economy and international trade and the subsequent implication in trade activities with other EU Member States The share of Germany is still quite high, over 30% of the total purchases. The main increases in terms of value of exports are again Germany and a large group of EU Member States, another sign of the progressive and firm integration of Hungary in the EU Internal Market (see Figure 46).

The evolution of the structure of the types of goods imported and exported since 1993 is very similar to the Czech Republic. The structure of imported goods has suffered interesting changes, starting for the fall of the proportion of mining and quarrying products: it has fallen by 50%, from 10% to 5% of the total imports, with a rise of the percentage of manufactured goods imported from 87% to 93%. The structure of exports has suffered more important changes, as in 1993 almost 92% of the exports were manufactured goods and in 2004 this number rose up to 97%, with an important reduction of exports of agricultural goods of nearly 65% (from 6.8% to 2.5% of total exports). Another relevant change was the shift from medium and low to medium and high technology exports: in 1993, the figures were 40% and 60%, and in 2004 had changed to 75% and 25% respectively. As in the Czech case, the average aggregated value of the produced goods by the Czech economy has gown, most likely derived of the changes on its national industry and the relocation of firms devoted to manufacture of goods.

As in the Czech case, the types of flows and partnerships and the evolution in the types of transported goods determine the evolution of the transport sector and its perspectives for the near future. The expected effects in the transport system are the following:

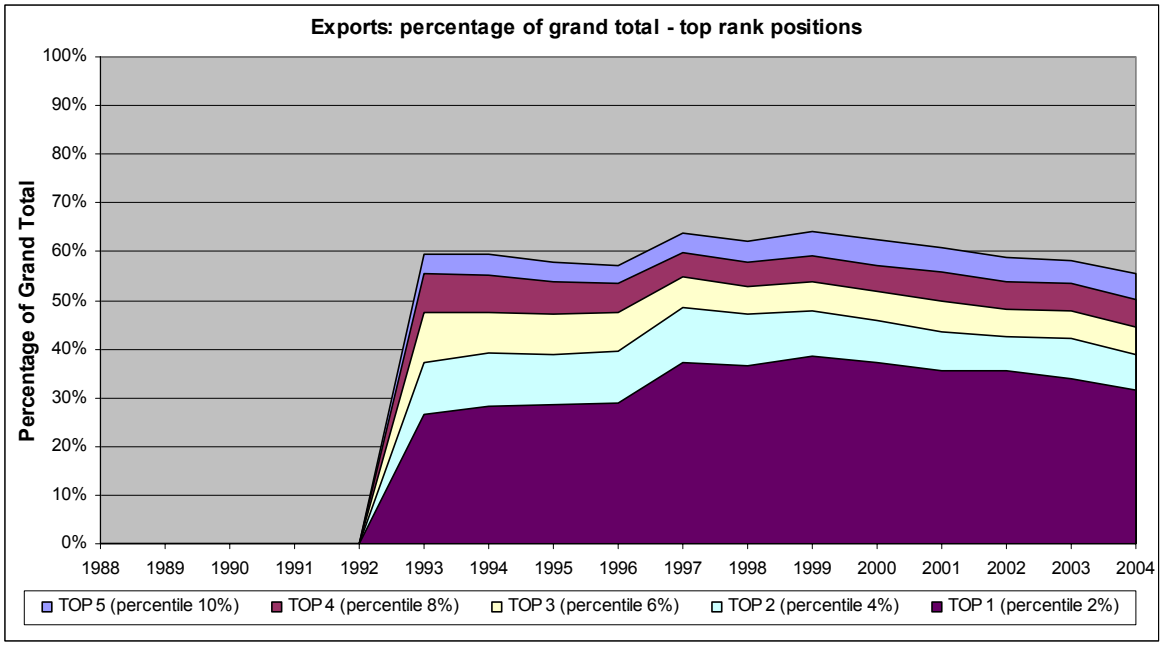
- The road sector has increased its freight share since 1993 from 59% to 66%. It is expected that its share will continue to grow in the near future, due to the increasing commercial relationships with its neighbour countries, Slovakia, Czech Republic and specially Austria, and also due to the types of goods transported, with an average value that has been rising in the last decade;

- The rail freight has lost share, but not as much at it would be expected, given the situation of the Hungarian network (in general terms, needing modernisation) and the pressure from the road haulage sector. The railway share in 1993 was 36% and in 2004 was reduced to 28%. However, the most relevant issue is that the share fell to values around 28% in 1998 and since then the railway sector managed to maintain it. In the near future it is expected more pressure from the road operators (more competence) and from the logistics operators (asking for a higher integration of rail freight in the logistic chains). A point for the rail freight are the long distances of Hungary from its main trade partners, Germany, France, the Russian Federation, Netherlands, etc, that can favour the use of railways, if the correct measures concerning modernisation and investment are taken;
- Inland waterways transport has a significant share over the total tonnes transported and has even managed to increase it since the beginning of the 90s. In 1993 the share was 4.5% and in 2004 6.1%, being the evolution somehow erratic with several ups and downs during the period. Hungary can take more advantage of its situation and the use of the Danube for trade, and the success of this mode will depend on the evolution of the type of good transported and distances travelled, the preferential partnerships (Danube river countries) and the effectiveness of the transport policies promoting this mode.



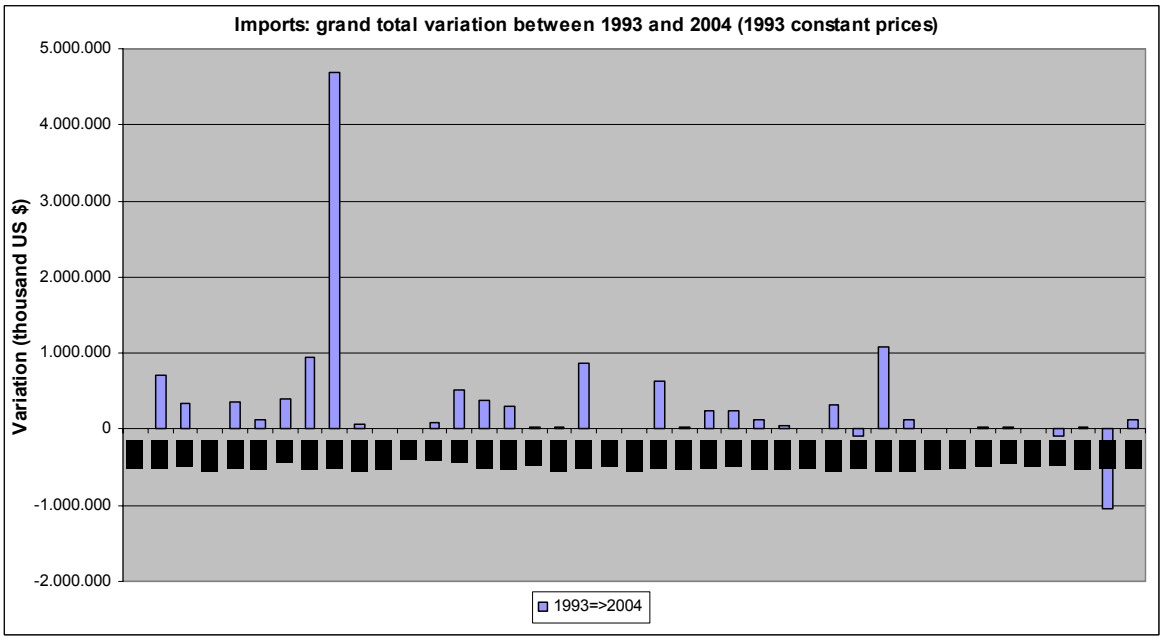
Source: own elaboration from OECD, BTD data

Figure 43: Percentage of total Hungarian **imports** from the Top5 commercial partners (1993 constant prices)



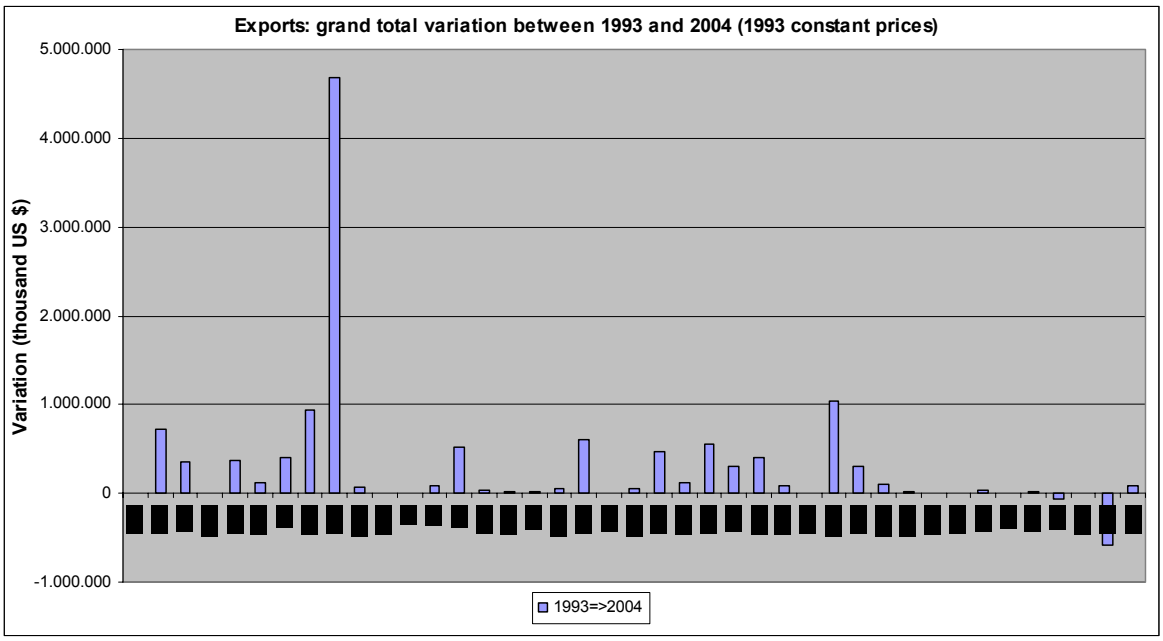
Source: own elaboration from OECD, BTD data

Figure 44: Percentage of total Hungarian **exports** absorbed by the Top5 commercial partners (1993 constant prices)



Source: own elaboration from OECD, BTD data

Figure 45: Variation of Hungarian **imports** per commercial partner (1993 constant prices)



Source: own elaboration from OECD, BTD data

Figure 46: Variation of Hungarian **exports** per commercial partner (1993 constant prices)

3.10 Poland

The evolution of the Polish trade has, as in the cases of the Czech Republic and Hungary a evolution linked largely to the integration of the national economy in the EU Internal Market. The evolution of the transport sector and the composition of import and export flows are also very similar to those of the other NMSs studied.

The evolution of the Top10 Polish commercial relationships since 1992 (see Table 17) is characterised by a general increase in the weight of the EU partnerships and, thus, a larger implication of the Hungarian economy in the EU Internal Market. Between 1992 and 2004 Germany occupies the first place of the ranking, being accompanied by several UE Member States, including Hungary. There is a certain degree of stability, being the USA and Austria the only countries with significant losses in the value of the goods exported to Poland. China entered in the Top10, a sign of the opening of Poland to the global economy. The share of the Top5 (see Figure 47) has been quite stable since 1993, with a significantly high percentage of the top partner, Germany, over 25% of total imports during the whole period. Figure 49 presents the variation in value of imports per partner, being Germany the one with the largest increase. However, this increase is accompanied by large increases from other countries, which means that the base of Polish supplier countries is larger that those of the Czech Republic and Hungary. China and the Russian Federation have quite large increases, together with Italy, France, Czech Republic, Spain, Sweden, Slovakia, etc (all EU Member States).

Table 17: Top10 Polish commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	1992	2004	Rank	1992	2004
1	Germany	Germany	1	Germany	Germany
2	Netherlands	Italy	2	Russian Fed.	Italy
3	Italy	France	3	Italy	Russian Fed.
4	Russian Fed.	United Kingdom	4	United Kingdom	France
5	United Kingdom	Czech Republic	5	Netherlands	China
6	Former Czechosl.	Netherlands	6	Austria	Czech Republic
7	France	Russian Fed.	7	France	Netherlands
8	Austria	Sweden	8	USA	United Kingdom
9	Bel-Lux.	Bel-Lux.	9	Former Czechosl.	Sweden
10	Denmark	Hungary	10	Bel-Lux.	Bel-Lux.

Source: own elaboration from OECD, BTD data

The evolution of the Polish exports is similar to imports, with a background of further integration of the Polish economy within the EU Internal Market: the Russian Federation is the only country in the Top10 not a Member of the EU (see Table 17). The share of the Top5 purchasers of Hungarian exports (see Figure 48) followed a quite stable trend, with a slight reduction from 1999 on. In 2004 the share of the Top5 was over 50%, corresponding to Germany more than a half of the share (30% of the total value of imports). The main increases in terms of value of exports are again Germany (the most significant), Czech Republic, France, Italy, the UK, a group of EU Member States and the Russian Federation.

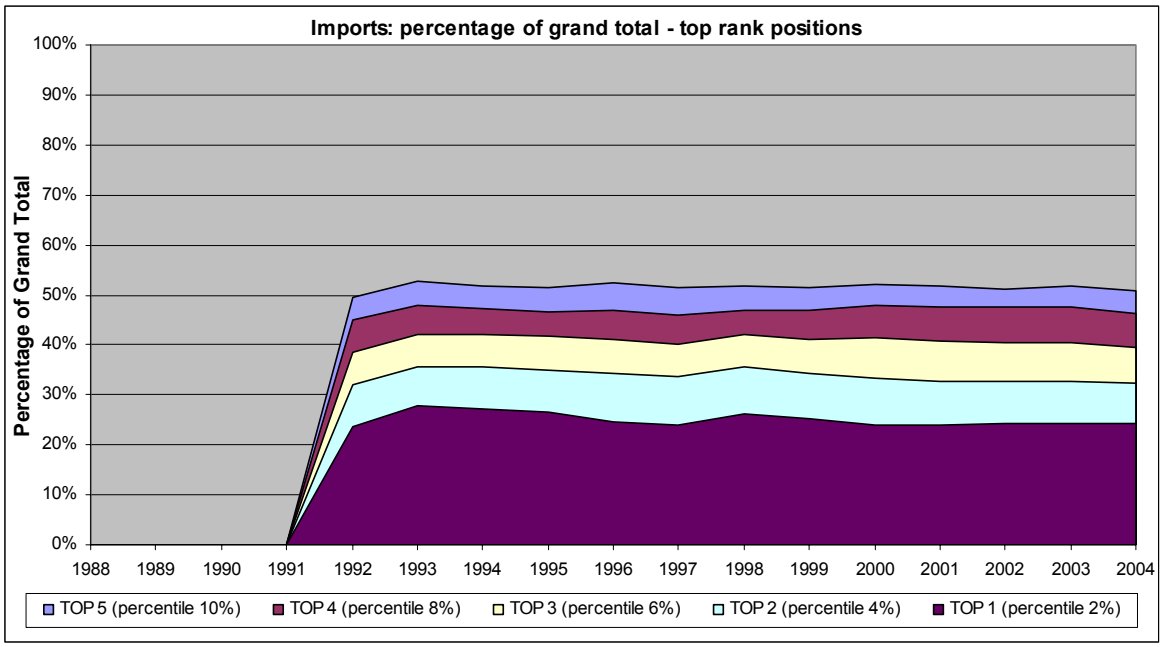
As in the other two NMSs analysed, the evolution of imports and exports in terms of the types of products purchased and produced reveals a patter of modernisation of the Polish economy. The structure of imports has undertaken an structural change in the period under analysis, increasing the share of manufactured goods and decreasing the shares of mining and agricultural products. In 1992 the shares for agriculture products, mining products and manufactured goods were 5%, almost 16% and 79% respectively. In 2004, the shares were 2.4% 7.6% and 89% respectively. The reductions in imports of agricultural and mining products were superior to 50%. The structure of export responds to the same evolution path: increase in the production and export of manufactured goods and reductions in exports of agricultural and mining products. In 1992 the shares of agricultural products, mining products and manufactured goods over the total value of exports were 6.4%, 9.4% and 81.3% respectively, being in 2004 1.8%, 2.2% and 95.4% respectively. The changes per category were 72.3%, 77.4% and 16.3% respectively. The type of exported manufactures in terms of their technological level, there is also a significant change. In 1992 31% of the exports were medium and high technology goods, being 44% in 2004. These trends in exports and imports are signs of modernisation of the Polish economy, in very similar terms to the situations of the Czech Republic and Hungary. The productive systems tend to a specialisation in the production of manufactured goods of higher value, requiring also inputs of higher value and higher technological level.

The effects of the evolution of the Polish trade flows over the transport sector and the expected evolution in the near future are the following:

- The land based sectors have followed a trend since 1993 of intense shift from rail to road freight. In 1993 the shares of land transport (only goods transported by land based modes) were 60.5% for rail and 39% for road haulage. In 2004 these figures had inverted, being 33.5% for rail and 65.8% for road. Given the evolution of types

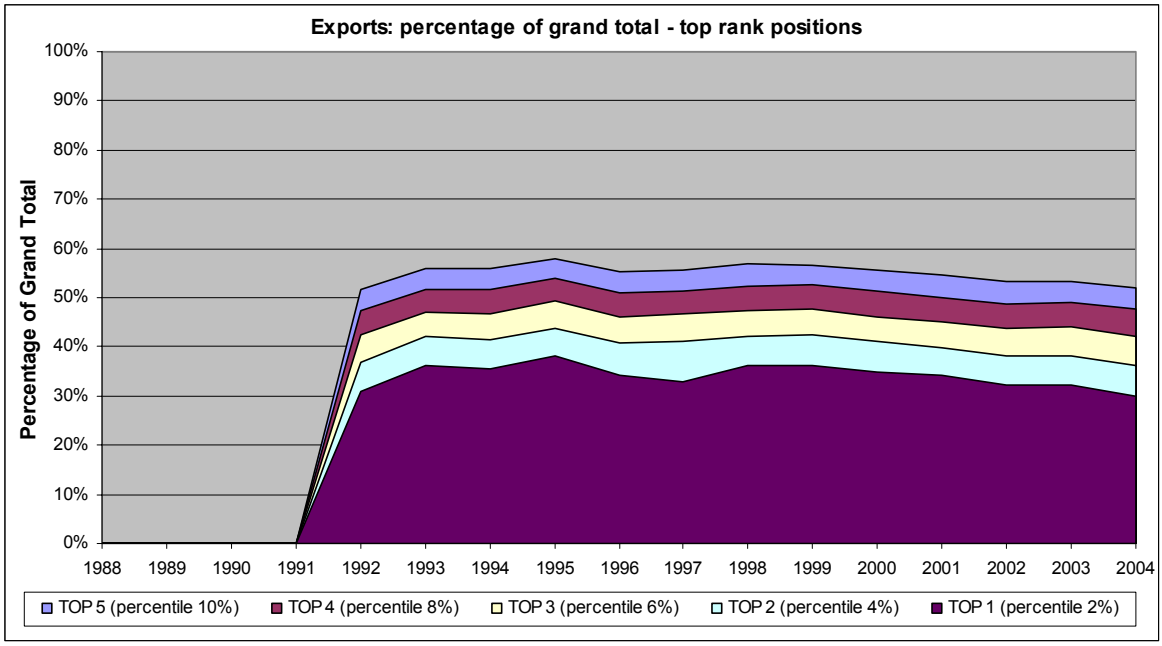
of goods imported and exported (reduction of bulk mining products, increase in high value goods) and the modernisation path that the Polish economy is following (in terms of production), it seems quite likely that the share of road haulage will continue to grow, putting more pressure in the road network and increasing the potential for congestion, specially in the road connections with Germany, the top supplier and purchaser of the Polish economy;

- As mentioned above, rail freight has lost around 45% since 1993 of its share of total tonnes transported by land based modes. Apart from the structural economic changes (shift to a secondary sector economy, increase in the value of produced goods, etc), a key factor for this loss is the need for modernisation of the Polish rail network and the need for an effort to promote interoperability. Some of the top commercial partners of Poland require trips in distances where the rail freight can be competitive in duly integrated in the logistic chains (Russian Federation, France, Netherlands, etc). An effort must be made in modernisation of the network and in the promotion of interoperability and the entry as rail operators of logistic partners that integrate rail in their transport chains, in order to allow rail freight to keep (and even increase) its share in the near future;
- The maritime transport in Poland has grown by 13% since 2001(Eurostat data), in terms of total tonnes transported by the whole national transport system, being the mode used by the overseas commercial partnerships and (potentially) in some intra-EU commercial routes of long distance. To this it must be added the increasing integration of the Polish ports in the Baltic region trade. In overall terms, the Polish port sector can be classified as very dynamic, with one of the highest growth rates since 2000 (together with Spain). In this context, it is foreseeable a further growth of the sector in the near future.



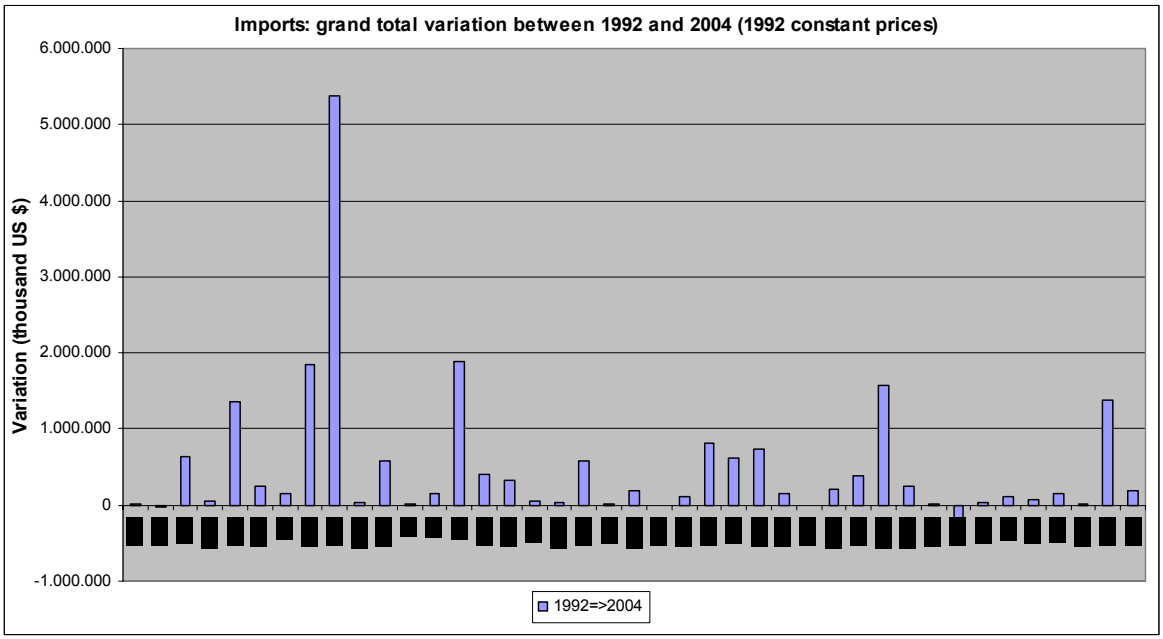
Source: own elaboration from OECD, BTD data

Figure 47: Percentage of total Polish **imports** from the Top5 commercial partners (1992 constant prices)



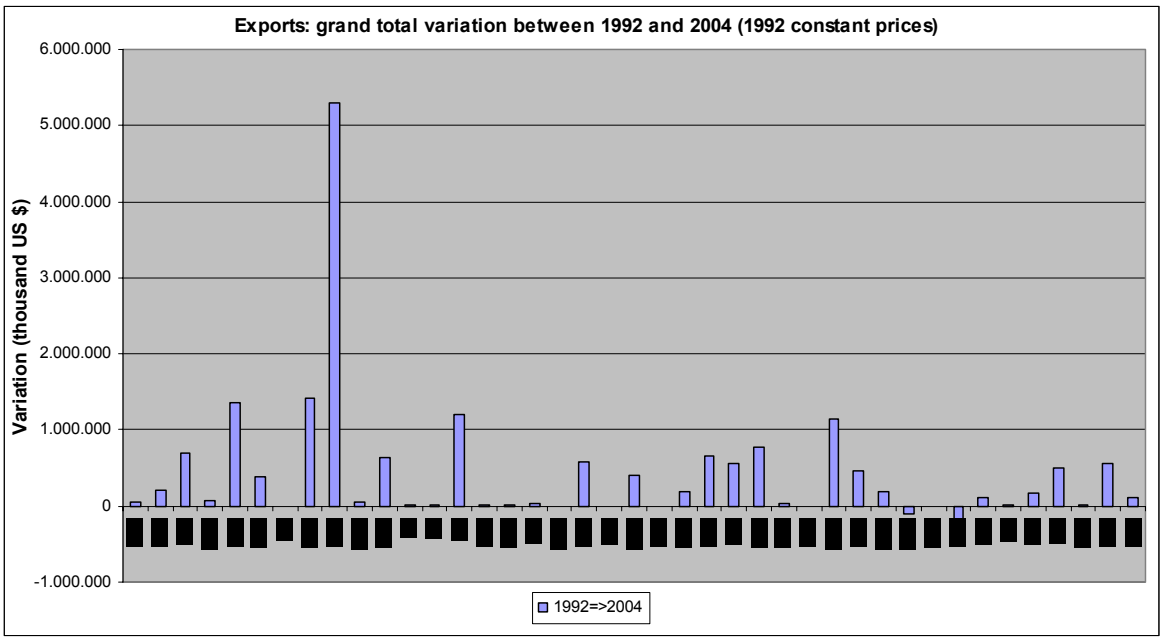
Source: own elaboration from OECD, BTD data

Figure 48: Percentage of total Polish **exports** absorbed by the Top5 commercial partners (1992 constant prices)



Source: own elaboration from OECD, BTD data

Figure 49: Variation of Polish **imports** per commercial partner (1992 constant prices)



Source: own elaboration from OECD, BTD data

Figure 50: Variation of Polish **exports** per commercial partner (1992 constant prices)

3.11 USA

The USA has gone through a process of commercial and trade integration due to the implementation of the North American Free Trade Agreement (NAFTA) in 1994. The NAFTA has meant a significant rise in trade activity between the signing countries, USA, Canada and Mexico. However, in aggregated terms, the effect of the NAFTA agreement in the ranking of Top10 commercial partners for imports and exports was very limited, mainly because Mexico and Canada were already in 1990 amongst the USA preferential trade partners (Canada was first importer and first exporter that year).

As first economy of the world, the structure of the USA trade partnerships is very complex and rich. However, there are three trade blocks quite well defined amongst the Top10 ranking of imports and exports (see Table 18):

- NAFTA countries, Canada and Mexico;
- European countries, all EU Member States;
- Far East countries, China, Taiwan, Korea and Japan.

Table 18: Top10 US commercial partners (imports & exports)

	Top10 - Exports			Top10 - Imports	
Rank	1990	2004	Rank	1990	2004
1	Canada	Canada	1	Canada	Canada
2	Japan	Mexico	2	Japan	China
3	Mexico	Japan	3	Mexico	Mexico
4	United Kingdom	United Kingdom	4	Germany	Japan
5	Germany	China	5	Chinese Taipei	Germany
6	Korea	Germany	6	United Kingdom	Korea
7	France	Korea	7	Korea	United Kingdom
8	Netherlands	Netherlands	8	China	Chinese Taipei
9	Chinese Taipei	Chinese Taipei	9	France	France
10	Bel-Lux.	France	10	Italy	Italy

Source: own elaboration from OECD, BTD data

The structure of the providers of USA imports in terms of main partners has not changed since 1990, except for some ups and downs in the ranking (see Table 18). The main changes have been in rise of China to the second place in 2004 and the fall of Taipei. The rest of the countries loose or gain few positions. The share of the Top5 partners is very stable throughout the period, slightly over the 50% of the total value of imports (see Figure 51). In terms of the changes in the value of traded goods (see Figure 53), the main variations are China followed by Canada and Mexico, and with less important variations Germany and Ireland[38]. The types of goods imported changed very little during the period: the proportions of manufactured goods, agricultural goods and mining goods are almost constant, and the type of goods imported according to its technological level is almost constant.

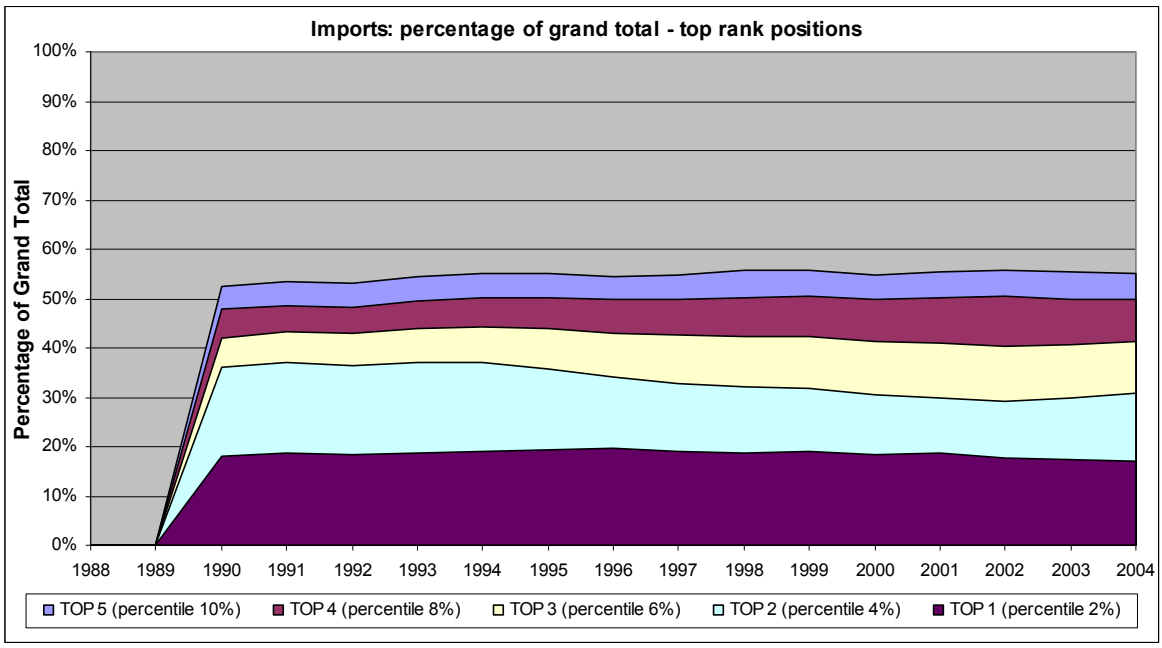
The USA exports are also quite stable throughout the period, with the same Top10 purchasers with the exceptions of the entry of China and the fall out of the ranking of Belgium and Luxemburg (see Table 18). Canada is also the first commercial partner, with Mexico reaching the second place in 2004. The share of the Top5 purchasers is very stable (see Figure 52), slightly over 50% of the total value of exports, having Canada an individual share of more than 20%. In terms of the variations of the value of exported goods by partner, Figure 54 presents very large increases by Canada and Mexico, followed by China (roundly one third of the Canadian increase of value) and a set of minor increases from several countries, including some EU Member States.

The exported goods follow a trend already analysed for several EU Member States: the USA economy has increased the technological level (and thus the value per unit) of the produced and exported goods. Between 1990 and 2004, the proportions of agricultural product, mining products and manufactured goods over total exports changed from 7.3% to 4.4% (a reduction of 39%), from 1.92% to 1.1% (a reduction of 44%) and from 85.5% to 89.9%, respectively. In terms of the technological level of the exported good, there is an increase in the proportion of medium and high level goods over total exports: in 1990 it was 71.8%, being 75.2% in 2004, an increase of 4.7% during the period.

[38] Compared with the variation of the value of China's exports to the USA, the value of the German variation is small taken as a proportional value. However, it is quite large in absolute terms, as it is over 30.000 millions of 1990 US $.

The consequences of the trends analysed in the USA transport sector and the expected effects in the near future are the following:

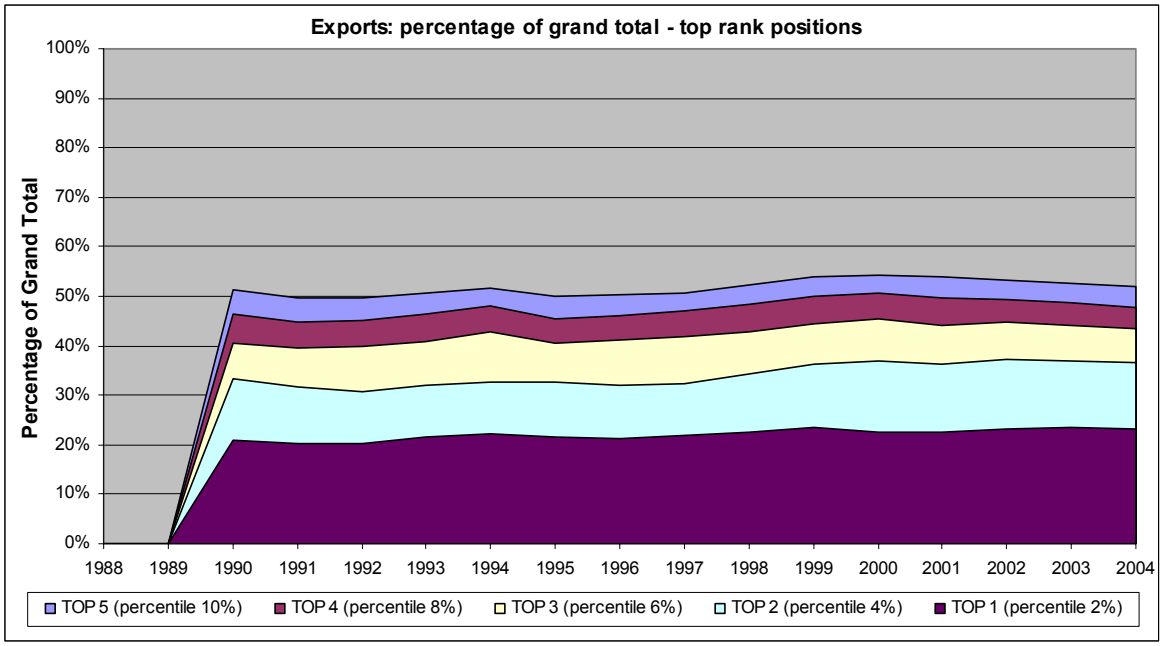
- The long distances travelled by the external USA trade determine largely the transport mode used. In the commercial relationships with Canada and Mexico, it can be found since 1997[39] a trend to reduce the share or road haulage and increase the shares of rail freight and maritime transport. The road share goes from 66% to 60% in the trade with Mexico, and from 71% to 69% in the trade with Canada;
- The USA port sector is key for handling most of the extra-NAFTA external commerce of the USA. The trade flows through the Pacific towards Japan, Taiwan and China, and through the Atlantic towards the EU. The development of the port sector will be especially important in the Pacific routes given the pattern of high growth rate followed by the Chinese economy and the increasingly intense relationship with the USA economy.



Source: own elaboration from OECD, BTD data

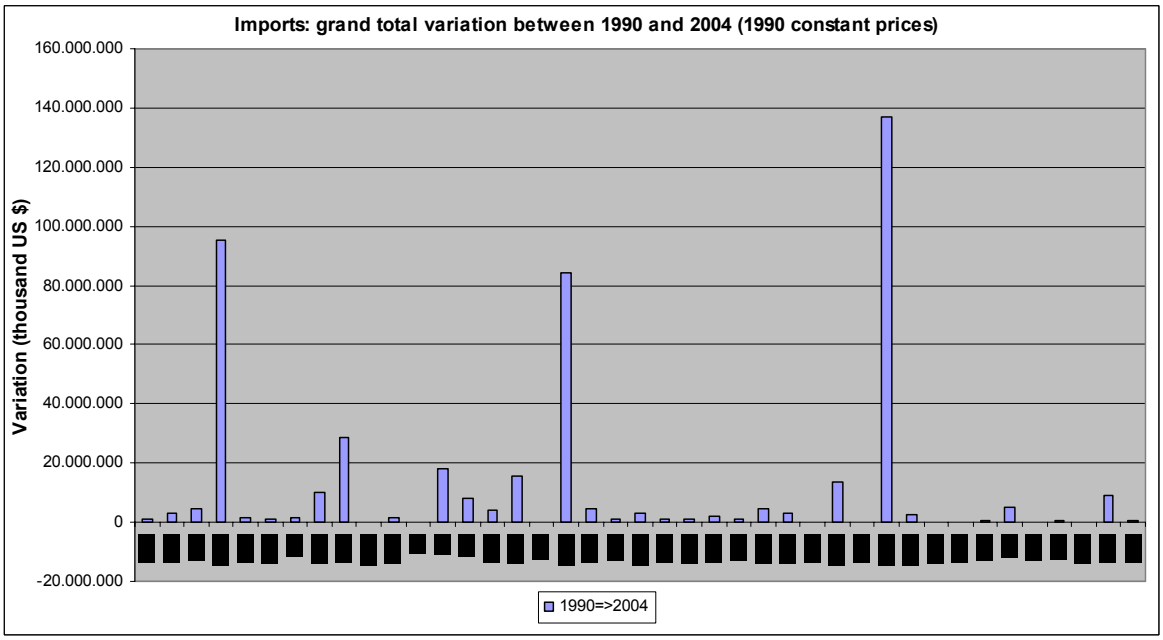
Figure 51: Percentage of total US **imports** from the Top5 commercial partners (1990 constant prices)

[39] 1997 is the first year in the public series from the North American Transportation Statistics with full data from the three main modes.



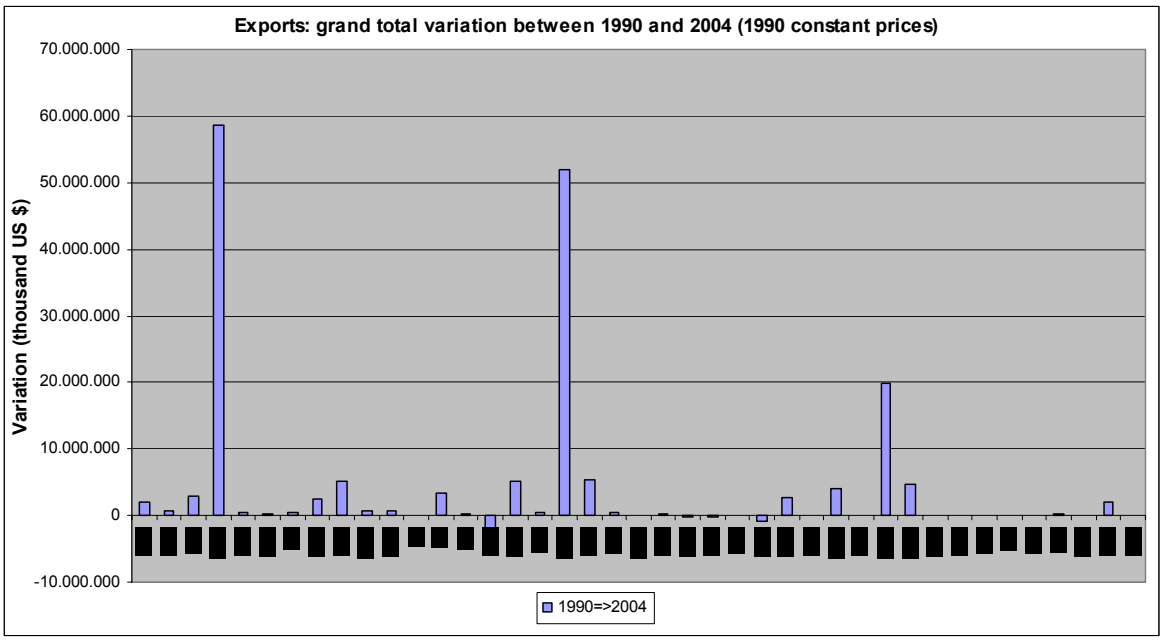
Source: own elaboration from OECD, BTD data

Figure 52: Percentage of total US **exports** absorbed by the Top5 commercial partners (1990 constant prices)



Source: own elaboration from OECD, BTD data

Figure 53: Variation of US **imports** per commercial partner (1990 constant prices)



Source: own elaboration from OECD, BTD data

Figure 54: Variation of US **exports** per commercial partner (1990 constant prices)

3.12 Resume of national effects concerning trade flows and patterns

The following section presents the resume of the analysis of the main commercial flows, their evolution through time and types of transported goods traded. The overall objective is to provide insights of the evolution of the external sector of the national economies and the implications for the transport sector.

Denmark presents a very high level degree of stability on its trade flows, with an economy very integrated in the EU Internal market. The main trends concerning the trade flows since 1988 are: the progressive integration of the Danish external sector in the EU internal market through the reinforcement of the commercial relationships with several EU Member States; and the extension of its trade flows into the global trends, with increased relationships with China. The main effects on the Danish transport sector for the near future according to the present international trade trends are the following:

- Intensive use of the land modes, due to the preferential partnership with Germany and other growing flows with other EU Member States;
- Intensive use of the port sector, given the growing trade flows with countries of the Baltic area and North Sea (UK and Norway), and the increasing commercial flows with overseas countries, especially with China. The situation of several European hub ports can soften this pressure, as some are very near to Denmark: Bremen, Hamburg and Rotterdam;

Finland presents a mixture of commercial partnerships with several changes in the configuration of its main import providers and export purchasers. There are 3 groups of partners that can be highlighted: regional non-EU Member State partners (Russia, Norway and other Baltic states in lesser degree); EU Member States (Germany, Sweden, France and Netherlands

mainly); and overseas partners (USA, China and Japan). The main effects in the near future on the transport sector would be:

- Strong increase in the land based modes due to the large increase of the trade flows with the Russian Federation. The most likely mode increasing its share would be the road, as the situation of the Russian railway network would determine the capacity for responding to the demand for transport;
- The port sector will continue its growth path since the early 90s, due to the increase in maritime activity in the Baltic region and the growing partnerships of Finland with several EU Member States and overseas countries. Since 1996, the Finish port sector has a growth rate of 32% of the total transported tonnes;

France presents very stable commercial partnerships and flows, being the main importers and exporters amongst the same group of countries, mainly EU Member States. The most relevant variations in terms of partnerships are the growing role of Spain both as importer and exporter and the role of China as booming overseas partner. The main effects in the near future on the transport sector would be:

- Most flows are concentrated in neighbour countries (Germany, Spain, Switzerland, Italy and Belgium), putting more pressure in the land based modes. The most likely effect is a rise in the share of road haulage, due to the shorter distances covered and to the present trend of reduction of the rail freight share, though this could be counterbalanced by the success of the European transport policy opening up the markets for long distance and cross-border rail freight;
- The French port sector will continue to grow, as it concentrates 66% of the total extra-EU French trade and handles also important flows from the Mediterranean and Baltic routes. In this context, the global phenomenon of the rise of the Chinese economy will play a key role in the evolution of the tonnage handled by the port sector;

Germany can be considered as pivotal in the trade and transport sectors of the EU for two reasons: first, it is the main EU economy, generating very large flows of imports and exports not only with all EU Member States, but also extra-EU trade, and the subsequent transport flows; and second, its geographical situation in the core of Europe means that its networks also support trade between other European countries. The set of German commercial partners has been very stable through the period analysed, with well defined activities as main importer/exporter within the EU and as key global importer/exporter. The main effects in the near future on the transport sector would be:

- The recovery of the rail share on the total tonnes transported by the land modes depends largely on the evolution of the railway infrastructure in the emerging German partners, the NMSs. If it can not cope with the expected (and already ongoing) increase in trade, road transport will increase its share and put more pressure on the already congested German network;
- Maritime transport is key for the extra-EU German relationships and for trade in several long haul intra-EU routes. The strong increases of commercial flows to/from the

USA and China will rise as potential sources for congestion in the German ports and associated land networks;

The Netherlands present an interesting case of "specialisation" concerning the trade flows: exports flows are very EU oriented, having imports a more "global" orientation. This intense process of globalisation started in the late 80s. In both cases the main partnerships are neighbour countries and other EU Member States, with the inclusion of several overseas partners concerning imports. The main effects in the near future on the transport sector would be:

- The port sector is crucial for the fluent relationships of the Dutch economy, with some of the most important European hubs. The ports sector will suffer from more pressure and a high potential for congestion, not only for the Dutch trade flows, but also due to the concentration of European trade flows passing through them;
- The strong relationships with neighbour countries and other EU Member States and the commercial flows concentrated in the Dutch hub ports will put increasing pressure on the land based modes as far as they continue to grow. Of special importance will be the extra-EU relationships, that tend to use the Dutch port system;

Spain is a case study for evolution of the external relationships of its economy and the evolution of the transport sector. As the Netherlands, Spain presents a characteristic of double integration: first, with the strengthening of the intra-EU partnerships; and second with the increasing integration in the global trade relationships. This dual development has been handled quite separately by the maritime sector (mainly the global integration, extra-EU trade) and the road haulage (the intra-EU trade). The main effects in the near future on the transport sector would be:

- The road haulage is that high in Spain because of the interoperability problems of the railways. This mode is suffering from a lack of modernisation, that means that in the near future any increase in the intra-EU trade will be directly translated into a more intensive use of the road network;
- The port sector in Spain has experienced a large growth in the last decades, being the main mode for the Spanish extra-EU trade and getting increasing importance in intra-EU long haul routes in the Mediterranean and with the North Atlantic and Baltic areas. There are no important congestion problem in the ports (in aggregate terms there is some excess of capacity) but the associated networks are already congested in some locations;

The UK is, of all the European countries analysed, the one with the highest proportion of extra-EU trade over total trade, due to its traditional relationship with the USA. Moreover, both imports and exports have a very similar structure regarding the main partnerships, with a high level of stability in the last decades. The most important new partners are China and Spain, two different trends, globalisation and integration in the EU internal market. The main effects in the near future on the transport sector would be:

- Of course, the port sector is crucial in the British commercial interchanges. It is evident that the pressure of further increases in imports and exports will put more pressure on

the port sector and rise the potential for congestion. Complementary land based networks and their connections to ports must be also taken into account;

- Concerning the land based modes, the UK has followed since the 90s an interesting trend of reduction of the road freight share over the total volume of transported tonnes using land based modes. This can be due to the process of rail liberalisation in the UK, which is more advanced than in any other EU Member State, and to the highly developed presence in the rail freight market of specialised private operators;

The Czech Republic trade flows during the period are characterised by the strengthening of relationships with the former EU15 Member States, especially with Germany, a trend that verifies also in Hungary and Poland. Of these three NMSs, the Czech Republic is the one with higher increases in trade and with the most focused commercial flows. The main effects in the near future on the transport sector would be:

- The preferential Czech trade partnerships determine the transport modes used for commerce: the flows are extremely intense, both imports and exports, with Germany (especially), Austria and the Slovak Republic. Most of these commercial interchanges are performed using the road network. The trend followed by the Czech economy (increase in the average value of imports and exports) suggest further pressure on the road mode with a potential for more congestion;
- The rise of the road share has been complemented with a fall of the rail freight share due to several reasons, but the most important seems to be that the Czech rail network is lagging in terms of its ability to respond to the needs of the logistics operators, mainly due to its need for modernisation;

Hungary has a very similar evolution in several aspects to that of the Czech Republic: a common set of partners, a very similar evolution in the composition of imports and exports and a parallel evolution in the transport sectors. Hungary presents (as the Czech Republic) a fast integration in the EU internal market with strong regional partnerships. The main effects in the near future on the transport sector would be:

- The road sector has increased its freight share in the last decade and it is expected that it will continue to grow in the near future, due to the increasing commercial relationships with its neighbour countries, Slovakia, Czech Republic and especially Austria, haul distances where the road is more competitive;
- The railway share has been fairly stable since 1998 but in the near future it is expected more pressure from the road operators (more competence) and from the logistics operators asking for a higher integration of rail freight in the logistic chains as complexity of transport operation rises;

Poland is undergoing an accelerated process of integration in the EU internal market, as the Czech Republic and Hungary. The evolution of the transport sector and the composition of import and export flows are also very similar to those of the other NMSs studied. It is important to remark the high integration with Germany, first partner concerning imports and exports. The main effects in the near future on the transport sector would be:

- The land based sectors have followed a trend since 1993 of intense shift from rail to road freight. It seems quite likely that the share of road haulage will continue to grow, putting more pressure on the road network and increasing the potential for congestion, especially in the road connections with Germany, the top supplier and purchaser of the Polish economy;
- The maritime transport has grown steadily in Poland, being the mode used by the overseas commercial partnerships and (potentially) in some intra-EU commercial routes of long distance. To this it must be added the increasing integration of the Polish ports in the Baltic region trade. In this context, it is foreseeable a more intensive use of the sector in the near future.

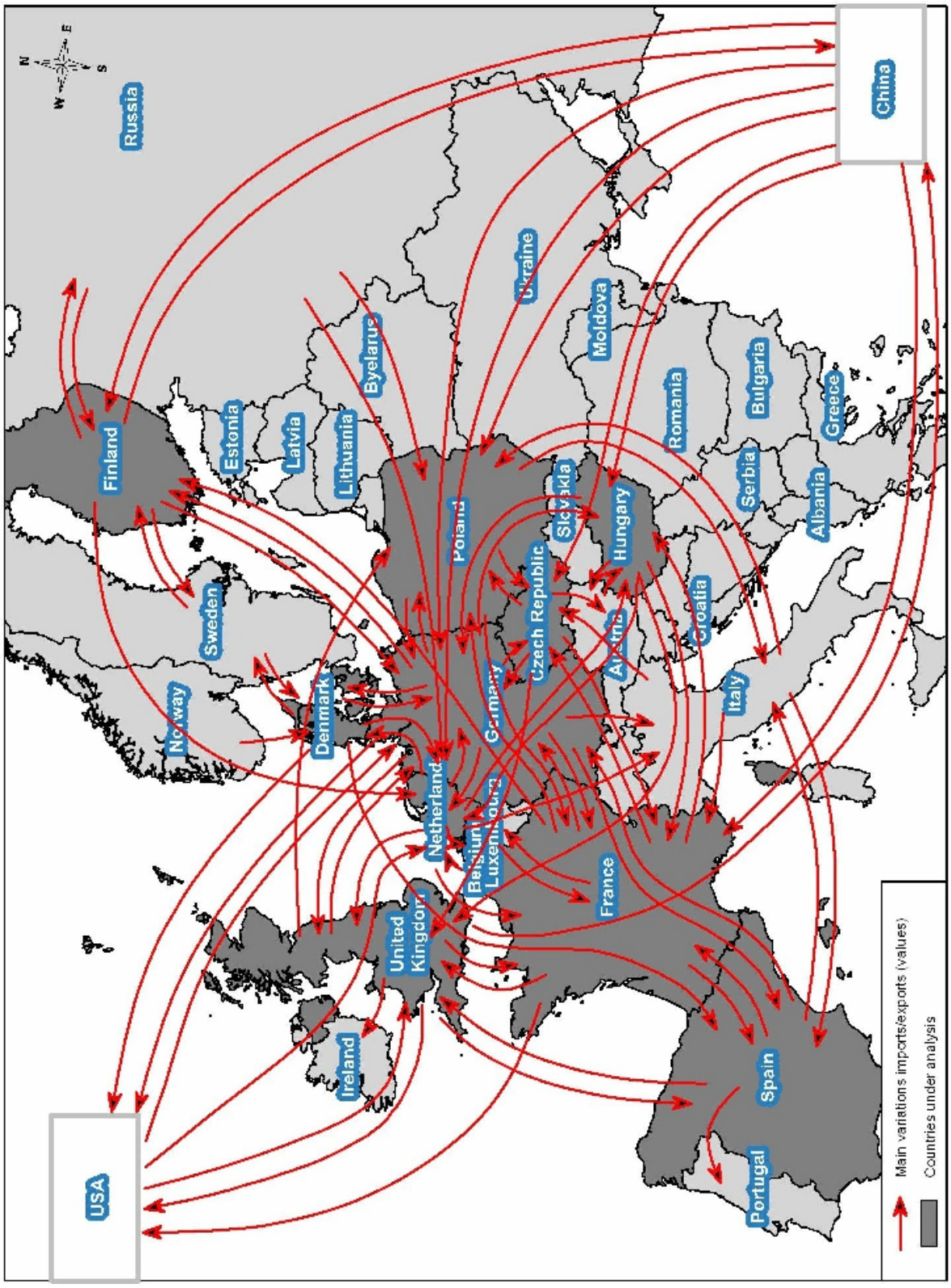
The USA has gone through a process of commercial and trade integration due to the implementation of the NAFTA agreement in 1994, that has meant a significant rise in trade activity between the signing countries, USA, Canada and Mexico. However, in aggregated terms, the effect of the NAFTA agreement in the ranking of Top10 commercial partners for imports and exports has very limited, mainly because Mexico and Canada where already before the agreement amongst the USA preferential trade partners As first economy of the world, the structure of the USA trade partnerships is very complex with three trade blocks quite well defined: NAFTA countries, Canada and Mexico; European countries, all EU Member States; Far East countries, China, Taiwan, Korea and Japan. The main effects in the near future on the transport sector would be:

- The long distances travelled by the external USA trade determine largely the transport mode used. In the commercial relationships with Canada and Mexico, with a trend to reduce the share or road haulage and increase the shares of rail freight and maritime transport. It is expected a similar evolution in the near future;
- The USA port sector is key for handling most of the extra-NAFTA external commerce of the USA. The trade flows through the Pacific towards Japan, Taiwan and China, and through the Atlantic towards the EU. The development of the port sector will be especially important in the Pacific routes given the patter of high growth rate followed by the Chinese economy and the increasingly intense relationship with the USA economy.

Figure 55 presents a schematic representation of the main variations in the value of trade flows between countries, according to the values of the detailed analysis presented previously. The objective of such representation is to put together in one figure all the main increases in trade flows (both intra and extra-EU) for the countries analysed and draw some qualitative conclusions concerning the main regions and transport networks affected. The final objective is to set the basis for the analysis of the potential bottlenecks in transport and logistics, that serves as conclusion of this report.

From Figure 55 we can highlight the high concentration of rising trade flows around Germany, with the former EU15 Member States and the NMSs. Thus, central Europe will face, if trade trends evolve under the same parameters of nowadays, a more intense use of the land based modes. This will be especially important in countries with rail infrastructure needing modernisation, as in such situations road haulage will increase its share steadily. This can be

the case of Poland, Czech Republic and Hungary. Another important transport area will be the North Atlantic and Baltic regions, where the increasing trade flows from overseas partners (USA, China, Japan, etc) concentrate. The port sector will be of utmost importance, as well as the accesses to the associated land based networks.



Source: own elaboration

Figure 55: Schematic representation of the main increases in the trade flows for the EU Member States analysed

4 Structural change of the economies

The main objective of the structural analysis is to assess the evolution of the transport related sectors performance and its insertion in the wider national economies in order to forecast their potential evolution in the near future in qualitative terms. This forecast should provide a view per country and transport sector on the expected trends that they will follow in the near future[40].

In order to maximise the quality of the aggregate information, the analysis on the structural change in the national economies and its potential impact on transport must be performed using several perspectives. For the analysis carried out, three data sources were used:

a) The evolution of the contribution of the transport sectors (road, rail, maritime, air) and other productive sectors linked to transport activities (production of motor vehicles, trailers and semi-trailers and production of other transport equipment) to the economy. This analysis is performed through the analysis of the **Input-Output Tables (IOT) series**, more precisely the **use tables**, which provide the contribution of each transport and transport-related sector to different sectors of the economy. The IOT were provided by Eurostat, except for the Czech Republic, that was provided by the Czech Statistical Office, for years 1995 to 2001. The Eurostat IOT system units are millions of Euros at current prices of each year, with some countries providing data in their national currencies;

b) The evolution of general economic and industrial indicators related to the provision of transport services and to the production of transport vehicles and equipment, such as the contribution as percentage of the transport sectors for the total Gross Domestic Product (GDP). This analysis is performed using data from the **OECD STAN Structural Analysis Database (SAD)** from 1988 on. The STAN database provides information concerning several economic variables, for instance: total production and value added per sector, volume of Gross Fixed Capital Formation, total employment, etc. The STAN Structural Analysis Database (SAD) provides figures at current prices, that were deflated using CPI index series from the OECD in order to provide the most adequate base for comparison between countries through time;

c) The evolution of the balance of payments on transport services (and general services) per country, based on data from the **Eurostat International Trade in Services (ITS) database**. These figures provide information on the balance between transport services performed by nationals of each country to the rest of the world (credits) and transport services performed by nationals of the rest of the world to each country. The Eurostat ITS database provides current data, which were deflated using the already referred OECD CPI series.

[40] For instance, in terms of expected growth or reduction of output, internationalisation, etc.

These sources will be complemented with data concerning transport performance (modal shares, tonnes transported, etc) extracted from several sources, mainly Eurostat and the OECD.

Additionally, this information will be complemented with the conclusions from the analysis of the previous chapter "Changes of trade patterns and trade flows of the EU and US", in order to provide a panorama of the potential bottlenecks for logistics and transport, according to three parameters[41]:

- Expected qualitative evolution of the transport related sectors of the economy;
- Conclusions from the analysis of the evolution of the trade flows between countries;
- Status of the European Transport Networks in terms of availability, density and quality.

4.1 General considerations

In this chapter the methodologies and data that will support the analysis of the structural changes on the national economies and transport sectors are presented. More precisely, the overall methodology used for the Eurostat Input-Output Table (IOT) analysis is introduced, as well as a series of indicators transversal to all countries analysed from the OECD STAN Structural Analysis Database (SAD).

4.1.1 Input-Out Tables (IOT) analysis

The Eurostat IOT system is the source for an important part of this project. The use of IOT was chosen as it provides a common reference framework concerning the diverse sectors of the economy and the relationships between measured in monetary units. The IOT system is fully standardised for all the EU Member States using the same sectorial division and assumptions for harmonisation purposes.

The specific data for the analysis were provided directly by Eurostat and consist of a series of input-output matrixes for several years, varying across countries. In general terms, for the 11 countries under analysis, the years of reference in most cases go from 1995 to 2000. Finland presents data between 1995 and 2001, Hungary between 1998 and 2001, and the Czech Republic between 1995 and 2003 (although highly incomplete, with full data only for 3 years). The only data available for Poland and the USA are one year input-output matrixes, that not allow performing a comparison between transport sectors, much less to investigate on the evolution of the main figures and indicators[42].

The specific focus of the IOT analysis is on the transport related sectors of the economy, the output per sector in terms of value and the relationship with the main aggregates of the economy. The transport sectors are classified (as well as all the sectors of the economy) using the NACE Rev. 1 classification, standard of the statistical figures compiled by EU Member States and used as well by the System of National Accounts (SNA95). The economic sectors used in the analysis are divided into Transport and Storage sectors, devoted to the provision

[41] These three variables will be conveniently described in the chapter "Bottlenecks in future transport and logistic systems".

[42] Polish IOT data were supplied by Eurostat. The USA IOT was supplied by the OECD.

of transport services, and Transport Equipment production sectors, devoted to the production of transport vehicles and equipment.

The division of the Transport and Storage sectors presents an important drawback for our analysis, as provides aggregated all land based modes under one figure. The modes are (considering passenger and freight transport together):

- Land transport, transport via pipelines: as mentioned above, includes all the land based modes (rail, road and pipeline transport);
- Water transport: includes maritime transport (sea and coastal) and inland waterways transport;
- Air transport (both scheduled and non-scheduled);
- Supporting and auxiliary transport activities: includes cargo handling, stevedoring activities, storage and warehousing, operation of railway, air and port terminals, activities of travel agencies and tour operators, etc.

The Transport Equipment production sectors include the following sub sectors:

- Production of motor vehicles, trailers and semi-trailers, parts and accessories for motor vehicles and their engines;
- Production of other transport equipment, including railway and tramway locomotives and rolling stock, building and repairing of ships and boats, aircrafts and spacecrafts, and other transport equipment.

The aggregation problem concerning the land based modes was overcome splitting the value of that figure between the modes using the modal shares per country and year supplied by Eurostat. This solution presents two problems:

- First, the values for rail include the pipeline share, as the split was used multiplying the original IOT values for land transport by the road transport share per country and year (this modal share split was based on Eurostat publication "Energy, Transport and Environment Indicators 1009-2001", European Communities, 2004). This might introduce some distortion in some countries with high pipeline transport shares;
- And second, the configuration of the output values of rail and road transport is exactly the same, as there is no way to differentiate them. This means that some accuracy is lost in the analysis of the contribution of each mode to the aggregates we present and some conclusion could be slightly out of balance in countries were rail and road transport have very different roles in the economy.

Despite the two problems mentioned, the method for splitting land transport figures into rail and road figures is the only feasible way for extracting disaggregated conclusions and, subsequently, providing a proxy for the real values.

The methodology for the analysis of the 7 sectors selected was based on the calculation of the uses given by the main sectors of the economy to the output value of each transport sector. In other words, the analysis focuses on the value produced by each transport related sec-

tor of the economy and how it is split in the main uses given to it by groups of agents. The economic parameters analysed were:

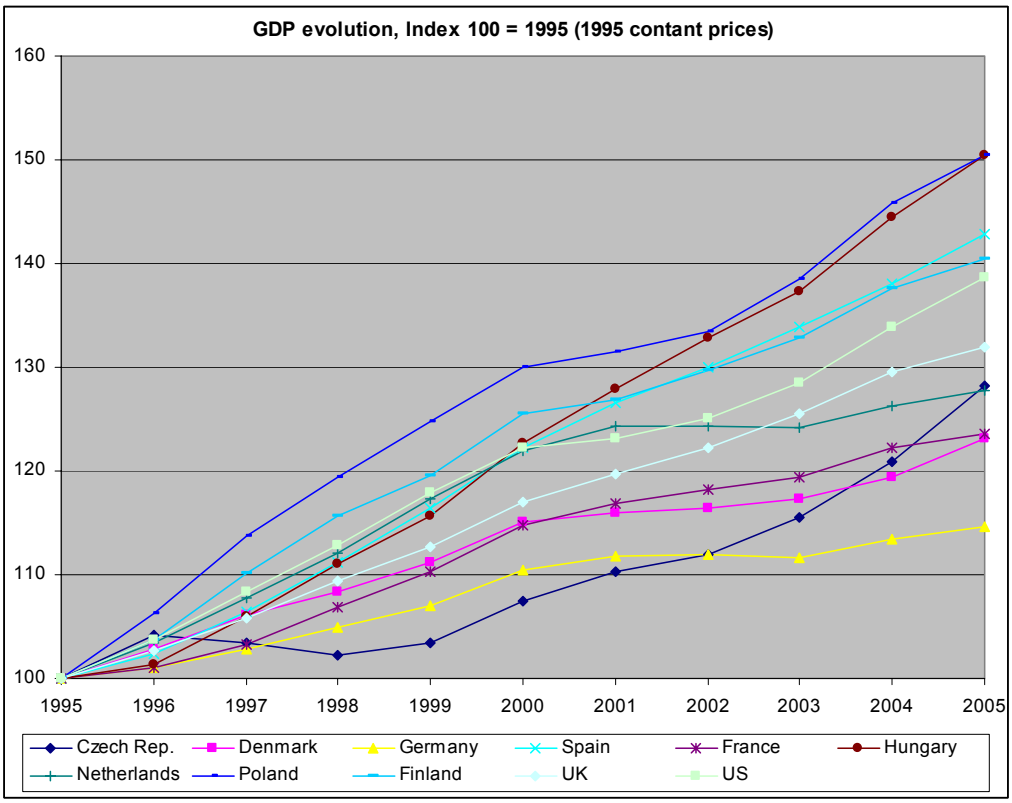
- Contribution to the external sector, this is, output consumed for export purposes (named "Export" in the figures presented), analysed for both transport service and production sectors;
- Contribution to the consumption of households or output consumed by the households ("ConsHH"), , analysed for both transport service and production sectors;
- Contribution to consumption of the public sector of the economy ("ConsGov"), relevant only for the transport service sectors;
- Contribution to consumption by other sectors of the economy as intermediate inputs used ("InterP"), analysed for both transport service and production sectors;
- Contribution to the investment, measured in terms of Gross Fixed Capital Formation (GFCF) undertaken by other sectors of the economy ("Invest"), relevant only for the transport production sectors.

The conjunction of these 5 indicators provides a full picture of the uses given to the output value produced by each transport sector. The evolution of the indicators through time can provide information concerning the structural trends underlying per transport mode and potential development lines, mainly in qualitative terms.

4.1.2 STAN Structural Analysis Database (SAD) analysis

In this chapter we present several data that will support the analysis of the structural changes on the national economies and transport sectors, complementing the IOT analysis results. More precisely, these data present transversal variables for all countries and all transport related sectors. The origin of the data is, in most cases, the OECD STAN Structural Analysis Database (SAD). The data are presented in figures that will be referenced throughout the texts of the national analyses presented in this Annex. Additionally, brief descriptions of the data and their evolution are presented together with the figures.

The evolution of the GDP in the 11 countries analysed is presented in Figure 56. The first general trend that can be highlighted is the sustained growth of the GDP in all the countries during the 10 years under analysis, with the exception of a reduction by the Czech Republic in the late 90s. The most dynamic economies in the period were those from Poland, Hungary (both with a GDP growth of 50% in 10 years), Spain, Finland and after them the US.



Source: own elaboration from Eurostat data

Figure 56: Evolution of the **Gross Domestic Product** in the countries analysed

Two of the most relevant figures for the analysis of this part of the project are Figure 57 and Figure 58 that represent the contributions of the transport and storage sectors (services) and transport equipment sectors (production) to the total GDP respectively. More precisely, the figures are presented as percentage of the Value Added created by each sector over the total annual GDP measured in 1995 constant prices[43]. The Value Added is defined by the OECD as a derived measure from the difference between Total Production and use of Intermediate Inputs as is usually referred as "GDP by industry". Thus, the Value Added provides an accurate measure on the real contribution of the transport related sectors to the total value of goods and services produced.

The classification of industries of the OECD STAN Structural Analysis Database (SAD) is, of course, the same as the one used by the STAN Bilateral Trade Database (BTD) classification and fully compatible with the one used by Eurostat in the IOT system and in the Standard National Accounts (SNA95) Convention[44] and all the Eurostat trade databases. This guaran-

[43] The origin of the data is OECD STAN Industrial Analysis Database at current prices. The figures were duly converted to 1995 constant prices using the same CPI index series used along this report.

[44] The OECD databases use the ISIC Rev. 3 classification of goods and services for all manufacturing and non-manufacturing sectors, fully compatible with the NACE Rev. 1 classification used by EU Member States.

tees that the analysis of the several sources is not only compatible but provides a high degree of consistency[45].

There will be three groups of additional data from the OECD STAN Industrial Analysis Database providing information for the national analysis: production data per sector (more precisely, Value Added created), investment per sector (measured in terms of total Gross Fixed Capital Formation) and total intermediate inputs consumed in the production process per sector.

Figure 57 presents the evolution since 1995 of the contribution of the Transport and Storage sectors to the total GDP in the 11 countries analysed. The four sectors included (considering passenger and freight transport together) are the following:

- Land transport, transport via pipelines: includes rail, road and pipeline transport[46];
- Water transport: includes maritime transport (sea and coastal) and inland waterways transport;
- Air transport (both scheduled and non-scheduled);
- Supporting and auxiliary transport activities: includes cargo handling, stevedoring activities, storage and warehousing, operation of railway, air and port terminals, activities of travel agencies and tour operators, etc.

In general terms, the transport sectors have a fairly stable participation in the GDP through time, meaning that transport and GDP have a similar growth rate. The exception to this stability trend are Hungary, that has a strong reduction in the percentage of participation of transport in the GDP (from 7% in 1991 to less than 5% in 2001), as well as the UK and the Netherlands although in a lesser degree (from 5.5% to 4.5% and from 5% to 4.4%, respectively). The main increase comes from Finland (6.5% to 7.2%).

In terms of the GDP percentage, the largest share of the transport modes in the GDP comes from Finland and Hungary. However, the reduction of the latter since the beginning of the 90s brings it to the middle of the table. For 2003, the percentage varies from the 7.3% of Finland to the 2.9% of the US[47].

Figure 58 presents the contribution of the Transport Equipment production sectors to the total GDP. The sectors included are the following:

- Production of motor vehicles, trailers and semi-trailers, parts and accessories for motor vehicles and their engines;

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[45] The United Nations Statistics Division (UNSD) provides a comprehensive list of all statistical classifications used. Source: http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2&Lg=1

[46] This figure is treated later in this report in disaggregated terms dividing per year the total value between the shares of each transport mode using Eurostat figures. More precisely, the publication: *Energy, Transport and Environment Data 1991-2001*, the same source of data used for obtaining the road and rail modal shares in the IOT analysis.

[47] For the Czech Republic and Poland there are no available data concerning the contribution of the transport sectors to the GDP at the STAN Industrial Analysis Database.

- Production of other transport equipment, including railway and tramway locomotives and rolling stock, building and repairing of ships and boats, aircrafts and spacecrafts, and other transport equipment.

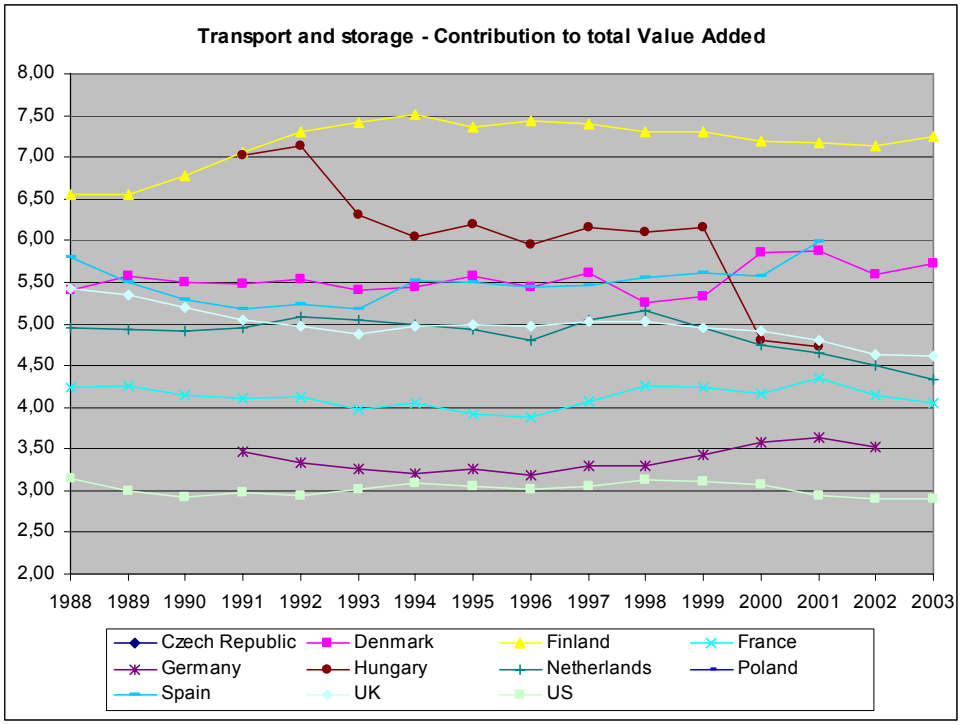
The evolution of the contribution of the Transport Equipment production sectors for the total GDP is quite variable. In general terms, the level of variation through the period is quite high, reflecting trends such as the increase of motor vehicles production in the NMSs. For instance, the Czech Republic and Hungary have experienced important increases in the participation on the GDP of the transport-related production sectors (from 2% to 3.2% and from 0.7% to 2.3%, respectively). Moreover, Germany typically presents a high percentage of participation of the Transport Equipment production sectors on its economy, the highest and the most sustained through time in Europe. The most common percentage of the sector on the GDP can be found around 2%, from countries such as France, UK, US and Spain, with a significant Transport Equipment industry.

Figure 59 and Figure 60 present the annual average percentage of Gross Fixed Capital Formation (GFCF) of the transport-related sectors for the total figures of GCFC for each national economy. The GCFC measures the annual value of the total purchases, less disposals, of new tangible assets (such as machinery and equipment, transport equipment, livestock, constructions) and new intangible assets (such as mineral exploration and computer software) to be used for more than one year in the production of goods and/or services[48]. In other word, the GFCF provides figures of the investment in assets to be used in the production process.

In general terms, the percentage of the GFCF generated by Transport and Storage sectors (see Figure 59) is quite unstable through time, with examples of several countries that performed large investment efforts since the late 80s. For instance, Finland presents a very high rate of investment in the transport and Storage sectors between 1991 and 2000 with a peak of 12% over the total GFCF of the economy. Denmark presents similar high rates with average values around 12.5%. The evolution of the UK is quite remarkable: from 1988 to 2003 the annual average percentage of transport and storage GFCF over total GFCF has more than doubled, changing from 6% to 13%. The three countries with the lowest GFCF figures are examples of developed economies with (arguably) low needs of investment in assets for the transport sectors, which are mainly infrastructures and equipment: the US, Germany and UK.

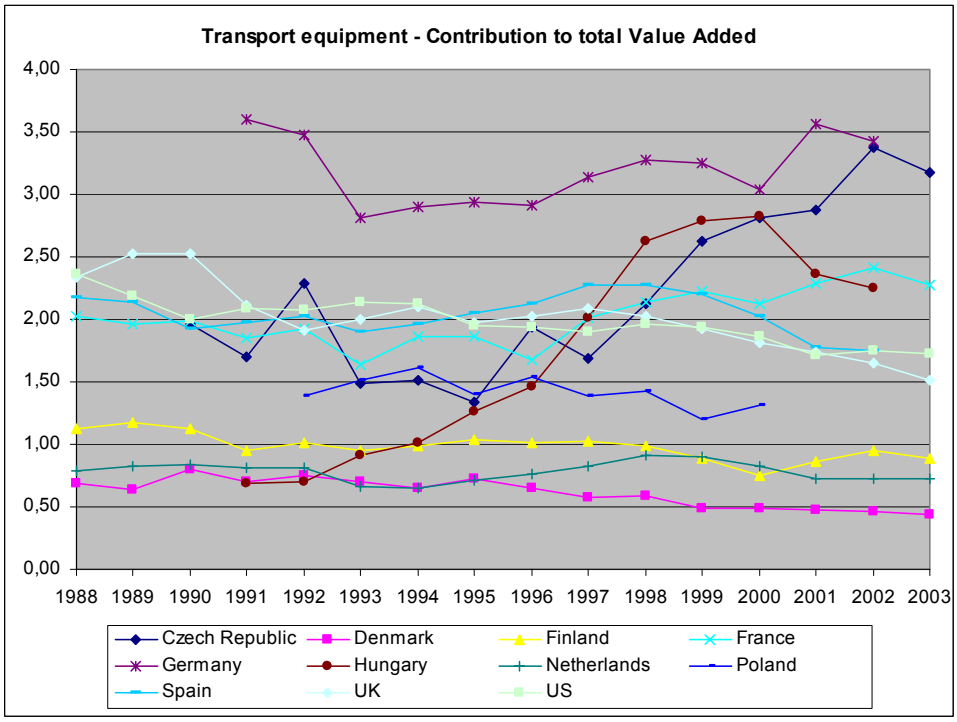
There are several countries that do not provide GFCF figures, more precisely, the Czech Republic, Poland, Hungary and Spain. This means that there is no data concerning three of the most important countries for our analysis, the NMSs under analysis, and an example of the evolution of a NMS of the 80s, Spain. The unavailability of the data will not hamper seriously the results of the analysis per country, but indeed reduces the capacity for comparison across the economies. For instance, it does not allow assessing the evolution of the Spanish economy investment rate in years with huge investment in infrastructures, mainly ports and roads.

[48] Excluded are acquisitions of land, mineral deposits, timber tract etc (although their improvement and development are included) and government outlays primarily for military purposes (source, OECD).



Source: own elaboration from OECD, SAD data

Figure 57: Evolution of the contribution of **Transport and Storage** sectors to total GDP

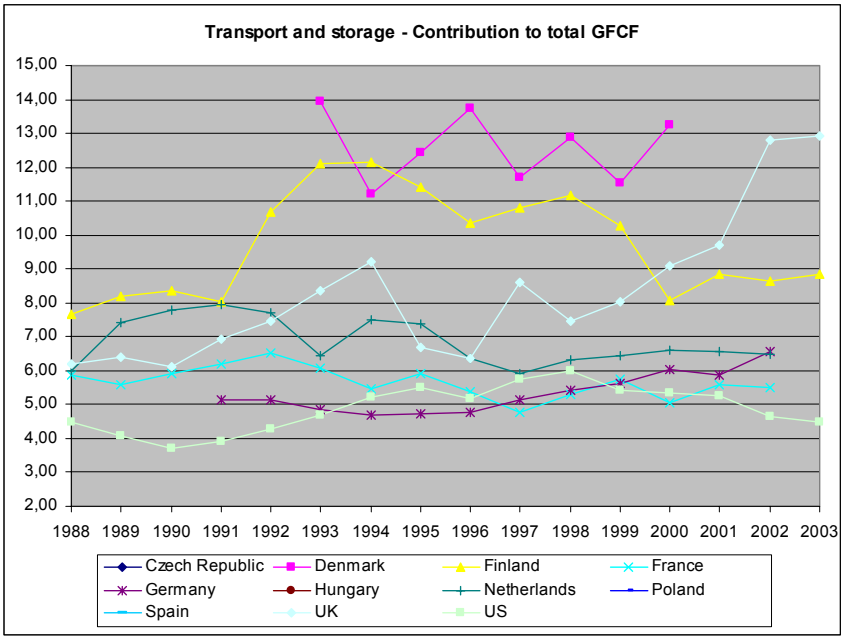


Source: own elaboration from OECD, SAD data

Figure 58: Evolution of the contribution of **Transport Equipment** sectors to total GDP

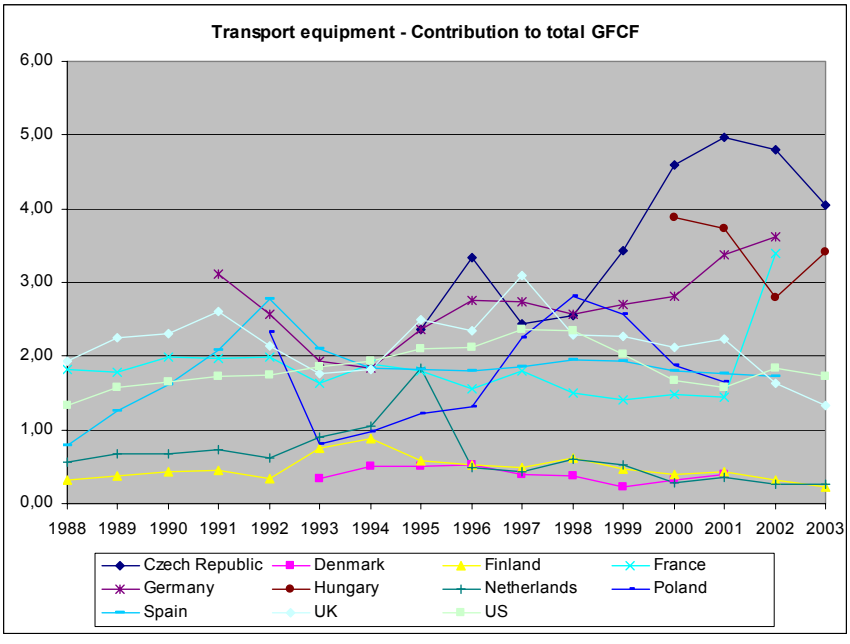
Figure 60 presents the evolution of the percentage of GFCF on transport equipment production sectors over total GFCF for each national economy. The figures are quite coincident to those provided by Figure 58: those countries with higher levels of GCFC of the transport

equipment sectors have higher percentage of participation of production over the total GDP (for instance, Hungary and the Czech Republic). These countries present important investment rates, most likely derived from the decentralisation process of European industries that has taken place in the last decade. The contribution of the transport equipment production sectors (as presented in Figure 58) is, logically, coincident. The combination of the GCFC and Value Added figures provides interesting characteristics related to the structural changes of the economies of the NMSs.



Source: own elaboration from OECD, SAD data

Figure 59: Evolution of the contribution of **Transport and Storage** sectors to total GFCF



Source: own elaboration from OECD, SAD data

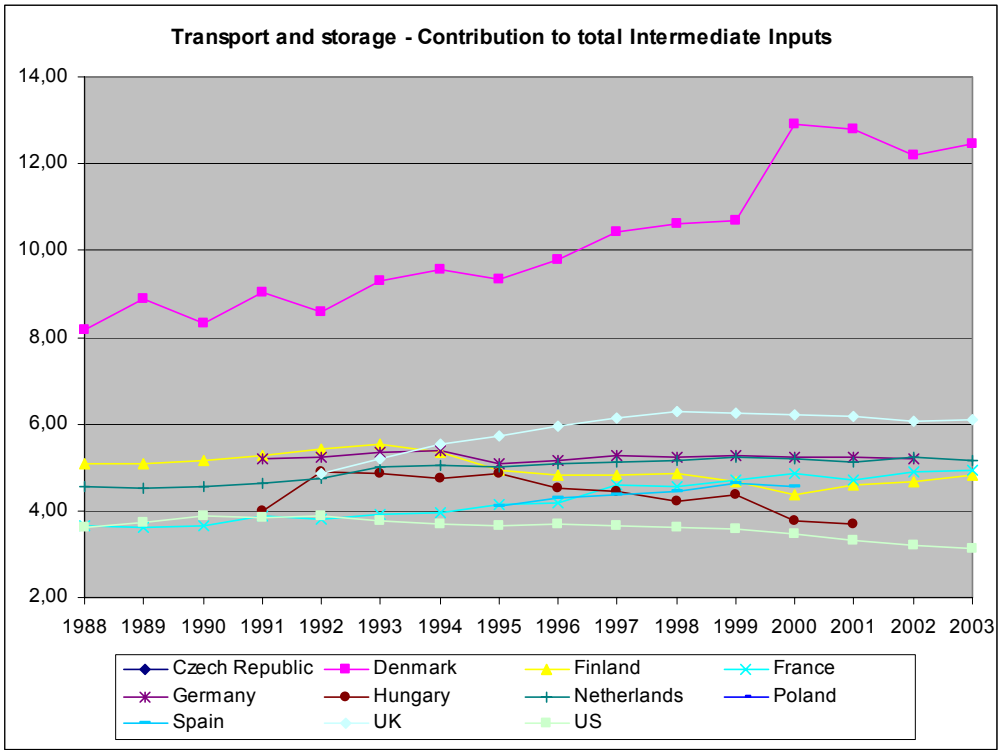
Figure 60: Evolution of the contribution of **Transport Equipment** sectors to total GFCF

Another important group of data provided by the OECD's STAN Industrial Analysis Database are the total inputs consumed as intermediate input by the economic sectors under analysis. The STAN database defines Intermediate Inputs as the difference between gross production and value added of goods and/or services produced in a year. Therefore, it represents the value of inputs into processes of production that are consumed within the accounting period for each sector[49]. The evolution of the percentage of total intermediate inputs of the transport-related sectors over the total intermediate inputs consumed in the whole economy can provide interesting insights on structural changes concerning the level and intensity of the use of production inputs per sector when compared with the output figures.

Figure 61 presents the evolution of the total inputs consumed by the Transport and Storage sectors over the total inputs used by the national economies. In general terms, it can be said that there is a tendency for the reduction of the use of inputs consumed by the transport sectors. If combined with the outputs figures of the national transport sectors both in terms of tonnes transported and tonnes-kilometre produced, conclusions can be extracted concerning the increase (or reduction) of intensity of use of inputs and efficient (or inefficient) evolution of the transport sectors. From Figure 61 we can highlight the high participation on total inputs of the Danish transport and storage sectors and its trend for increasing its weight. The rest of the countries present values between 3% and 6.5% (which is already a quite large interval of variation).

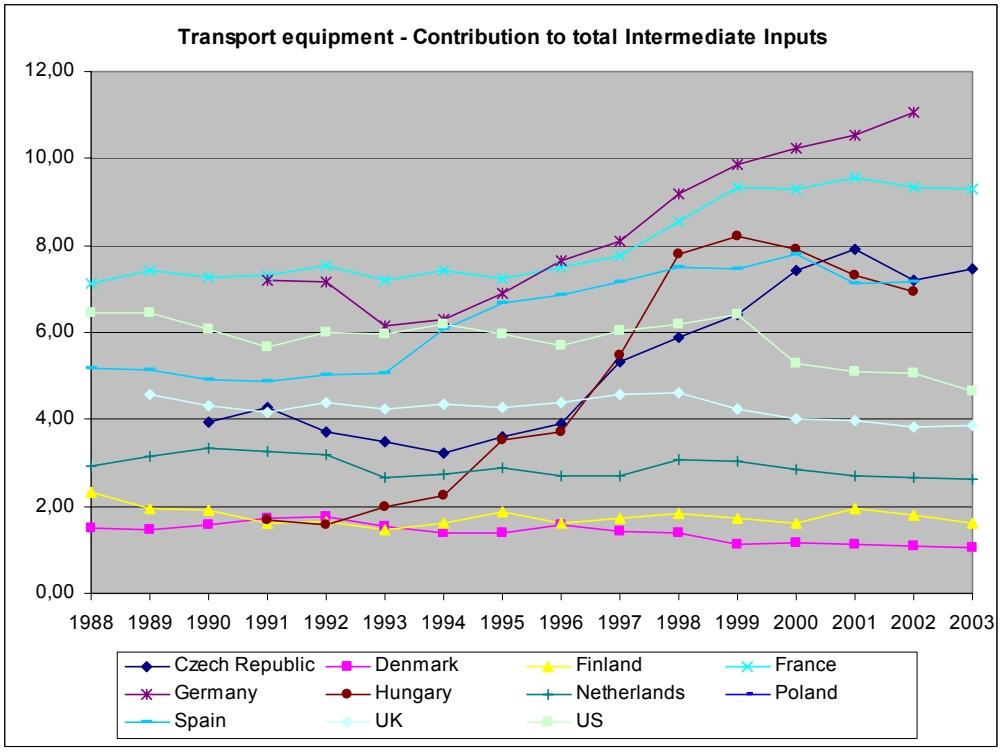
Figure 62 provides information concerning the evolution of the total inputs consumed by the Transport equipment production sectors over the total inputs used by the national economies. In general terms, it can be highlighted the similarity between these series and those concerning total Value Added produced.

[49] This comprises materials, energy and services required to produce the final output per sector. This kind of data is normally collected from the national Input-Output tables (source, OCDE).



Source: own elaboration from OECD, SAD data

Figure 61: Evolution of the contribution of **Transport and Storage** sectors to total use of Intermediate Inputs



Source: own elaboration from OECD, SAD data

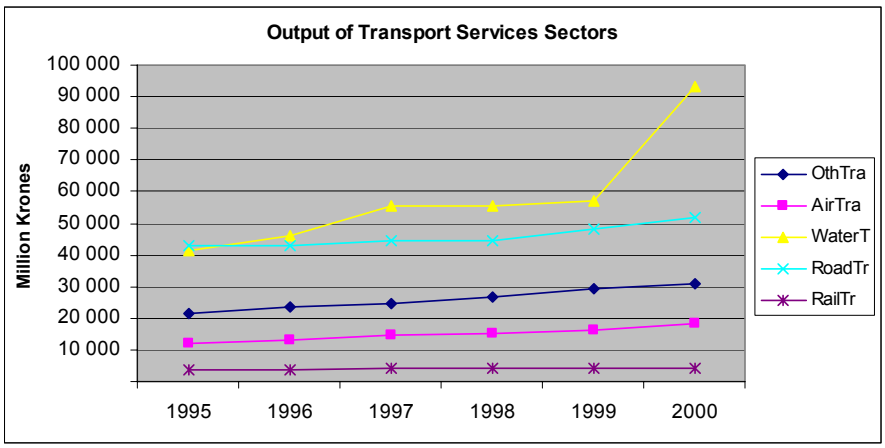
Figure 62: Evolution of the contribution of **Transport Equipment** sectors to total use of Intermediate Inputs

4.2 Denmark

4.2.1 Transport and Storage Sectors

The Danish Transport and Storage sectors have very particular characteristics when compared with other European countries. First of all (see Figure 63) the value of the economic output of the maritime sector is the highest of all transport sectors of the country, a unique characteristic in Europe. Of great importance for the total output value of the maritime sector are the activities of the A.P. Moller-Maersk Group, that with the purchase of Royal P&O Nedlloyd N.V. that was completed during 2005 has become the largest single shipping company and the largest container line in the world with more than 550 vessels. In terms of tonnes transported, for 2000 the maritime sector transported roughly 97 million tonnes of goods (national and international transport), being the outputs of road and rail 224 and 8 million tonnes respectively[50]. During the period under analysis, all transport sectors grew in terms of output value produced, with a peak of maritime transport in 2000[51].

The data concerning the general figures of the Danish transport sectors present also interesting figures. The contribution to the total GDP is amongst the highest of the EU (see Figure 57 in page 101), the same as the GFCF over total GFCF of the economy (see Figure 59 in page 102) as well as in terms of inputs consumed over total inputs of the economy (see Figure 61 in page 104). It can be said that transport and storage activities have a very important weight in the national Danish economy, with a large proportion of total inputs consumed and a high rate of investment.



Source: own elaboration from Eurostat, IOT system database

Figure 63: Denmark, output of all **Transport Services** sectors (evolution)

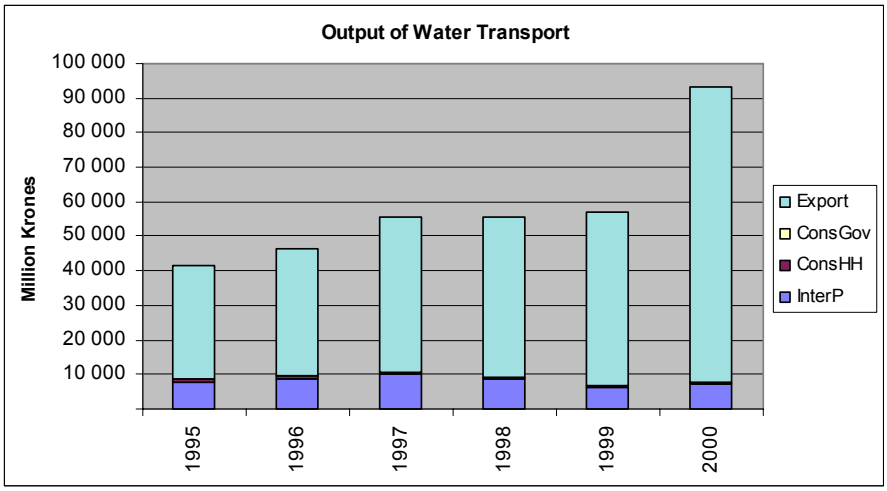
The maritime transport sector has a very strong involvement in international operations, with a tendency for reduction of the share devoted to inputs for other sectors of the economy (InterP) as presented in Figure 64. The category devoted to the consumption of households is

[50] Source: Eurostat.

[51] This peak might be due to an inconsistency in the Eurostat IOT data, as no volume output indicator suggests such an increase. In fact, total tones transported are almost the same as in 1999.

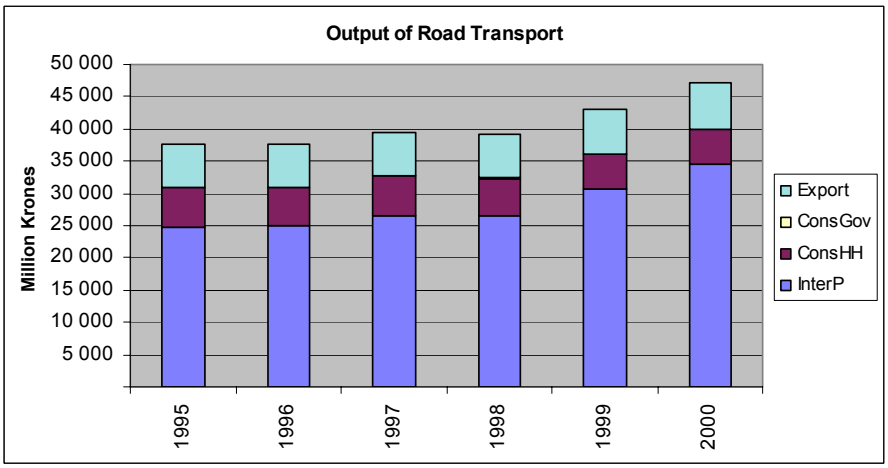
also significant, as Denmark has a very relevant passenger maritime transport activity: in 2000 the passengers transported per 1000 inhabitants were over 9.700, the highest rate in Europe[52].

The road transport sector presents a quite high national orientation in terms of output value, as approximately 73% of the output is devoted to inputs to other sectors of the economy (see Figure 65), with smaller contributions to exports and to the consumption of households (roughly equal and amounting to 11% of the total output value). In terms of volume output, the road sector is the second in Denmark with a total of 224 million of tonnes transported in 2000.



Source: own elaboration from Eurostat, IOT system database

Figure 64: Denmark, output of the **Water Transport** sector (evolution)



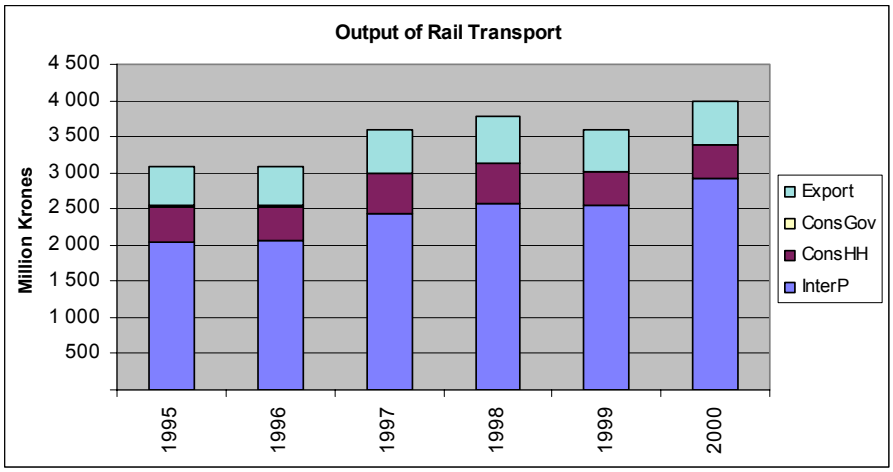
Source: own elaboration from Eurostat, IOT system database

Figure 65: Denmark, output of the **Road Transport** sector (evolution)

[52] Source: Eurostat.

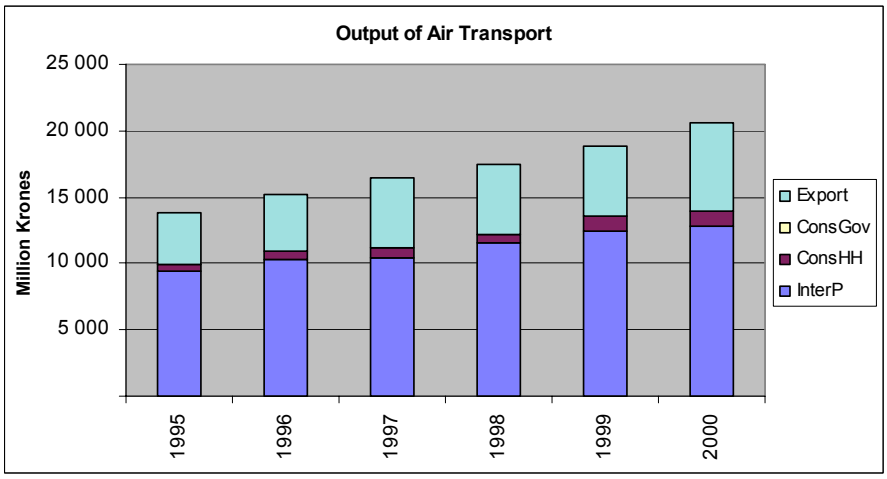
Rail transport is the one with the smallest market share (about 8 million tonnes transported in 2000) and smallest output value (see Figure 63). The shares of its output value are quite similar to those of the road transport: strong orientation as input sector for other sectors and very similar shares of consumption of households and exports.

The output value of air transport (see Figure 67) has been growing since 1995 supported by the growth of all categories of its uses. The most relevant characteristic of air transport is the low participation of the consumption of households, when compared with the majority of countries analysed.



Source: own elaboration from Eurostat, IOT system database

Figure 66: Denmark, output of the **Rail Transport** sector (evolution)

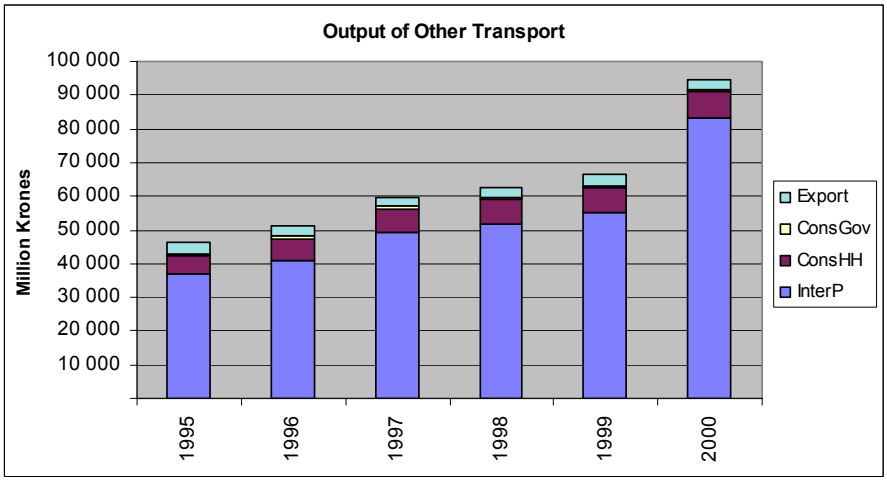


Source: own elaboration from Eurostat, IOT system database

Figure 67: Denmark, output of the **Air Transport** sector (evolution)

The total output of the supporting and auxiliary transport activities does not have much weight as other developed economies of the EU (see Figure 63). Only Hungary and Spain present similar figures of the output of the sector over total output, being in most countries the supporting and auxiliary transport activities the transport sector with higher output value (for instance, in Germany). It is important to remind that logistics and the transport activities

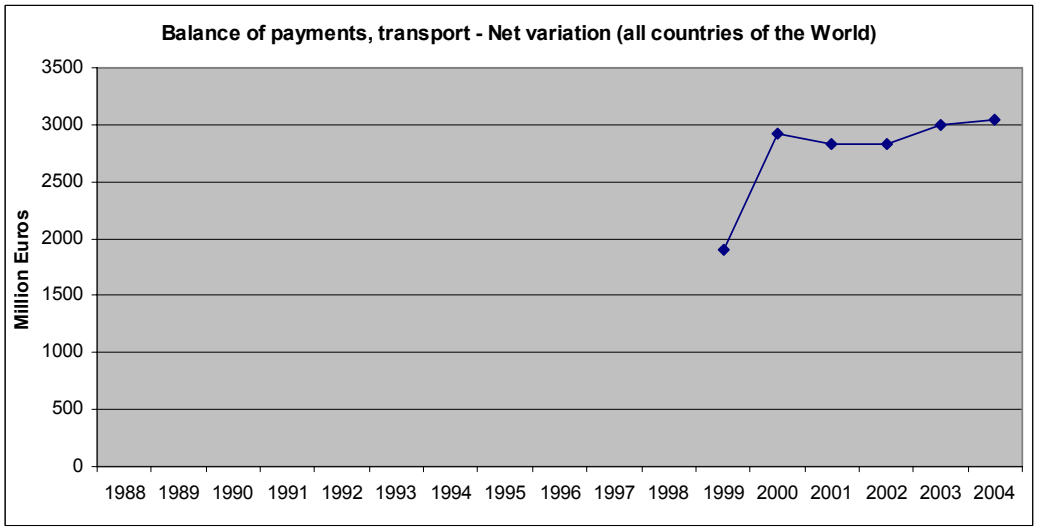
derived are included under this category. This means that the Danish logistic sector still has room to grow and to catch up with the figures and values of other countries. In terms of the destination of total output, the largest share is devoted to providing inputs to other sectors of the economy, as it would be expected from this sector.



Source: own elaboration from Eurostat, IOT system database

Figure 68: Denmark, output of the **Supporting Transport Activities** sector (evolution)

Figure 69 presents the evolution of the net result of the transport services balance of payment for Denmark. The only Eurostat ITS data available data present a clear positive balance, following a growth trend since 1999. This positive balance is provoked by the strong export orientation of the maritime transport, as the other transport sectors are more oriented to internal economic activities. Air transport can be considered as an exception to this since it has, by definition, a high average portion of its output value devoted to exports.



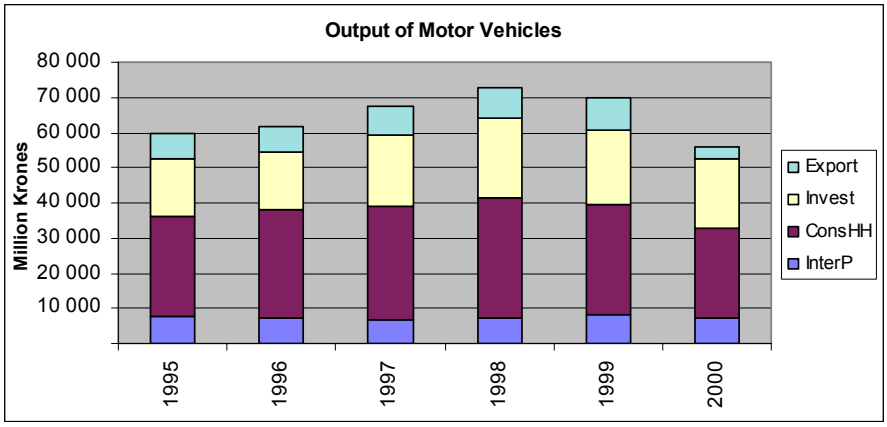
Source: own elaboration from Eurostat, ITS database

Figure 69: Denmark, **Balance of Payments** of transport services (evolution)

4.2.2 Transport Production Sectors

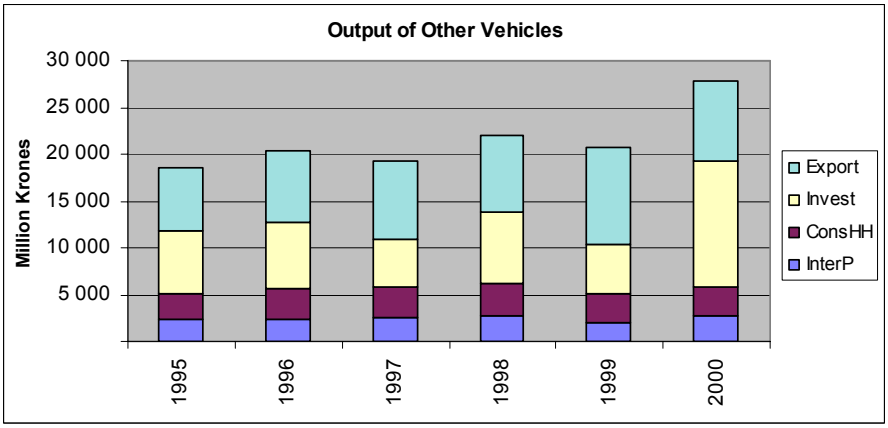
The two transport equipment sectors have a quite low contribution to the Danish GDP (measured in Value added produced), as showed in Figure 58 in page 101. The sectors present low rates of investment measured in terms of GFCF, the lowest of the economies analysed (see Figure 60 on page 102) as well as a low share of intermediate inputs consumed over total intermediate inputs of the economy (see Figure 62 on page 104). In other words, if transport services sectors were of prime importance for the Danish economy, transport equipment sectors have a low overall importance.

The composition of the output value of motor vehicles has, as expected, a strong share devoted to consumption of the households (see Figure 70). The share devoted to exports is smaller than the average values of most of the motor vehicle sectors across Europe, with a relatively large output portion devoted to investment in other sectors of the economy. The output of other transport vehicles sector (see Figure 71) is more similar to other countries analysed, with large portions devoted to exports and investment from other sectors, characteristics of a sector that produces mostly heavy transport equipment.



Source: own elaboration from Eurostat, IOT system database

Figure 70: Denmark, output of the **Motor Vehicles** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

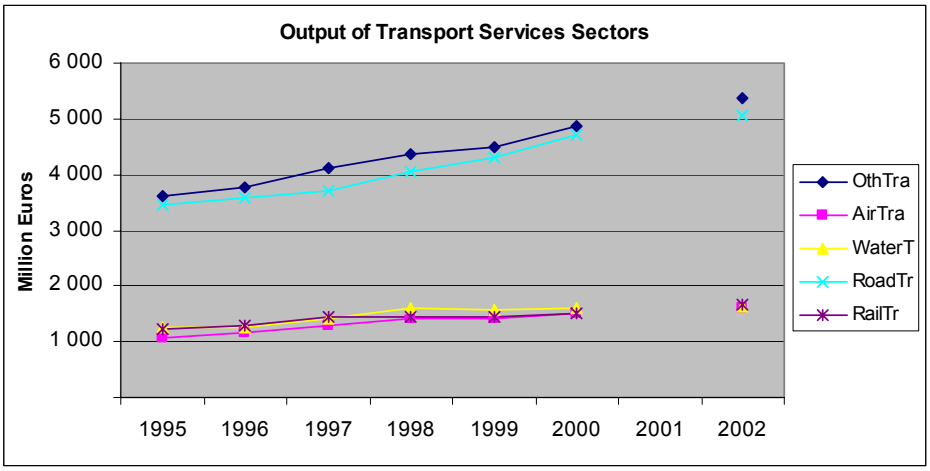
Figure 71: Denmark, output of the **Other Transport Equipment** sector (evolution)

4.3 Finland

4.3.1 Transport and Storage Sectors

The Finish transport activities are based, in terms of economic value, in the road and complementary transport activities followed by the other transport modes with smaller and very similar output values (see Figure 72). This structure, with the complementary transport activities sector as maximum value-creator of all transport-related sectors is a characteristic of highly developed transport and logistic systems. In terms of growth evolution, road and complementary activities sectors present a steeper growth than maritime, rail and air transport during the period.

In terms of evolution of the general indicators of the transport related sectors, the contribution to the total GDP is the highest of the analysed countries (see Figure 57 in page 101). The investment rate expressed as GFCF is also amongst the highest, with a peak period between 1991 and 2000 (see Figure 59 in page 102). In terms of intermediate inputs consumed (see Figure 61 in page 104), since the late 80s transport related sectors have lost some weight over the total intermediate inputs consumed, despite of the high investment rates of the 90s.



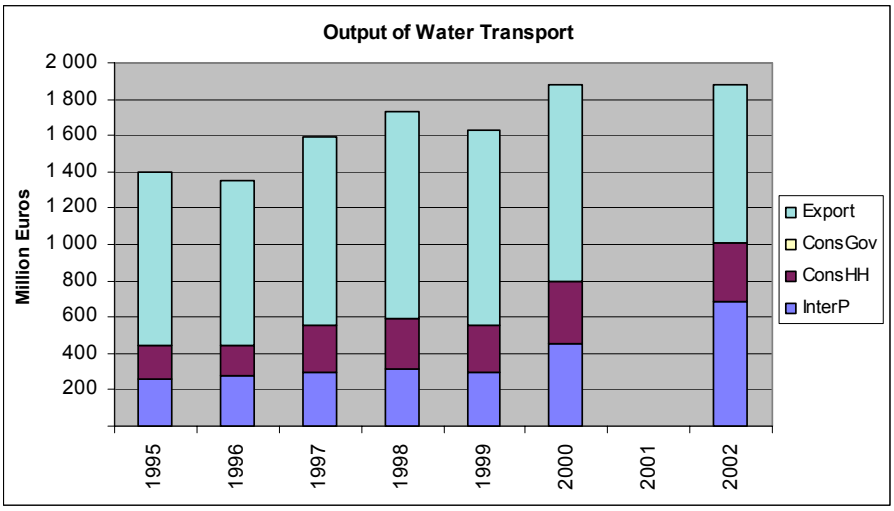
Source: own elaboration from Eurostat, IOT system database

Figure 72: Finland, output of all **Transport Services** sectors (evolution)

The Finish maritime transport sector (see Figure 73) presents a structure with a high share of its value devoted to exports and a quite important participation of households. This is mostly due to the importance of maritime passenger transport in Finland and throughout the Baltic region, having Finland a rate of more than 3.000 passengers per 1.000 inhabitants in 2000, one of the highest in the EU. The total output value of the sector is somehow variable, with several ups and downs in the period under analysis. This variability is introduced mostly by the exports and contribution as intermediate inputs to other sectors (InterP). It is important to remark the important growth of the InterP category since 1999, which reveals a trend for the increase of the maritime sector as intermediate input for the rest of economic sectors.

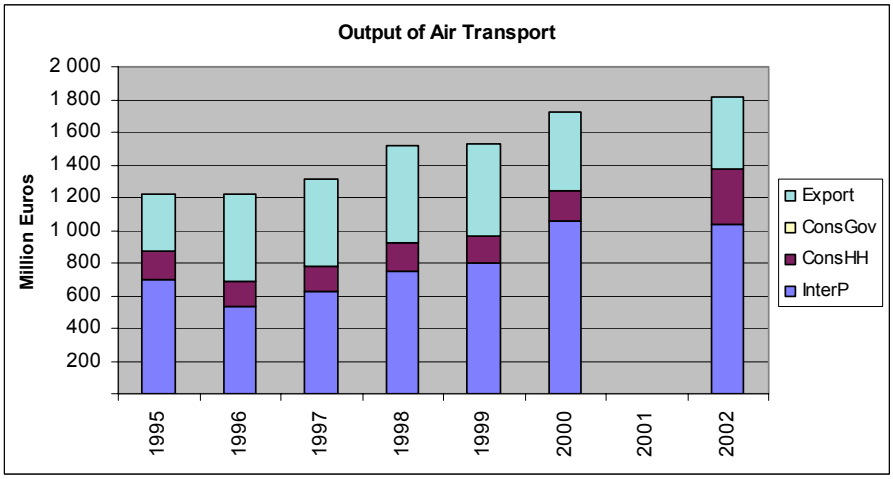
The air transport sector follows a similar trend of increasing importance as intermediate input for other national economic sectors but earlier than the maritime transport, by the mid 90s (see Figure 74). It can also be highlighted the increase of the value share consumed by house-

holds, although the lack of data for 2001 and after 2002 do not allow to confirm if we are dealing with a structural change of a temporary effect.



Source: own elaboration from Eurostat, IOT system database

Figure 73: Finland, output of the **Water Transport** sector (evolution)



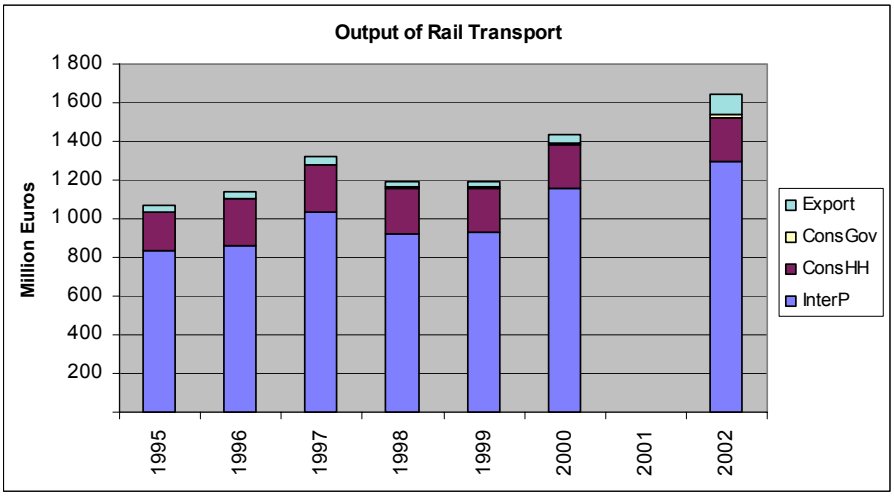
Source: own elaboration from Eurostat, IOT system database

Figure 74: Finland, output of the **Air Transport** sector (evolution)

Rail transport and road transport have very similar structures, although the output values are very different. Both sectors are highly oriented to internal economic activities: the higher percentage of their values is used as intermediate input by other economic sectors (see Figure 75 and Figure 76), with much smaller shares devoted to households consumption. Between 2000 and 2002 rail and road figures present important increases in the share devoted to exports, that grow more than 100% in each case. The lack of data for 2001 and 2003 onwards does not allow confirming if this is a structural trend or a temporary effect.

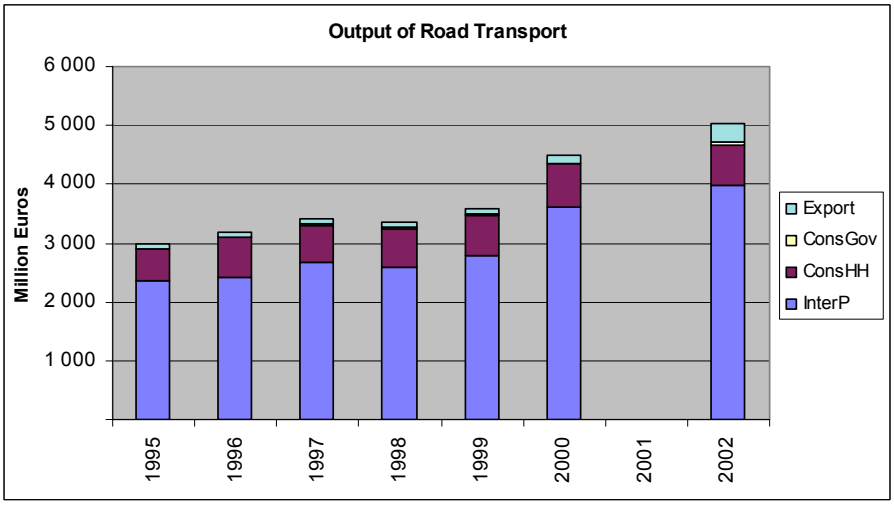
Figure 77 present the composition and evolution of the supporting transport activities sector output value. It has an interesting structure as Finland is the only country with such a high

share of the value devoted to consumption by the public sector, about one third of the total value. As in the case of road and rail, exports share grows over 100% between 2000 and 2002, as well as the share devoted to consumption by the public sector (although in a smaller proportion).



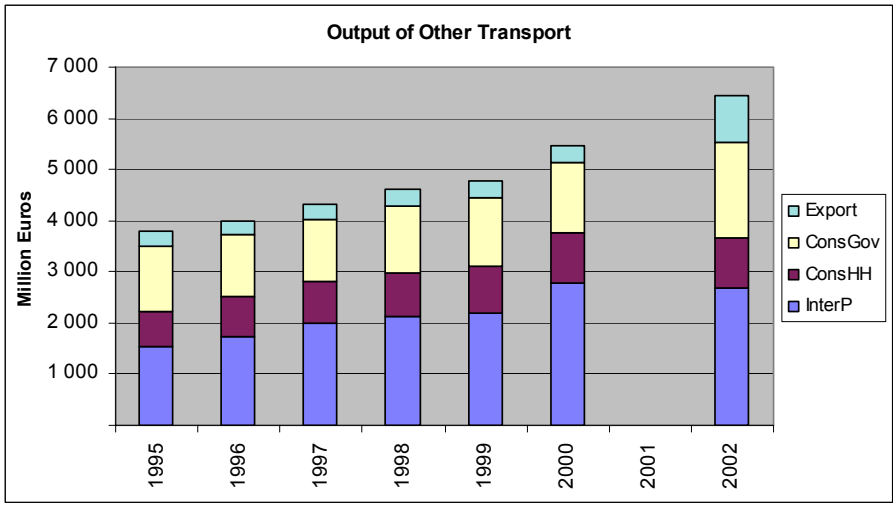
Source: own elaboration from Eurostat, IOT system database

Figure 75: Finland, output of the **Rail Transport** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

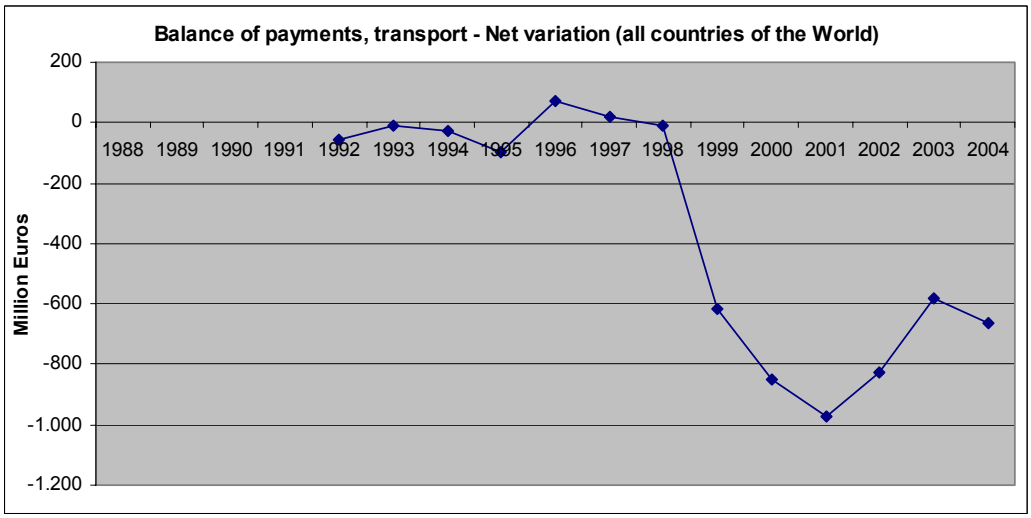
Figure 76: Finland, output of the **Road Transport** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 77: Finland, output of the **Supporting Transport Activities** sector (evolution)

Figure 78 presents the evolution of the net result of the transport services balance of payments. It shows a break of the net results from 1998 on: before that year, the transport services purchased and sold to foreign commercial partners were quite even, with small positive and negative net balances, having since 1998 negative results of considerable dimension. Such change cannot be due to a loss of competitiveness of the Finish transport service providers, as it is too sudden. It must be the combination of several factors, such as a change in the top preferential partners and the increase of commerce with partners with low transport costs.



Source: own elaboration from Eurostat, ITS database

Figure 78: Finland, **Balance of Payments** of transport services (evolution)

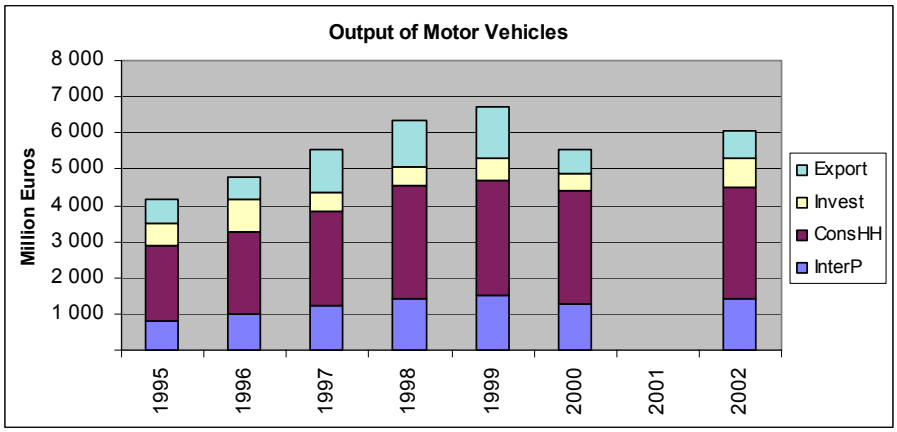
4.3.2 Transport Production Sectors

The contribution of the two Finish transport equipment production sectors for the total GDP is amongst the lowest in percentage of the countries analysed, together with the Netherlands

and Denmark (see Figure 58 in page 101), as well as in terms of investment rate over the total investment of the economy measured in GFCF (see Figure 60 on page 102). These figures, as in the case of Denmark, provide a scenario of high contracts between the high importance of the transport services sectors in terms of contribution to the GDP and a low overall importance of the transport equipment sectors.

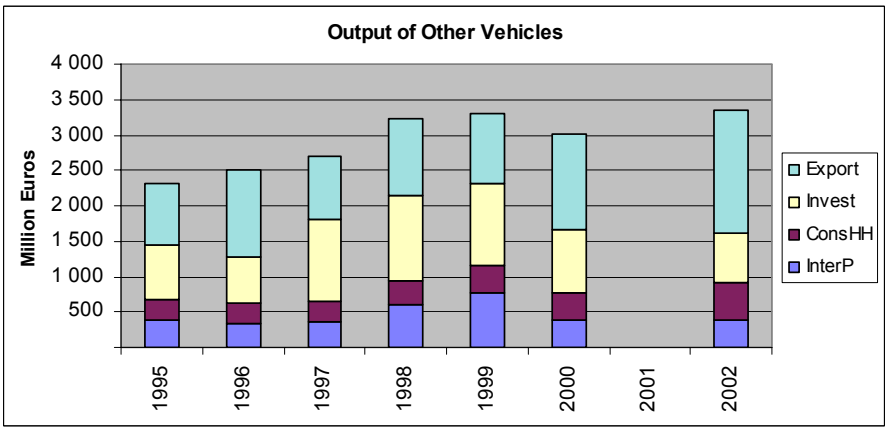
The composition of the output value of motor vehicles has a strong share devoted to consumption of the households (see Figure 79), over a half of the total value. The share devoted to exports grew largely in the late 90s, being one of the engines of the growth of the sector, with a reduction in 2000 to values of 1995.

The output of other transport vehicles sector (see Figure 80) is more similar to other countries analysed, with large portions devoted to exports and investment from other sectors, characteristics of a sector that produces mostly heavy transport equipment.



Source: own elaboration from Eurostat, IOT system database

Figure 79: Finland, output of the **Motor Vehicles** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

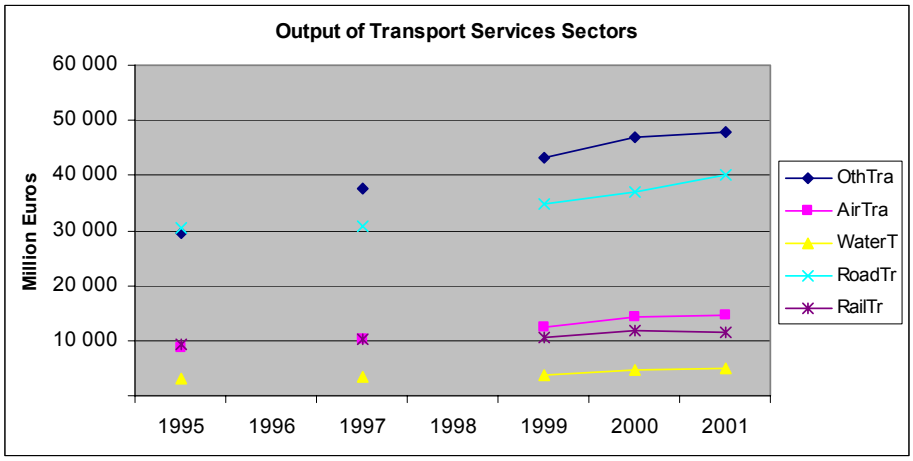
Figure 80: Finland, output of the **Other Transport Equipment** sector (evolution)

4.4 France

4.4.1 Transport and Storage Sectors

The transport related sector with higher chare of the total output value is the complementary transport activities sector, that took over this first place since the mid 90s when surpassed the road transport (in 1995, road transport was still ahead, as shown in Figure 81). This means that the French logistics sector has a very relevant role in relation to the other transport related sectors. This characteristic is observed in the most developed European economies. After the complementary transport activities and road transport sectors, the third in terms of output value created is air transport followed by rail, that has grown at a smaller rate than the former (in the late 90s both sectors had almost equal output values).

In terms of evolution of the general indicators of the transport and storage sectors, the contribution to the GDP is quite low with an annual average value around 4.2% in the period between 1988 and 2003 with a high degree of stability (see Figure 57 in page 101). The investment rate over total investment of the economy varied during the period between 6.5% and 5%, a low value compared to other countries (see Figure 59 in page 102). In terms of intermediate inputs consumed over the total intermediate inputs of the economy, the share of the transport and storage sectors has grown from under 4% to 5%, as show by Figure 61 in page 104.

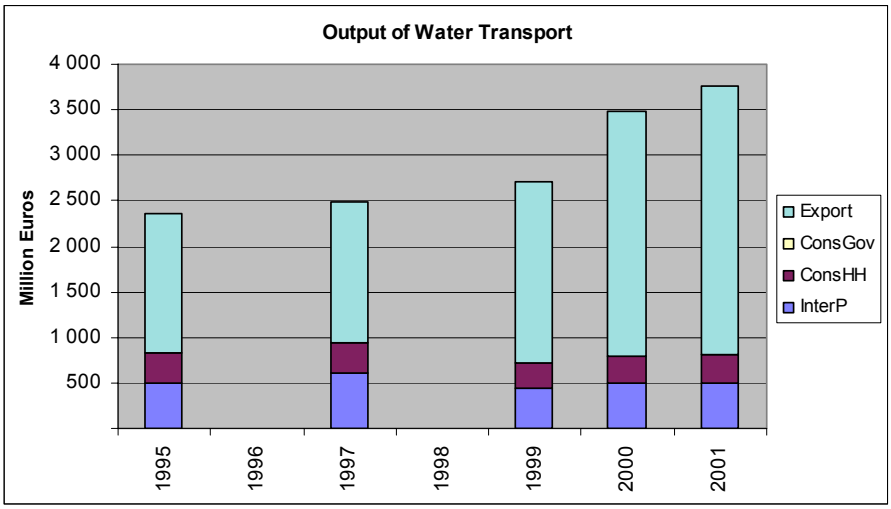


Source: own elaboration from Eurostat, IOT system database

Figure 81: France, output of all **Transport Services** sectors (evolution)

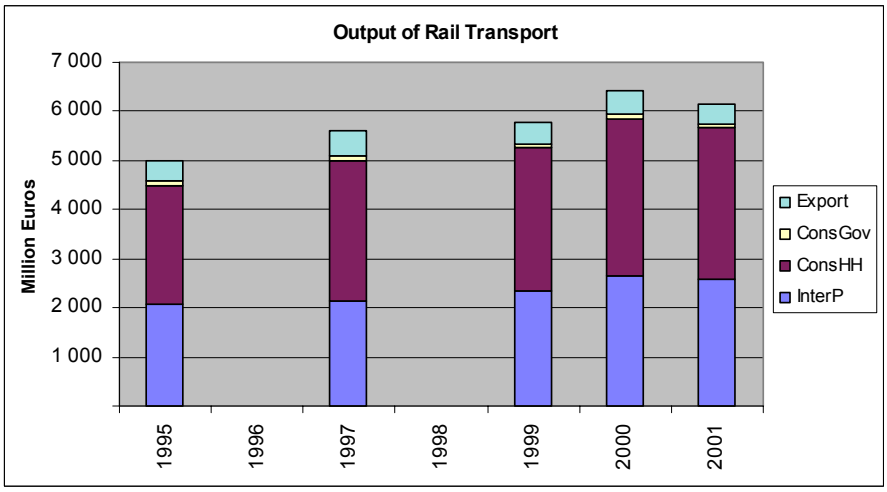
The maritime transport (see Figure 82) is the sector with the smaller contribution to the total output value of the transport and storage activities. It is however a sector highly devoted to export activities that has based its growth since the end of the 90s in such services. For instance, between 1999 and 2000 the growth of value devoted to exports was of about 30%. This trend has had an important impact in the net balance of payments of the transport services, which has grown since the mid 90s from negative to positive values. As the rest of transport services sectors have a low implication in exports that has maintained fairly constant, the only contributor to this improvement of the net result of the transport services balance of payments has been the maritime sector.

The rail and road sectors are highly devoted to internal activities, having small expression in the international field (see Figure 83 and Figure 84). The participation of both sectors as providers of intermediate inputs for other sectors of the economy is considerable (around 40%) as well as the consumption of households, the two shares that have supported the increase in their output values.



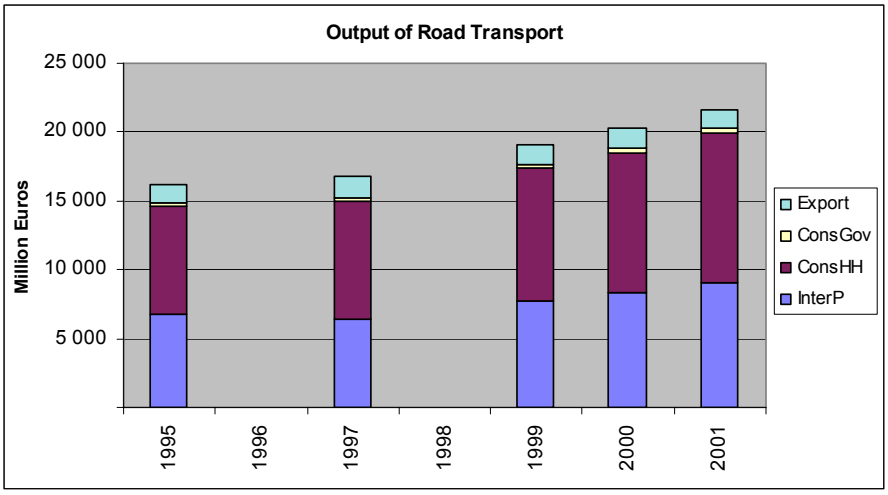
Source: own elaboration from Eurostat, IOT system database

Figure 82: France, output of the **Water Transport** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

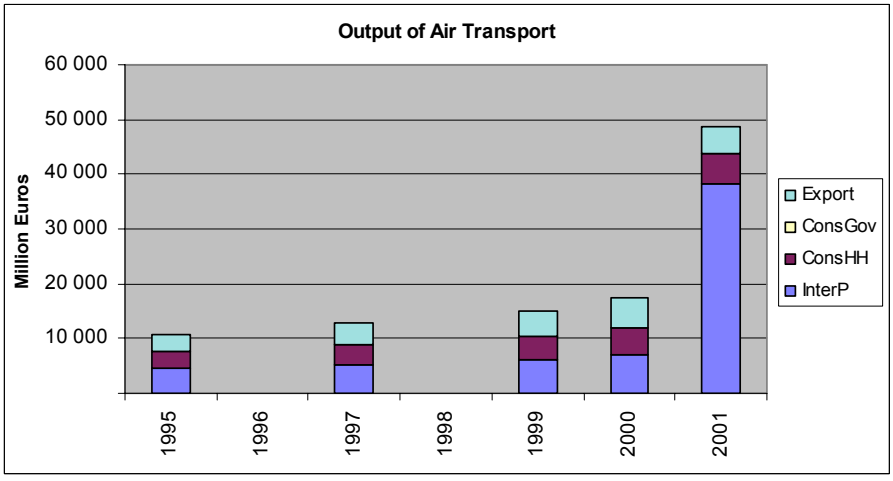
Figure 83: France, output of the **Rail Transport** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 84: France, output of the **Road Transport** sector (evolution)

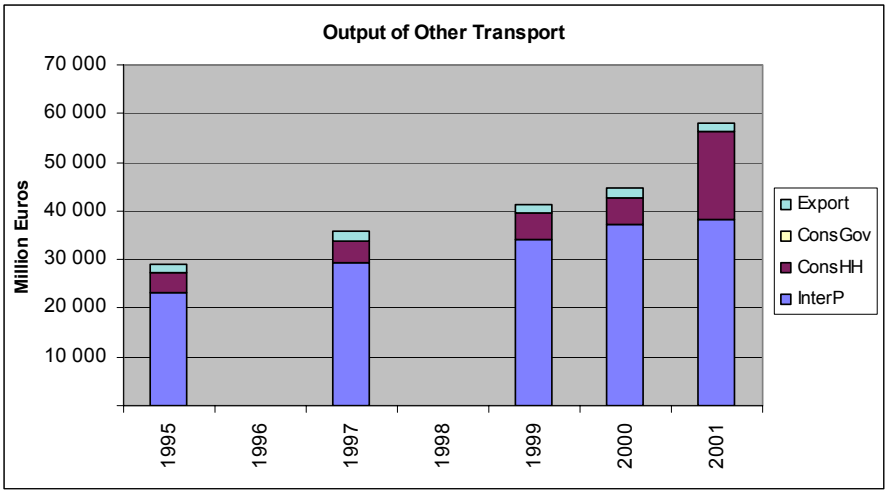
The air transport figures must be taken cautiously, due to the large increase of its output value in 2001. This large increase of the output value is based on the increase of the contribution of the sector to other sectors of the national economy. Apart from the high value, this structure of the air transport sector is not common amongst the countries analysed. Taking in consideration the values of the sector until 2000, the structure is compatible with those from other developed countries.



Source: own elaboration from Eurostat, IOT system database

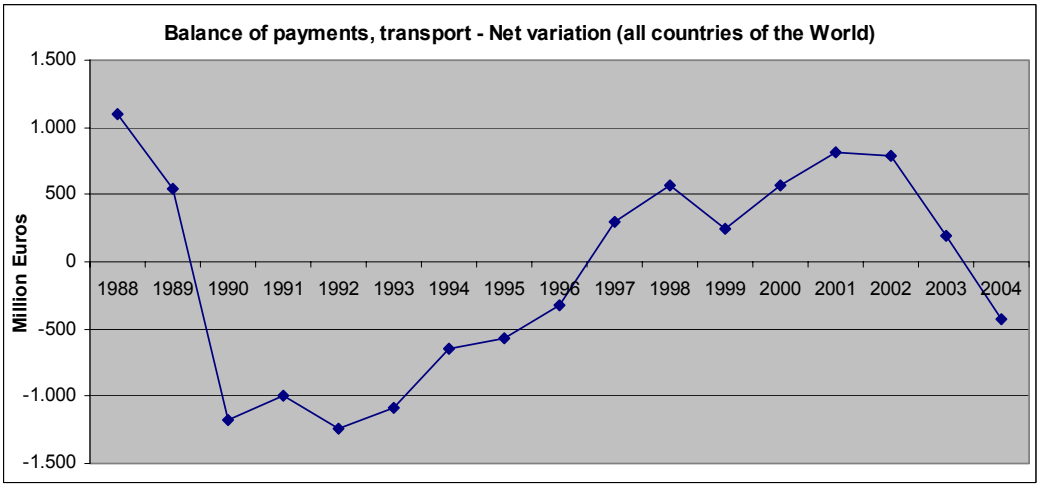
Figure 85: France, output of the **Air Transport** sector (evolution)

Figure 86 presents the composition of the supporting transport activities sector, the transport sectors with the highest output value of the French economy. As usual, it is a sector that contributes largely to other economic sectors as input, and shows an important rate of growth, doubling the output from 1995 to 2001. It can be said that logistics has a very important penetration in the French economy with a growing role since the mid 90s and is nowadays the main source of value creation of the French transport service sectors.



Source: own elaboration from Eurostat, IOT system database

Figure 86: France, output of the **Supporting Transport Activities** sector (evolution)



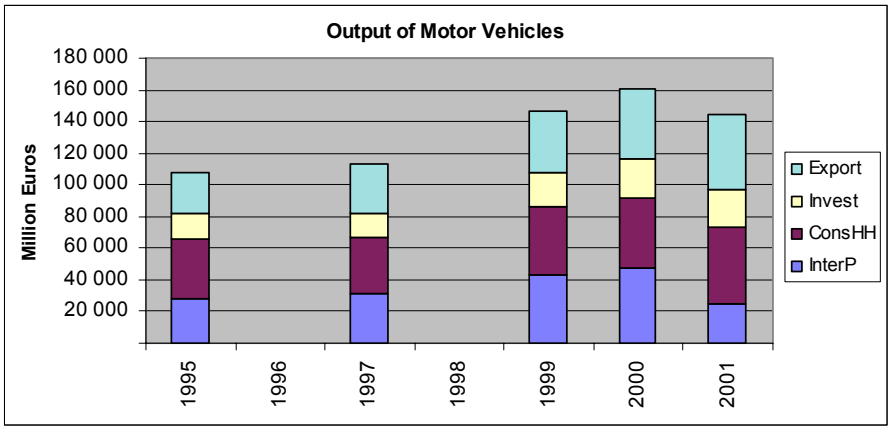
Source: own elaboration from Eurostat, ITS database

Figure 87: France, **Balance of Payments** of transport services (evolution)

4.4.2 Transport Production Sectors

The French transport equipment sectors have a important of the GDP, as shown in Figure 58 (page 101). In 2002 France was the third country amongst the analysed in terms of percentage of GDP produced by the transport equipment sectors, only after Germany and the Czech Republic. The participation of the sectors in the total investment measured in GFCF (see Figure 60 on page 102) is also quite relevant, as well as the consumption of intermediate inputs of the economy (see Figure 62 in page 104). In all, the transport equipment sector has a high importance for the French economy.

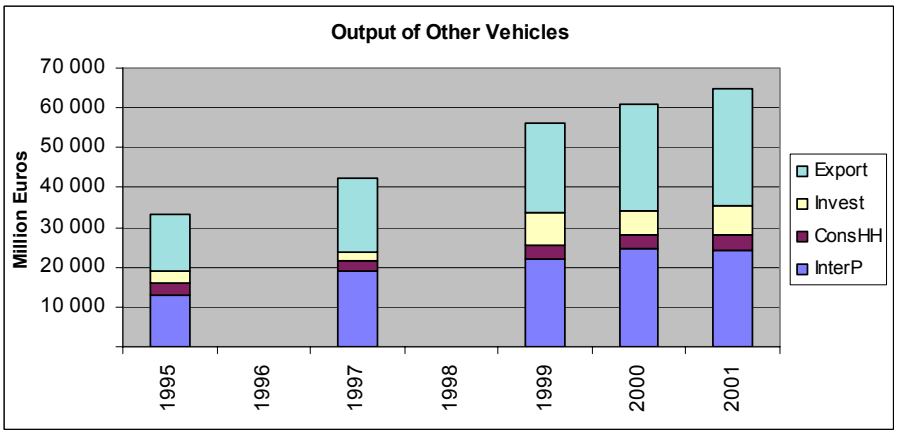
The composition of the output value of motor vehicles has two strong shares devoted to consumption of the households and exports (see Figure 88). The values peak in 2000 with an important reduction in 2001, but the lack of further data does not allow following the development of the trend.



Source: own elaboration from Eurostat, IOT system database

Figure 88: France, output of the **Motor Vehicles** sector (evolution)

The output of other transport equipment sector (see Figure 89) is similar to other countries analysed, with large portions devoted to exports and investment from other sectors in contrast with the larger share of household consumption of the motor vehicles sector.



Source: own elaboration from Eurostat, IOT system database

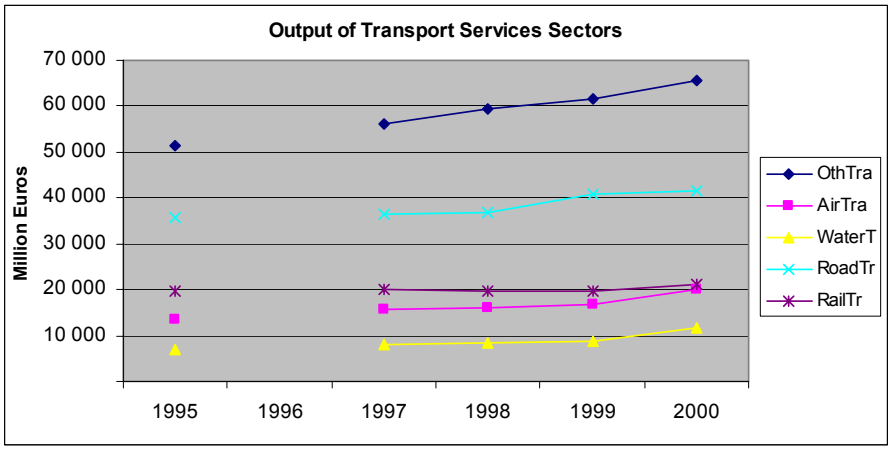
Figure 89: France, output of the **Other Transport Equipment** sector (evolution)

4.5 Germany

4.5.1 Transport and Storage Sectors

The German transport and storage sectors have evolved little concerning its structure since the mid 90s. Figure 90 presents the output value per sector, where it stands out the importance of the supporting transport activities over the total value created by the transport sectors. The second sector in term of output value is the road, followed with smaller values by rail and air transport. Finally, the sector with the lowest output value is maritime transport. The German economy, compared to the rest of countries analysed, is the one with the highest portion of output value related to transport created by the supporting transport activities sector.

Despite of the high level of evolution of the transport sector in Germany and the high implication of the supporting transport activities sector in the creation of value, the economic indicators of the transport and storage sectors show a low contribution to the formation of the GDP. Figure 57 in page 101 shows how the total value added of the sector has varied during the period around 3.4% in annual average terms, a low contribution only higher than the one from the USA. In terms of GFCF of the sector (see Figure 59 in page 102), the percentage over the total GFCF of the economy is also amongst the lowest. The value of intermediate inputs consumed can be considered, however, as high with an annual average value of 5% (see Figure 61 in page 104).



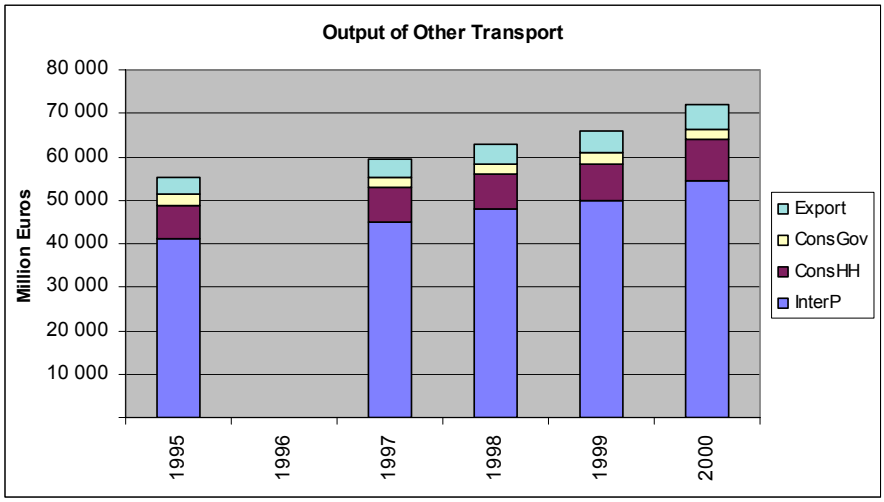
Source: own elaboration from Eurostat, IOT system database

Figure 90: Germany, output of all **Transport Services** sectors (evolution)

The output value of the supporting transport activities sector presents a sustained evolution in the period under analysis (see Figure 91) based in the large percentage of value consumed as intermediate input by other sectors of the economy and by its positive evolution.

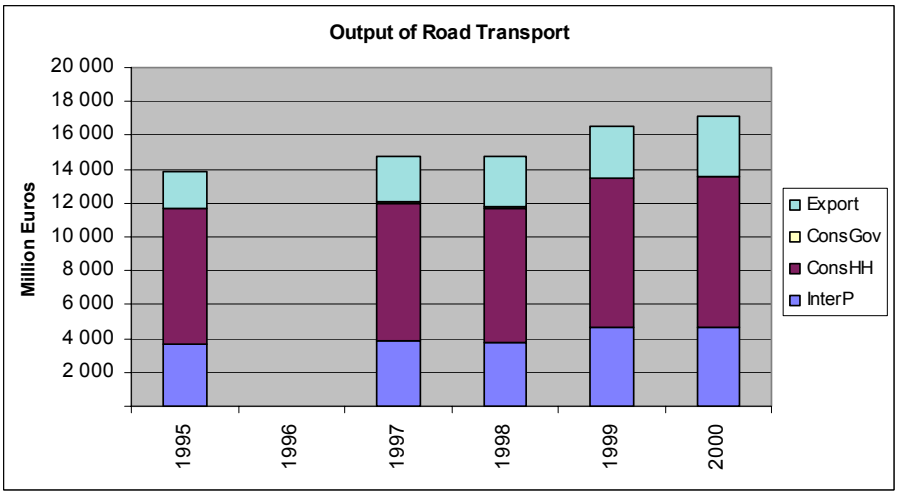
The second transport sector in terms of output value is road, that preset a structure strongly oriented to the internal sectors of the economy: about 50% of the value is consumed by households, with other (roughly) 30% consumed as intermediate inputs for other sectors of the economy and the rest devoted to exports (see Figure 92). Although the smaller share, the percentage devoted to exports is higher than most of the countries analysed and confirms the strong relationships of the German transport sectors with the external sectors of the economy.

The structure of the rail transport sector is the same as for the road transport (due to the calculation method of their shares taking as base the value of "land transport"), but the evolution between them has been different: the road transport has increased its output value and the rail sector lost some output value in the late 90s (see Figure 93).



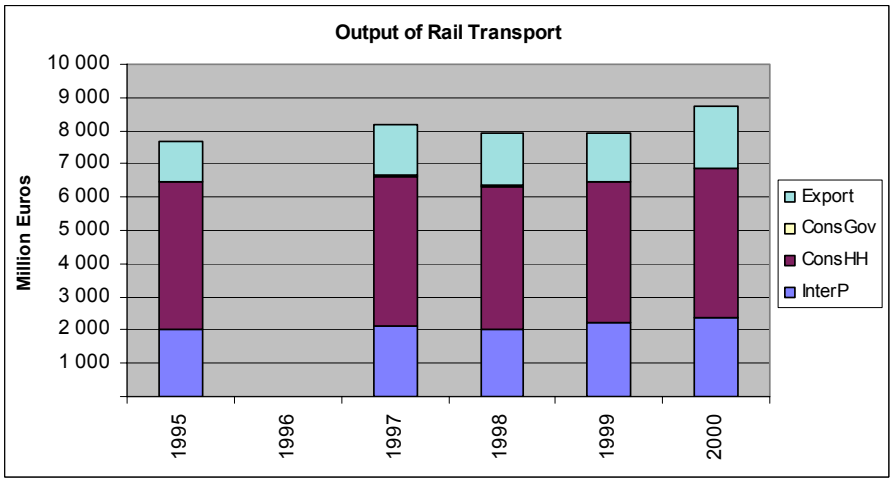
Source: own elaboration from Eurostat, IOT system database

Figure 91: Germany, output of the **Supporting Transport Activities** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

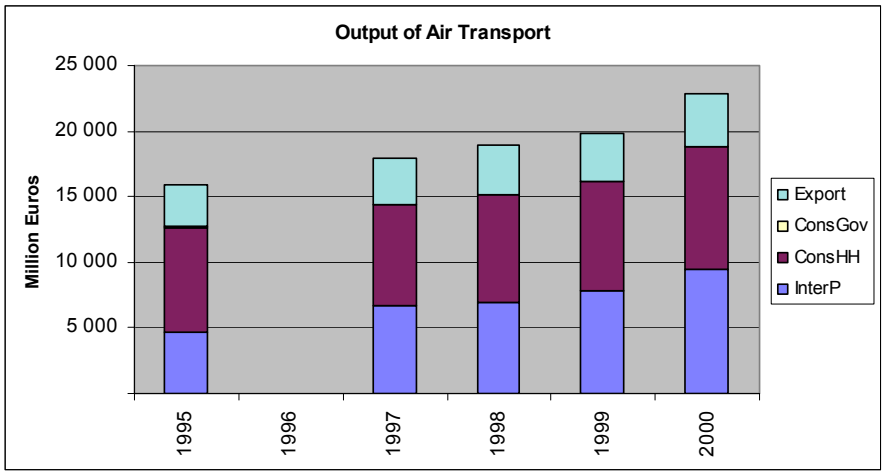
Figure 92: Germany, output of the **Road Transport** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 93: Germany, output of the **Rail Transport** sector (evolution)

The air transport output value has a different composition than in most of the countries analysed, with a significant proportion of its output devoted to exports, but with large shares of inputs for other economic sectors and for households consumption (see Figure 94). In fact, the growth during the period under analysis is due to the increase in the value of the sector as intermediate input for other sectors (mainly freight transport activities) and the increase in the consumption from households (mainly passenger transport).



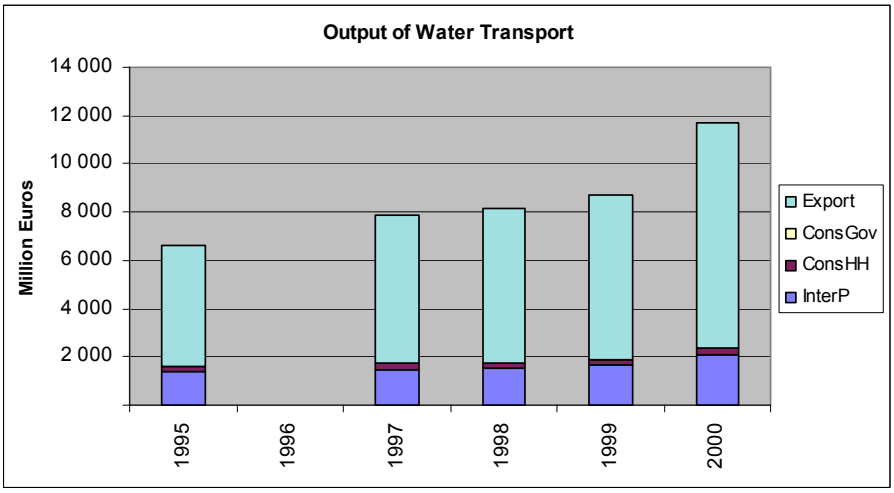
Source: own elaboration from Eurostat, IOT system database

Figure 94: Germany, output of the **Air Transport** sector (evolution)

Figure 95 presents the composition and evolution of maritime and inland waterways transport sector, that together sum up for 490 million tonnes transported in 2000, with a clear external orientation. The evolution of the sector has been supported by the growth of the output devoted to exports, with slight variations of the other shares, contribution to intermediate inputs and consumption of the households. Of great importance would be the German maritime sector, that moved more than 270 million tonnes in 2004, being Hamburg and Bremen the second and fourth container port of Europe with over 10.4 million TEUs transported[53].

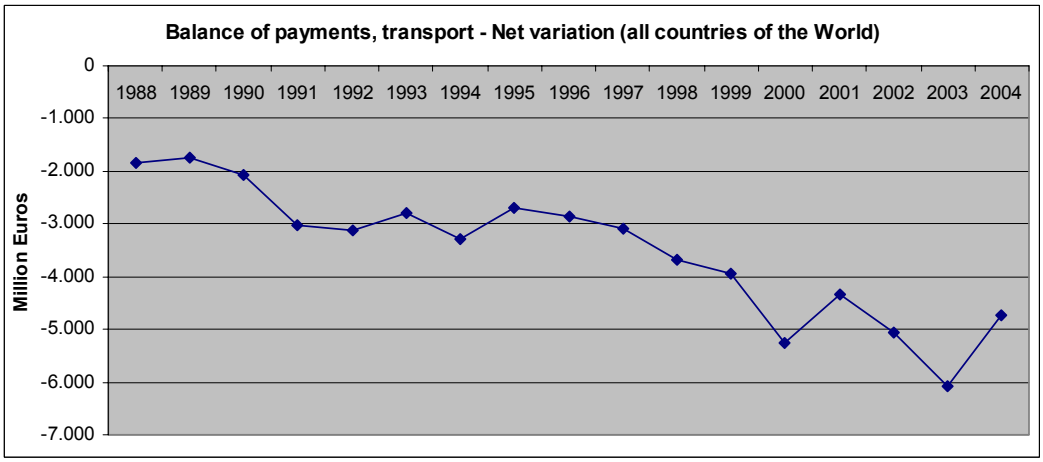
The importance of Germany as global commercial player is well known as well. The German transport services sectors however are minor players in the international context, as Figure 96 shows: the strong negative net result of the transport services balance of payments reveals a high dependence of external transport providers, allegedly for import and export products. This, put in the European context, might mean that neighbour countries such as the NMSs and the Netherlands (that has a very externally oriented transport sectors).

[53] The value created by some of these activities would also have influence in the share of supporting and auxiliary transport services.



Source: own elaboration from Eurostat, IOT system database

Figure 95: Germany, output of the **Water Transport** sector (evolution)



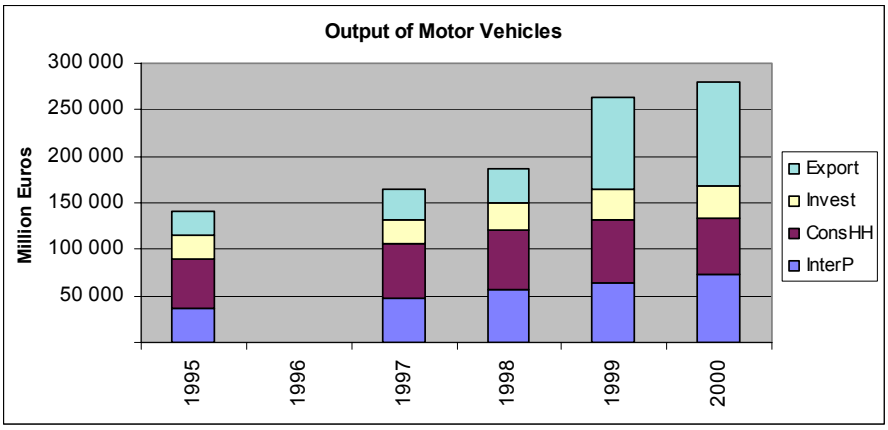
Source: own elaboration from Eurostat, ITS database

Figure 96: Germany, **Balance of Payments** of transport services (evolution)

4.5.2 Transport Production Sectors

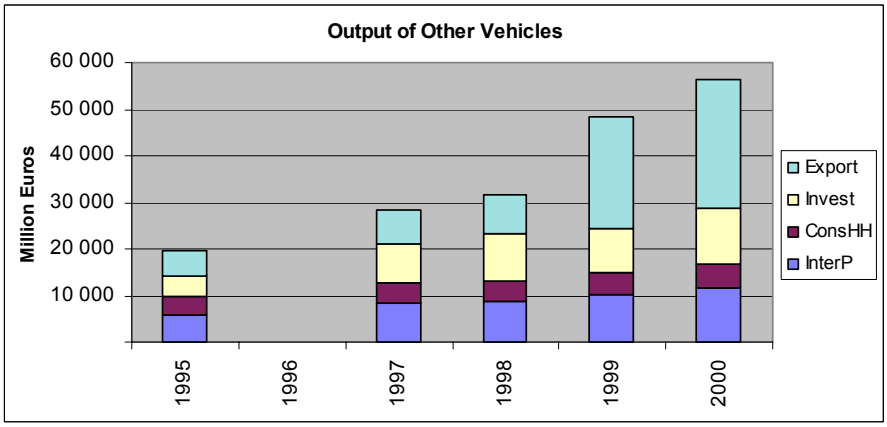
Both transport production sectors reflect the degree of internationalisation of the German economy, with important increases of the shares of output value devoted to exports since 1999 (see Figure 97 and Figure 98). The growth of both sectors has been supported by the external demand increase and by the internal demand, especially from the inputs for other sectors of the economy. The shares of both grew between 1995 and 2000 by 90% for motor vehicles and by 175% for other transport equipment.

Focusing on motor vehicles, the consumption of households, that traditionally absorbs large portions of the output value, does not have a contribution to its growth. In fact, between 1999 and 2000 it presents a reduction of its share in the composition of the motor vehicles output value. On the other hand, the other transport equipment sector has also a smaller than expected contribution to investment of the economy, especially after 1998.



Source: own elaboration from Eurostat, IOT system database

Figure 97: Germany, output of the **Motor Vehicles** sector (evolution)



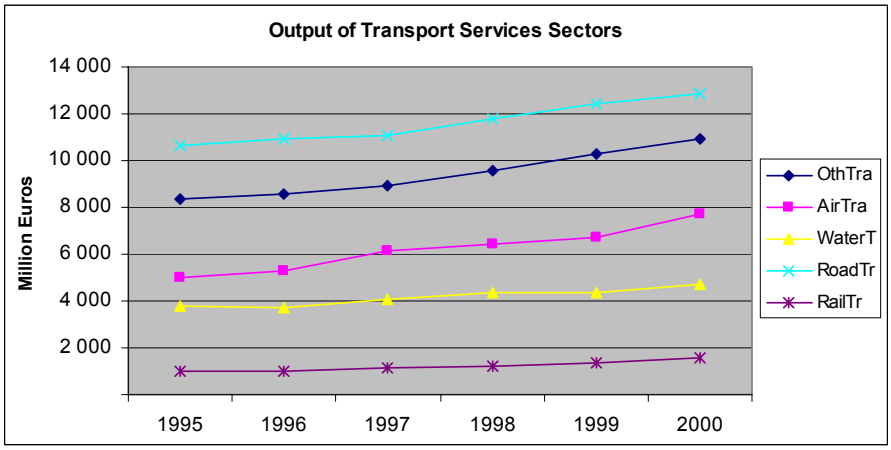
Source: own elaboration from Eurostat, IOT system database

Figure 98: Germany, output of the **Other Transport Equipment** sector (evolution)

4.6 Netherlands

4.6.1 Transport and Storage Sectors

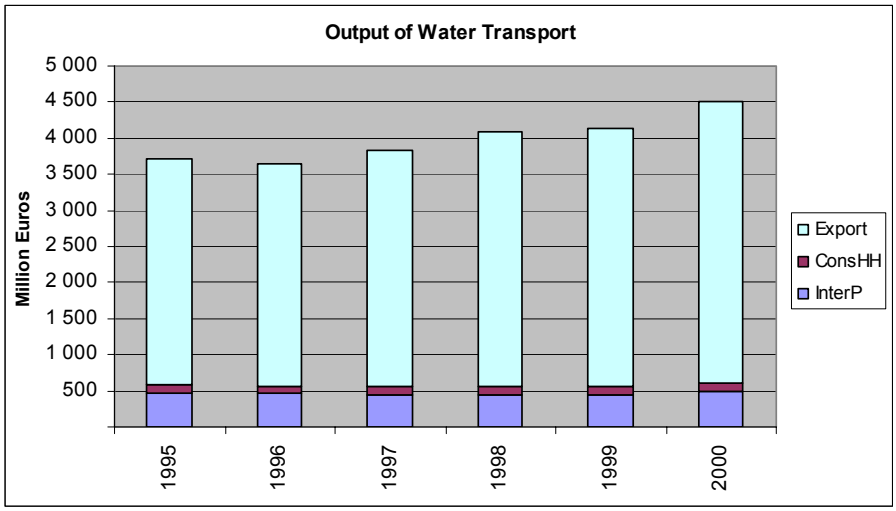
The contribution of the Dutch transport and storage sectors to the total production of the economy (measured in terms of Value Added created) has been around 5% during the 90s, with a recent decrease around 4.3% (see Figure 57 in page 101). In terms of output value (see Figure 99), all transport services sectors grow in absolute terms during the period, according to the IOT data from Eurostat. It is important to remark the high output value of the supporting and auxiliary transport sector (OthTra) that includes value generated by logistics activities and port terminal activities.



Source: own elaboration from Eurostat, IOT system database

Figure 99: Netherlands, output of all **Transport Services** sectors (evolution)

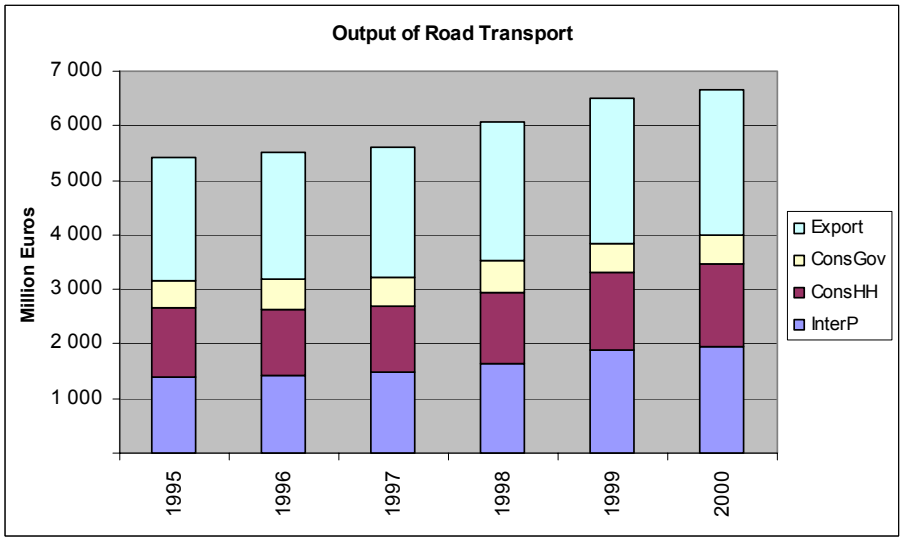
The Dutch transport sector is characterised by its high level of internationalisation due to the role of the Dutch seaports in the joint European transport system. In first place, Figure 100 and Figure 104 clearly represent this internationalisation: since 1995 the output of the maritime and waterways transport sector has been increasing its share devoted to exports of services (see Figure 100) from approximately 83% to 87%, being the contribution of the sector to consumption of households and to other sectors of the economy fairly constant. This change means an increase in the output devoted to exports of maritime transport services of 30% between 1996 and 2000. As mentioned above, this clear "exports orientation" of the transport sector in general and the maritime and waterways transport in particular can be confirmed with the net result of the transport services balance of payments (see Figure 104): it has been clearly positive since the beginning of the 90s with a maximum in 1997 and a trend for the reduction of the net positive result until 2003 (however, still clearly positive). According to Eurostat figures, the Dutch port system in 2004 was the third in total tonnes transported (over 440 millions), the first concerning dry and liquid bulks (145 millions of tonnes) and Rotterdam was the first port of Europe, both concerning total tonnes (over 330 millions of tonnes) and concerning container traffic (8.3 millions of TEUs). If we consider that 87% of this output can be roughly allocated to exported transport services, we can put in full context the importance of the Dutch maritime ports for the EU economy.



Source: own elaboration from Eurostat, IOT system database

Figure 100: Netherlands, output of the **Water Transport** sector (evolution)

The remaining transport modes also present high rates of participation in international activities; far larger taken altogether than most of the countries analysed. This can be confirmed through Figure 101 and Figure 102: both road and rail sectors present shares devoted to the export sectors higher in average that the rest of the countries, over 45% and 40% respectively.



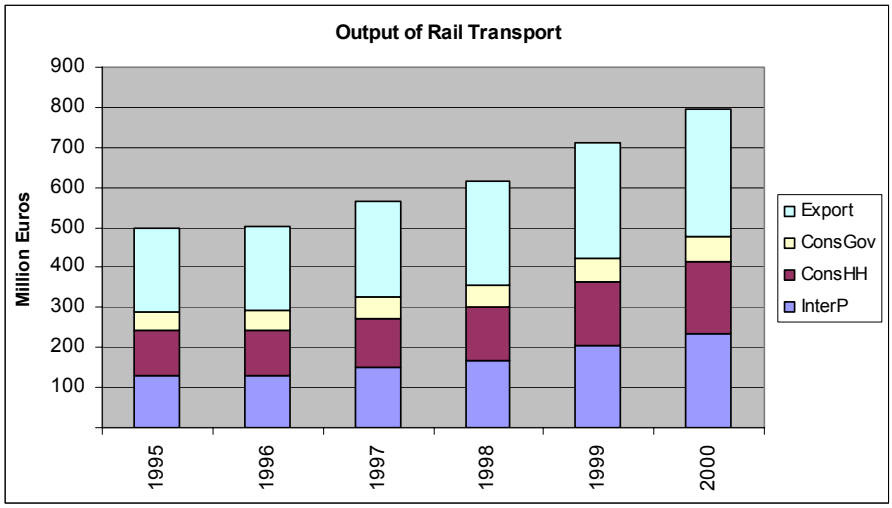
Source: own elaboration from Eurostat, IOT system database

Figure 101: Netherlands, output of the **Road Transport** sector (evolution)

The air transport sector also presents high rates of implication in exports activities. However, those figures are consistent with the ones presented by most of the countries, as this sector has, per se, a high international involvement. The supporting transport sectors have also a quite high percentage of output devoted to exports (see Figure 103), with a clear rising trend and a structure divided in three almost equal shares of output devoted to exports, consumption of households and intermediate inputs to other sectors of the economy. This means that

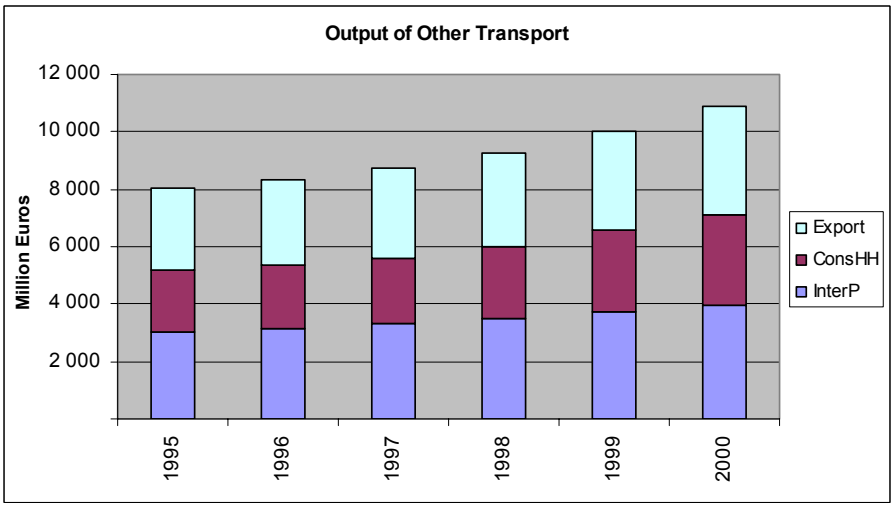
a large portion of warehousing and logistics is devoted to exports, unlike in the same sector of other economies analysed[54].

These numbers, again supported by the results of the transport services balance of payments (see Figure 104), clearly define a picture of the Dutch transport sector not only as the entry of a large quantity of goods imported and exported by the European economies. Its transport sector is also very involved in transport and distribution of these goods throughout Europe.



Source: own elaboration from Eurostat, IOT system database

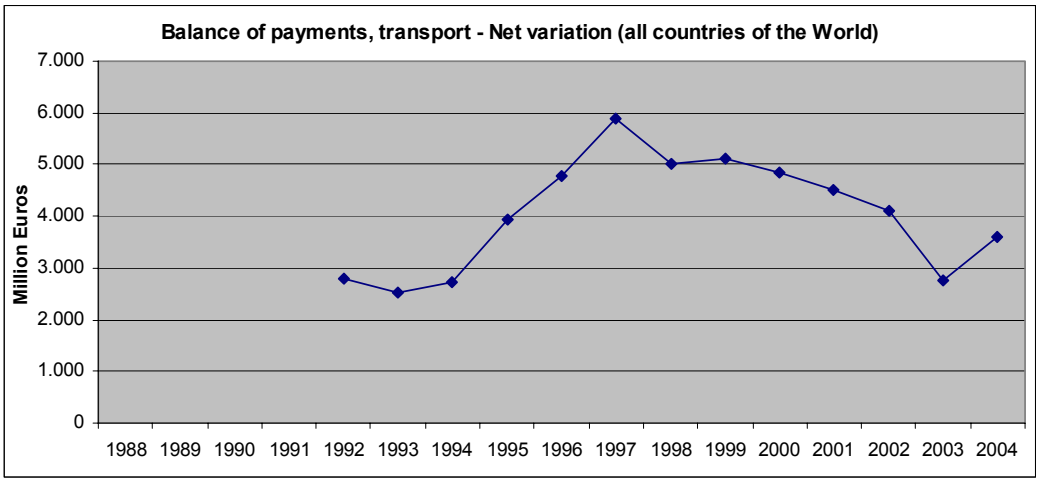
Figure 102: Netherlands, output of the **Rail Transport** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 103: Netherlands, output of the **Supporting Transport Activities** sector (evolution)

[54] For instance, in Germany most of the output value is devoted to satisfying the internal demand, as well as in France or Spain.



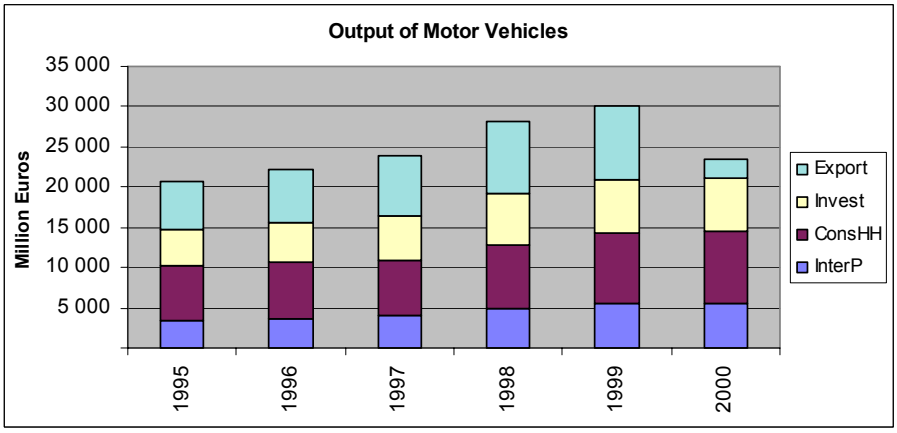
Source: own elaboration from Eurostat, ITS database

Figure 104: Netherlands, **Balance of Payments** of transport services (evolution)

4.6.2 Transport Production Sectors

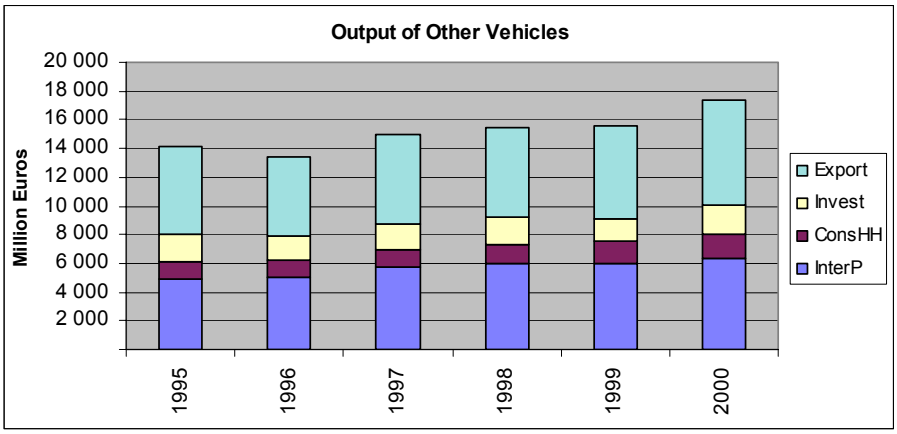
Together with Finland and Denmark, the two Dutch transport equipment sectors have the lowest contribution to the national GDP from all the countries analysed (see Figure 58 in page 101). However, in terms of investment rate over total investment of the economy and intermediate inputs consumed, the sector is rated amongst the average values (see Figure 60 on page 102 and Figure 62 on page 104). It can be said that the importance of the transport production sectors for the Dutch economy is quite limited. For instance, in 1999 the motor vehicles output was almost 10 times smaller than its German counterpart.

The composition of the output value of motor vehicles has, as expected, a strong share devoted to consumption of the households (see Figure 105), with an important share devoted to exports. The output of other transport vehicles sector (see Figure 71) is quite standard: it presents large portions devoted to exports and investment from other sectors, characteristics of a sector that produces mostly heavy transport equipment.



Source: own elaboration from Eurostat, IOT system database

Figure 105: Netherlands, output of the **Motor Vehicles** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 106: Netherlands, output of the **Other Transport Equipment** sector (evolution)

4.7 Spain

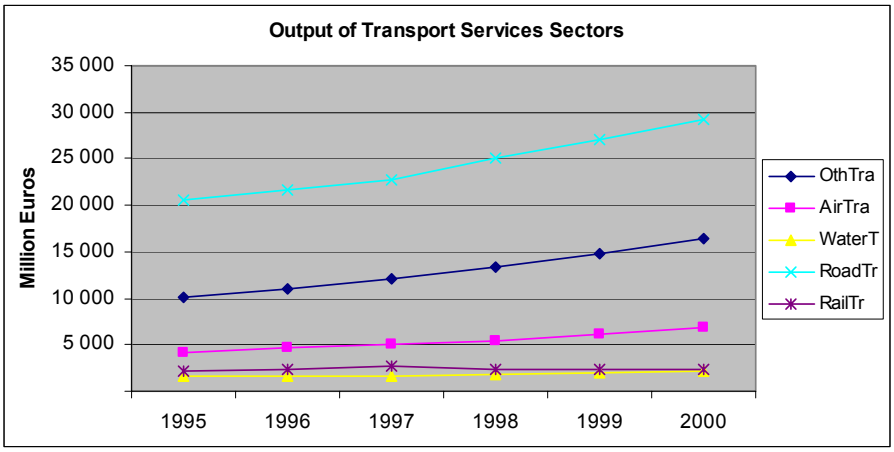
4.7.1 Transport and Storage Sectors

Since the mid 80s, and especially after the entry in the EU, the Spanish economy experienced an important growth that was complemented with strong investments in road infrastructures. This helped to construct a dense highway network based on which the growing transport sector was developed. Since then, the road transport has consolidated as the first transport mode in both in terms of output value created (see Figure 107) and tonnes transported (1.048 million tonnes in 2001, according to Eurostat data). In terms of output value, the growth of the road sector between 1995 and 2000 has been approximately 40%. The second sector in output value created is the supporting transport activities, followed by air transport. Both sectors had an important growth in the period under analysis: the supporting transport activities grew over 50%, a similar rate for the air transport. Rail and maritime transport are the sectors with the lowest output value during the period[55].

The joint contribution to the total Spanish GDP of the transport and storage sectors is amongst the highest of the countries analysed (see Figure 57 in page 101) with an average value during the period around 5.4%. In terms of intermediate inputs consumed, these sectors account for an average annual value of 4.5% with a slight trend to grow during the period[56]. There is no data available concerning the investment rate for the transport services sectors during the period.

[55] Maritime transport has grown rapidly in recent years in Spain. The Spanish port sector is nowadays the fourth in the EU in terms of total tones transported and has several port in the EU top10.

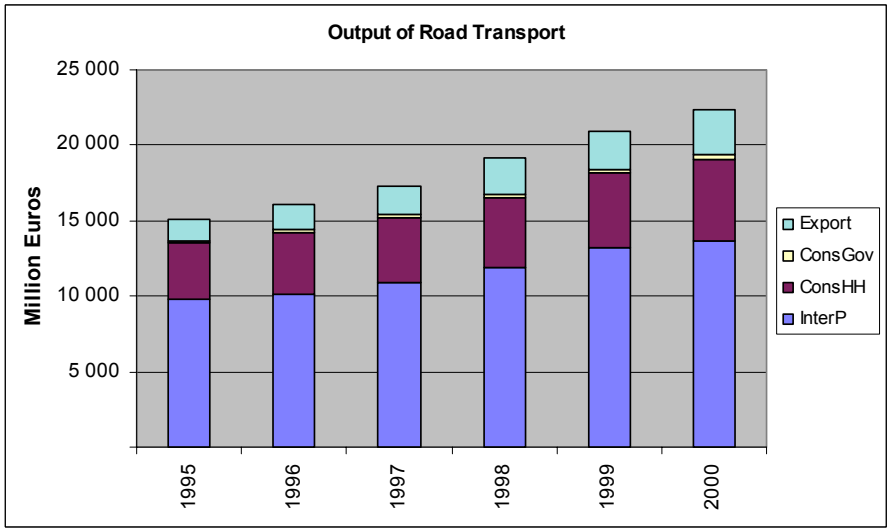
[56] For this variable, only 6 years of data are available.



Source: own elaboration from Eurostat, IOT system database

Figure 107: Spain, output of all **Transport Services** sectors (evolution)

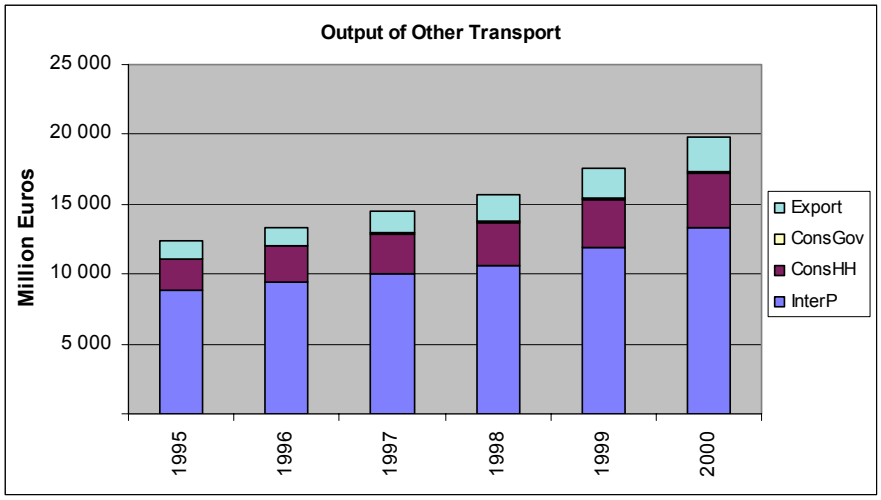
The evolution of road transport in Spain, as commented previously, has been highly conditioned by the strong development of road infrastructure since the late 80s. In terms of the composition of the output value of the sector, the main share corresponds to intermediate inputs consumed by other sectors of the national economy, followed by consumption of households. The contribution to exports is the third group in importance and is the one with a higher growth in percentage, around 100% during the period. This points at a progressive process of internalisation by the road sector, accompanying its overall growth.



Source: own elaboration from Eurostat, IOT system database

Figure 108: Spain, output of the **Road Transport** sector (evolution)

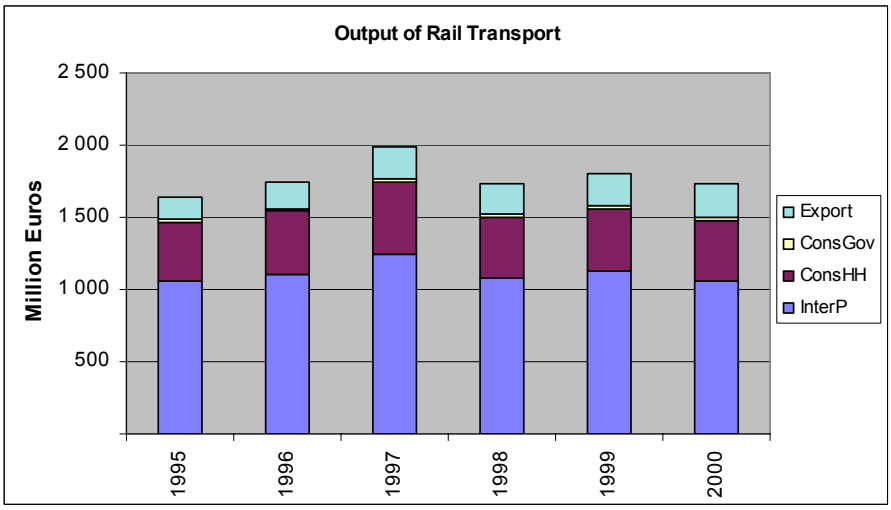
Development in the logistics sector has its expression in the growth of the supporting transport activities sector (see Figure 109). All the shares of the sector have grown during the period, which indicates a process of integration of the sector both in the national and international fronts of the economy.



Source: own elaboration from Eurostat, IOT system database

Figure 109: Spain, output of the **Supporting Transport Activities** sector (evolution)

The rail transport sector has been the only transport sector that has had a reduction in terms of output value created. Figure 110 shows the evolution of the output value, that has a peak in 1996 with a reduction in the following years. The main reason for this are the interoperability problems that the Spanish network has, mainly in terms of gauge, with the rest of the European network but also in terms of power source, signalling systems, etc. This has created a de facto "isolation" of the Spanish railway and a progressive loss of weight in the transport sector and in the economy[57].

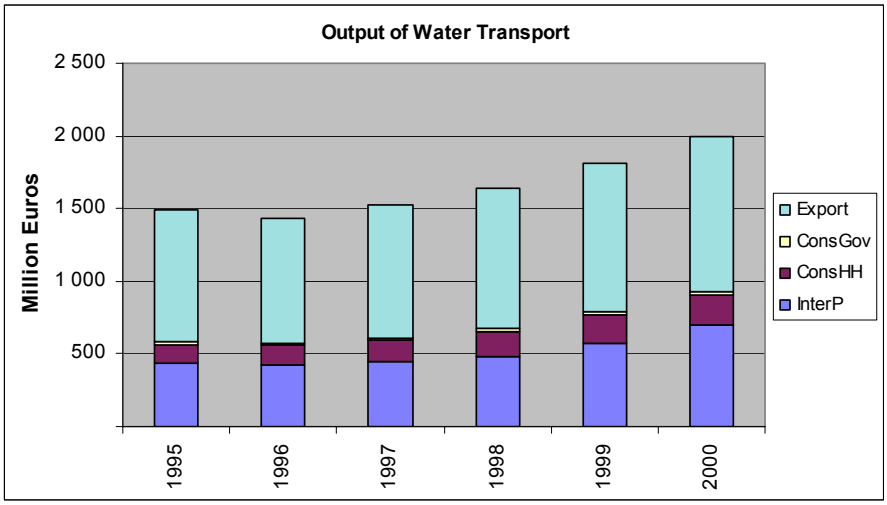


Source: own elaboration from Eurostat, IOT system database

Figure 110: Spain, output of the **Rail Transport** sector (evolution)

[57] The structure of the output value is the same as for the road transport due to the calculation method used to derive both figures. The relatively high share of imports in the case of rail might well have no adherence to reality.

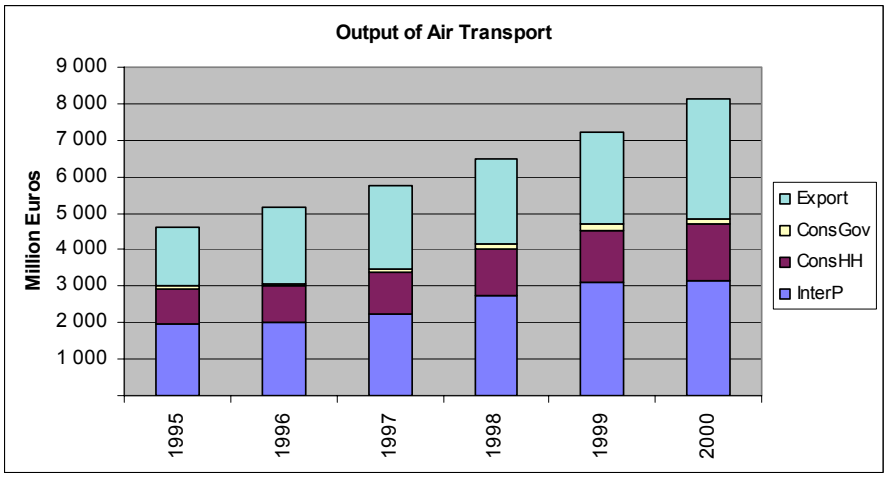
Maritime and air transport are the most internationally oriented transport modes in Spain. Maritime transport succeeded since the late 90s in turning the main mode for Spanish external trade, according to Eurostat data. Figure 111 shows the evolution of the output value of the sector, with an important growth after 1996 over 30%. Not only the contribution to exports grow, also the implication of the sector as provider of intermediate inputs for other sectors of the economy has grown substantially, confirming a trend for further integration of the sector in all aspects of the economy.



Source: own elaboration from Eurostat, IOT system database

Figure 111: Spain, output of the **Water Transport** sector (evolution)

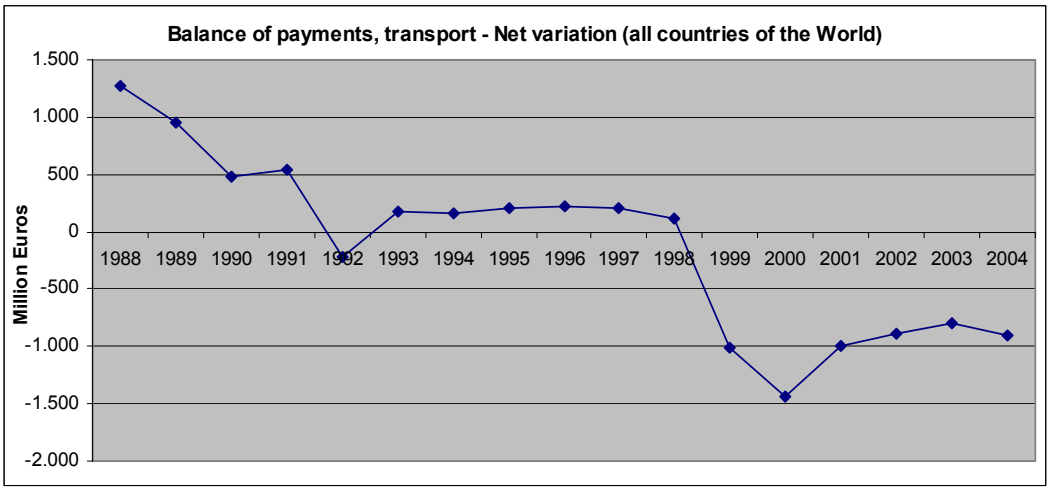
The evolution of the air transport sector has been positive, although it still has a low expression in absolute output value. Figure 112 presents the composition and evolution of the sector, which grew over 90% between 19954 and 2000. All the shares have increased its participation, but the main engines have been the exports and the intermediate inputs to other sectors. Again, as in the maritime transport case, it can be highlighted the growing implication of air transport with all the sectors of the economy.



Source: own elaboration from Eurostat, IOT system database

Figure 112: Spain, output of the **Air Transport** sector (evolution)

The net result of the transport services balance of payments (see Figure 113) has change from positive to negative during the period under analysis. This means that despite the strong internationalisation of most of the Spanish transport sectors, there is a strong trend to contract foreign transport services.



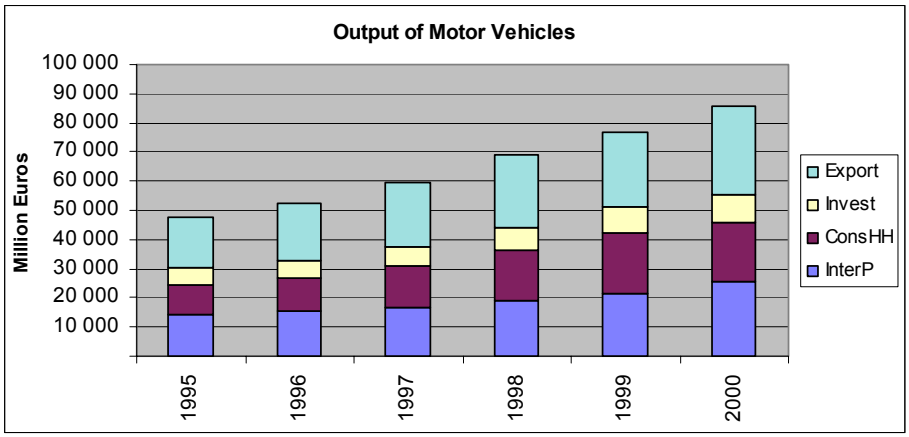
Source: own elaboration from Eurostat, ITS database

Figure 113: Spain, **Balance of Payments** of transport services (evolution)

4.7.2 Transport Production Sectors

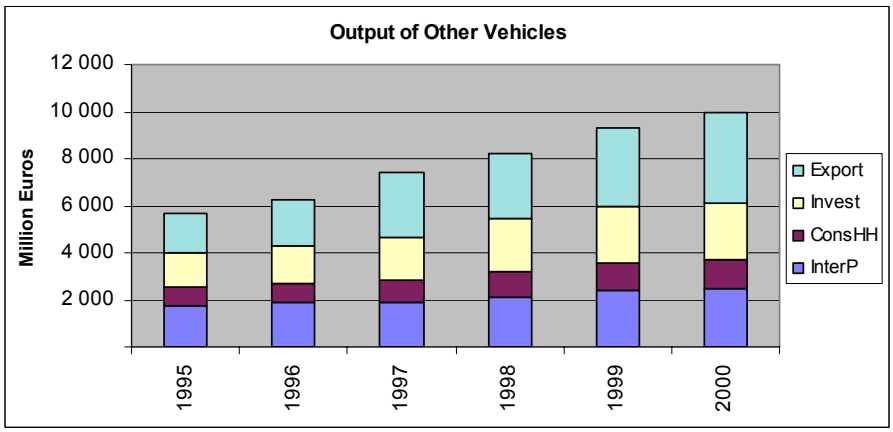
The transport production sector have a quite high contribution to the Spanish GDP, around 2% in average annual value, that is amongst the highest of the countries analysed (see Figure 58 in page 101). The contribution to the total national investment in terms of GFCF presents as well a stable evolution and figures amongst the highest of the countries analysed, slightly fewer than 2% of average annual value (see Figure 60 in page 102). The evolution of the inputs consumed by the sector over total inputs of the economy follows a different trend (see Figure 62 in page 104): since 1993 it has experienced a steep growth, which means that the sector has increased its demand of internal inputs. Both motor vehicles and other transport equipment sectors have increased largely their output values, over 40%, during the period. All categories of uses have contributed to the growth in both sectors: exports have an important contribution in both cases, as well as the share devoted to intermediate inputs of other sectors; for motor vehicles, the consumption of households has also a key role, as well as the investment of the public sector in the case of other transport equipment[58].

[58] In both cases, these are classic characteristics of the composition and destinations of the output value of the sectors.



Source: own elaboration from Eurostat, IOT system database

Figure 114: Spain, output of the **Motor Vehicles** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 115: Spain, output of the **Other Transport Equipment** sector (evolution)

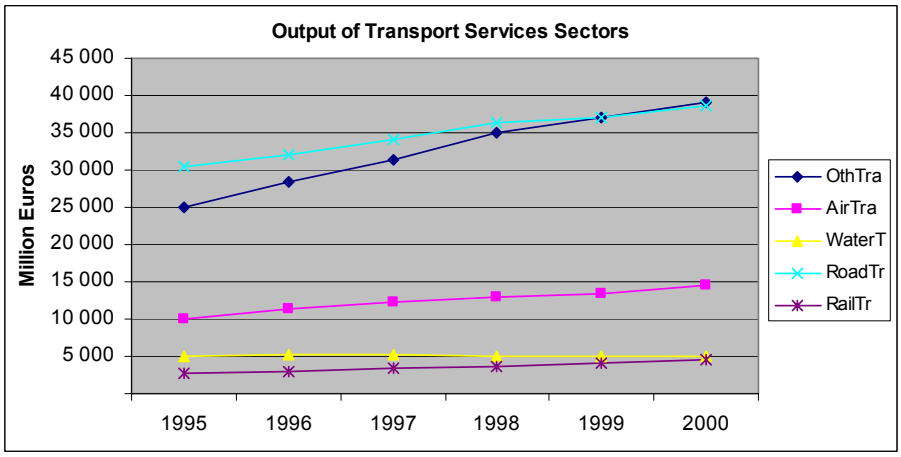
4.8 UK

4.8.1 Transport and Storage Sectors

The British transport and storage sectors have registered some noteworthy changes since the mid 90s. The analysis of Figure 116, which presents the output value per sector, suggests two major considerations: i) the overall and generally stable increase in all sectors, except water transport, and; ii) changes in the overall structure of the five studied sectors. Concerning this later consideration, one can note that the sector "other transport" has out placed the most significant sector (road transport) since 1999. In parallel, the two less significant sectors (water and rail transport) have become closer in terms of total output.

Despite the steady evolution of all transport services related sectors in the United Kingdom, the economic indicators of the transport and storage sectors show a decreasing contribution to the formation of the GDP. In fact, Figure 57 in page 101 shows how the total value added of the sector has varied, particularly it should be highlighted the diminishing contribution from this sectors registered since 1997. In short, although their absolute growth from 1995

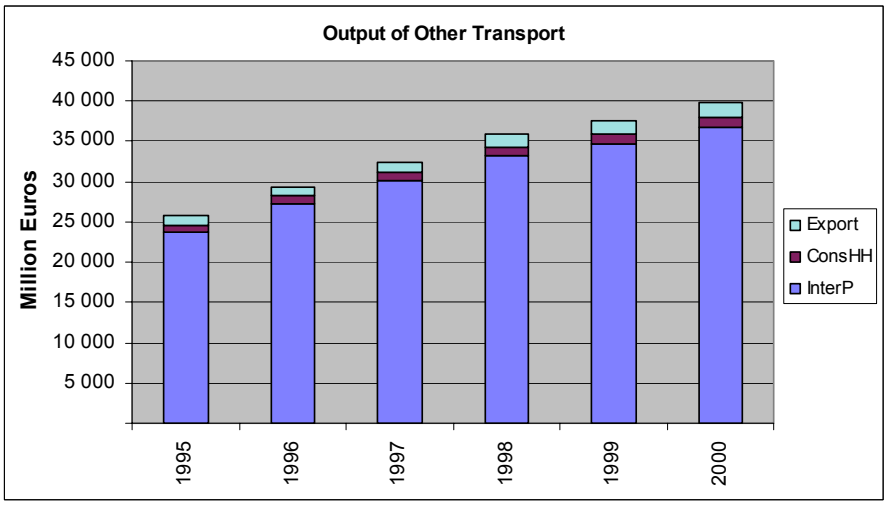
until 2000 has been positive, it was not enough to maintain its proportion in the wider national economic context.



Source: own elaboration from Eurostat, IOT system database

Figure 116: UK, output of all **Transport Services** sectors (evolution)

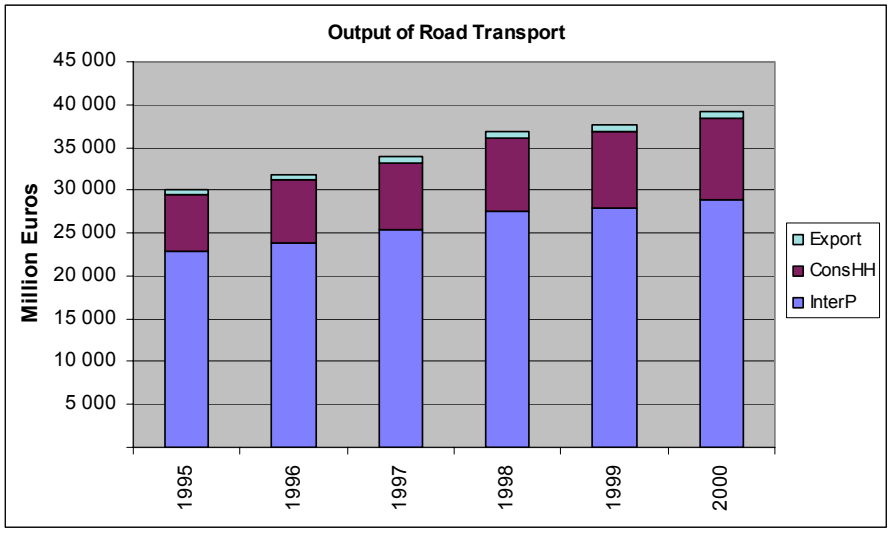
The output value of the supporting transport activities sector presents a stable evolution in the period under analysis (see Figure 117), following similar patterns already detected in other MS, based in the large percentage of value consumed as intermediate input by other sectors of the economy and a relatively low percentage consumed the remaining categories. However, this characteristic is far more extreme in the UK, as almost 90% of the output value is devoted to intermediate inputs, with very low shares of exports and consumption of the households. This characteristic can be also found in other transport sectors and is a consequence of the insularity of the UK.



Source: own elaboration from Eurostat, IOT system database

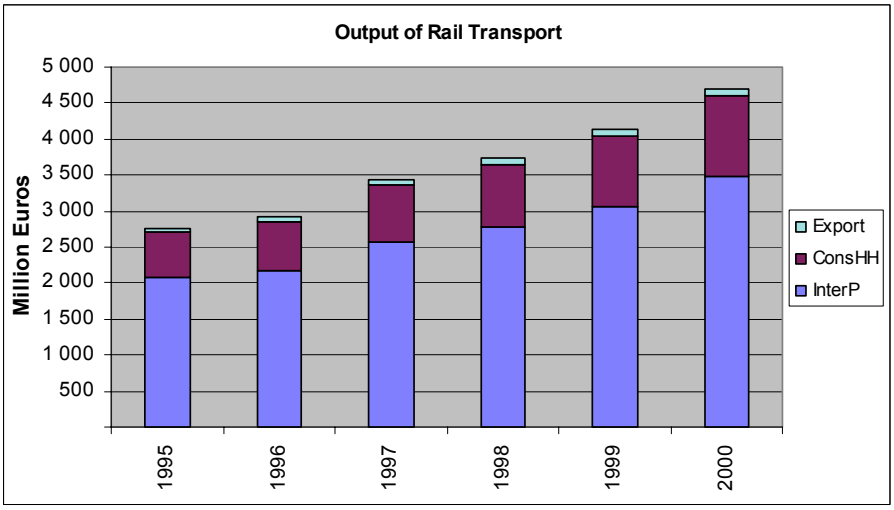
Figure 117: UK, output of the **Supporting Transport Activities** sector (evolution)

In 2000, the second transport sector in terms of output value was the road sector, which also presents a structure strongly oriented to the internal sectors of the economy (together with the rail sector since the calculation method of their shares is based on the value of land transport): about 24% of the value is consumed by households, with 74% consumed as intermediate inputs for other sectors of the economy and the rest devoted to exports (see Figure 118 and Figure 119).



Source: own elaboration from Eurostat, IOT system database

Figure 118: UK, output of the **Road Transport** sector (evolution)

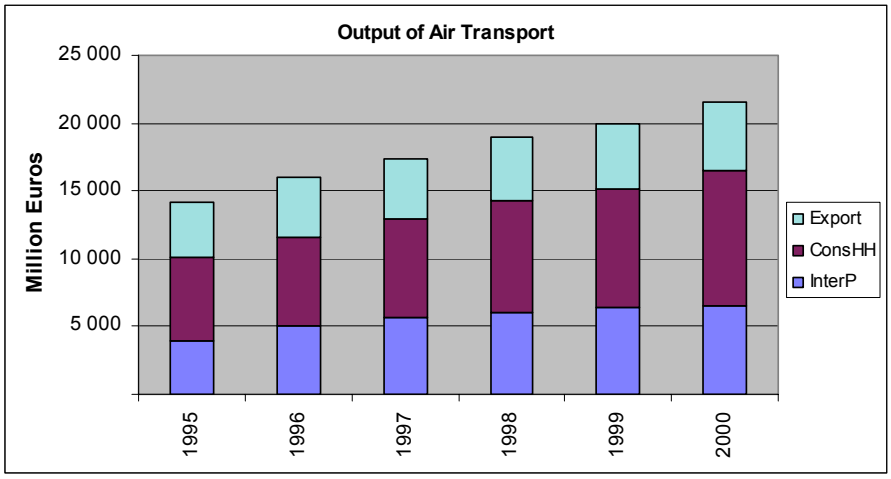


Source: own elaboration from Eurostat, IOT system database

Figure 119: UK, output of the **Rail Transport** sector (evolution)

The British air transport (see Figure 120), during the year 2000, presents a significant proportion of its output value devoted to households consumption (45%), followed by intermediate inputs for the other economic sectors (31%) and by exports (24%). It is interesting to note that although the overall production from the air transport sector in the UK has been grow-

ing from 1995 until 2000, the consumption distribution structure has been kept relatively stable during this period (in 1995: households, 44%; intermediate inputs, 29%; exports, 27%).



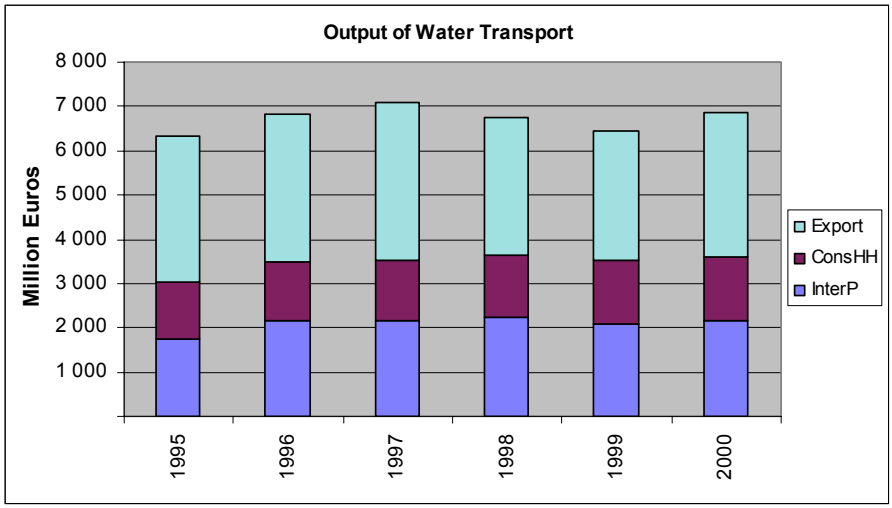
Source: own elaboration from Eurostat, IOT system database

Figure 120: UK, output of the **Air Transport** sector (evolution)

Figure 121 presents the composition and evolution of the British maritime and inland waterways transport sector, that together sum up for 577[59] million tonnes transported in 2000, with a clear external orientation. The evolution of the sector has been characterised by an absence of a consistent trend. In fact, there was an overall increase during the period 1995-1997, followed by a diminishing in the next two years, and again an increase in the year 2000. Concerning the consumption of water transport services, exports are the primary destination (48%), followed by intermediate production (32%) and finally, households (20%). This proportion has been kept evenly distributed among the three categories throughout the analysed period.

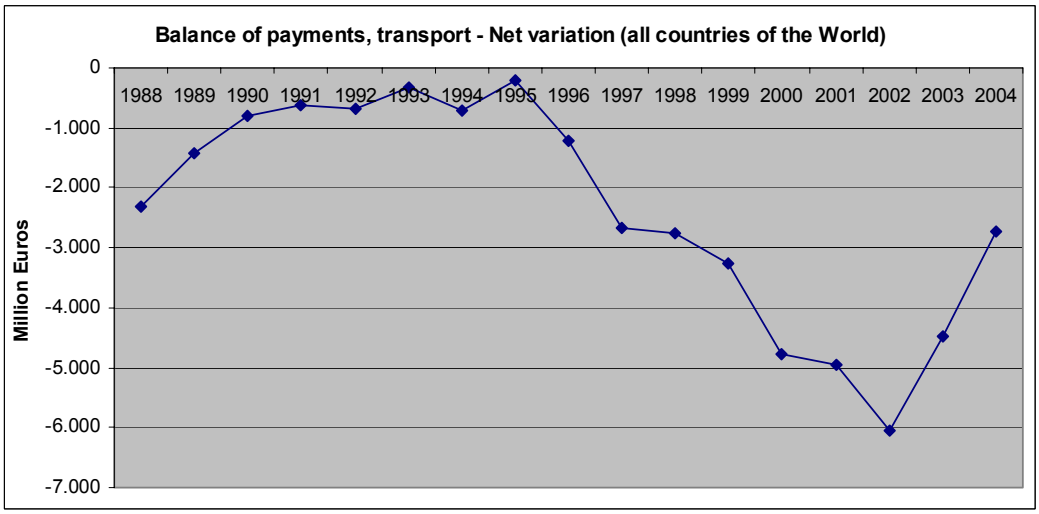
The importance of Britain as global commercial player is well known. However, since 1995 the transport services sectors are minor players in the international context, as Figure 122 shows: the strong negative net result of the transport services balance of payments reveals a certain dependence of external transport providers. Although negative, this value was increasing until 1995, when it reached an almost positive value. In 2002, a new inversion was detected - although this time positive - which continued until the end of the period analysed (2004).

[59] In total, 4 million tonnes transported using inland waterways and 573 million tonnes by maritime transport.



Source: own elaboration from Eurostat, IOT system database

Figure 121: UK, output of the **Water Transport** sector (evolution)



Source: own elaboration from Eurostat, ITS database

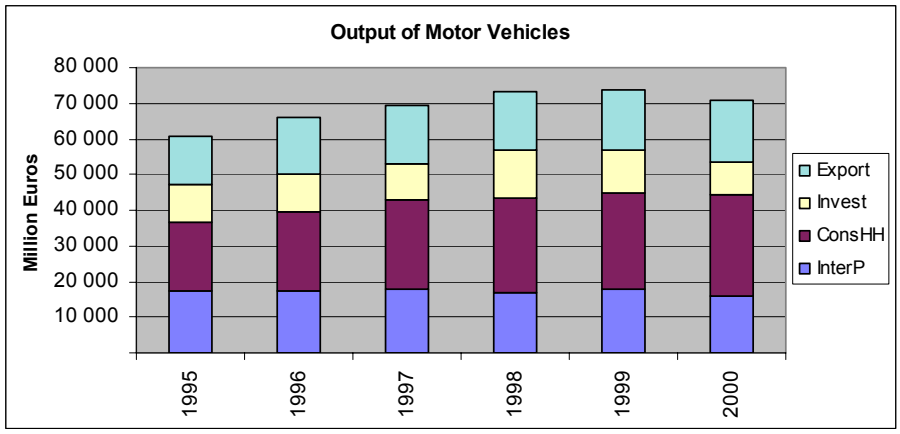
Figure 122: UK, **Balance of Payments** of transport services (evolution)

4.8.2 Transport Production Sectors

The analysis of Figure 123 depicts the relatively low level of internationalisation of the British motor vehicles production sector (25%). On the other hand, importance should be given to the internal market, particularly households which represent nearly 40% of the total motor vehicle national production consumption, followed by intermediate production (22%) and investment (13%). Also noteworthy is the inversion of the overall growth trend in this production sector registered from 1995 until 1999 due to a decrease observed in all categories except in exports.

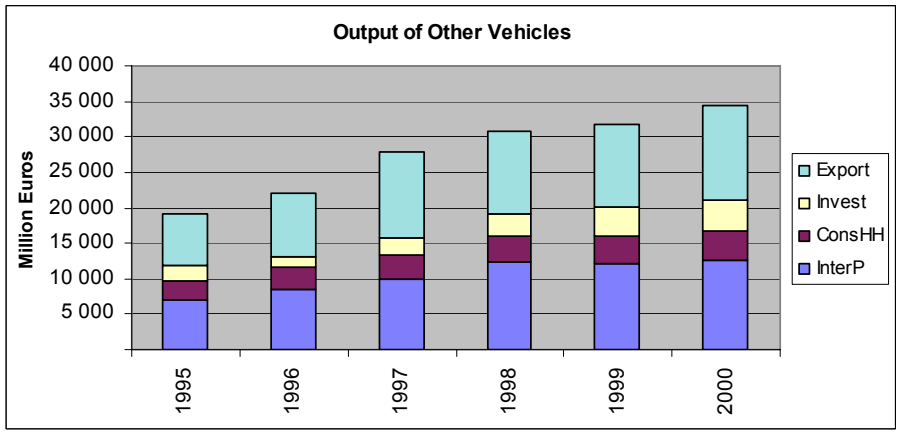
Concerning the other transport equipment output (Figure 124), one can note that this production sector is characterised by a constant growth during this period (1995-2000) driven by the increase in the external demand (exports represented nearly 39% of the total production

in the year 2000), and also in the internal demand (caused mainly by the growth in the intermediate production consumption, representing 37% of the total production of other vehicles in the UK during the year 2000). The investment share is smaller than in other countries analysed, showing a small demand of the national economic sectors for the British transport equipment.



Source: own elaboration from Eurostat, IOT system database

Figure 123: UK, output of the **Motor Vehicles** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 124: UK, output of the **Other Transport Equipment** sector (evolution)

4.9 Czech Republic

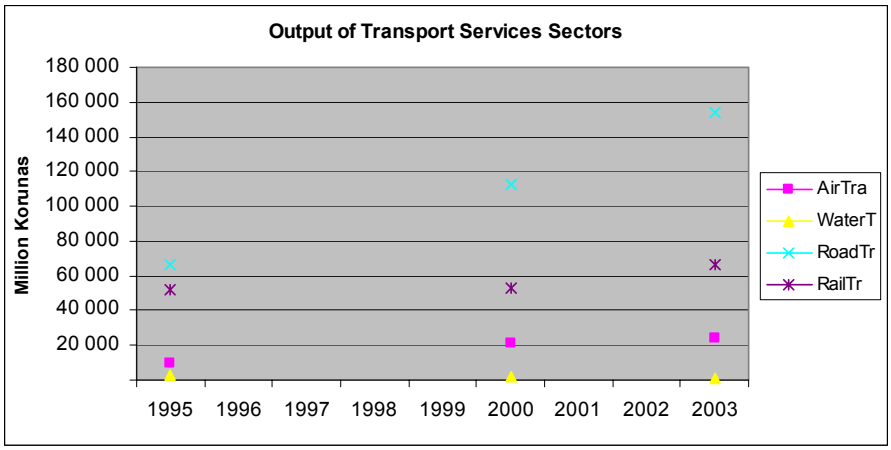
4.9.1 Transport and Storage Sectors

Although data is only available for three years (33% of the total period), one can observe a reasonably steady growth in all transport and storage sectors except in water transport (see Figure 125)[60]. The road transport sector has experienced a very strong growth during the period from 1995 until 2004 (230%), representing, in 2003, 63% of the total production

[60] No category concerning "other transport" was available in the Czech Republic IO tables.

from the four sectors considered. Also interesting is the significant growth in the output of rail transport services, totalizing nearly 29% from 2000 until 2003.

The data concerning the Czech transport sector are also incomplete concerning the OECD SAD database: There are no available data concerning contribution to total GDP, percentage of GFCF over total GFCF and intermediate inputs consumed.

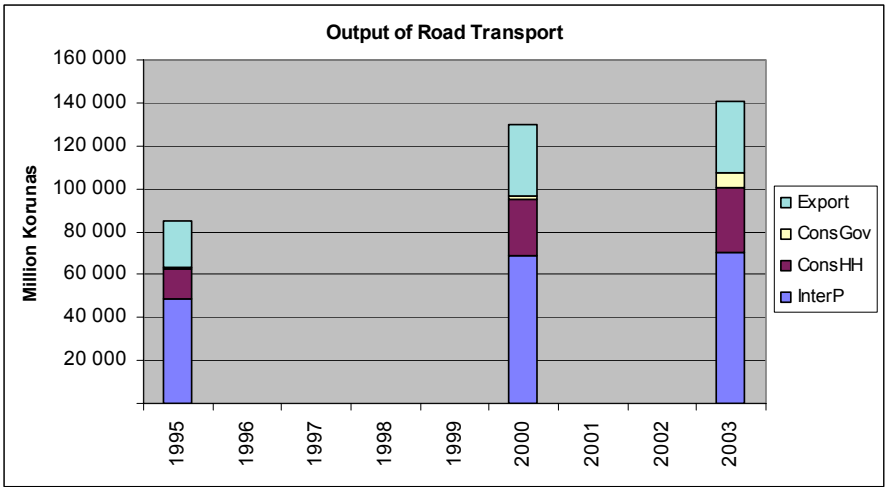


Source: own elaboration from Eurostat, IOT system database

Figure 125: Czech Republic, output of all **Transport Services** sectors (evolution)

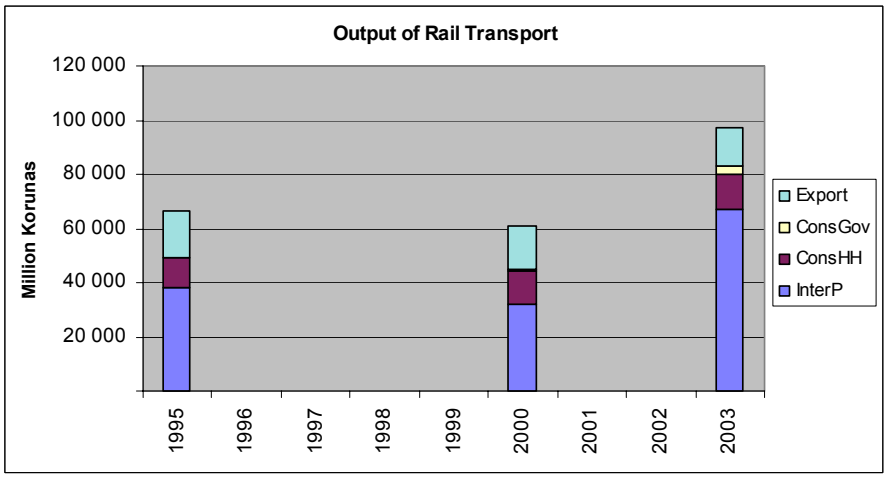
The output value of the road transport production sector presents a reasonably stable evolution in the period under analysis (see Figure 126) based in the largest percentage consumed as intermediate input by other sectors of the economy (50% in 2003) and a lower percentage consumed the remaining categories: exports (24% in 2003), households (21% in 2003) and government (5% in that same year). Moreover, the government consumption category had a significant growth between 1995 and 2003, a very large increase in percentage, above 2500%.

Concerning rail transport services (see Figure 129), one can observe a light reduction (9%) in the total value of this sector between 1995 and 2001. The distribution evolution thought the four categories follows the same pattern described previously for road transport since the calculation method of their shares is based on the value of land transport in the IOT.



Source: own elaboration from Eurostat, IOT system database

Figure 126: Czech Republic, output of the **Road Transport** sector (evolution)

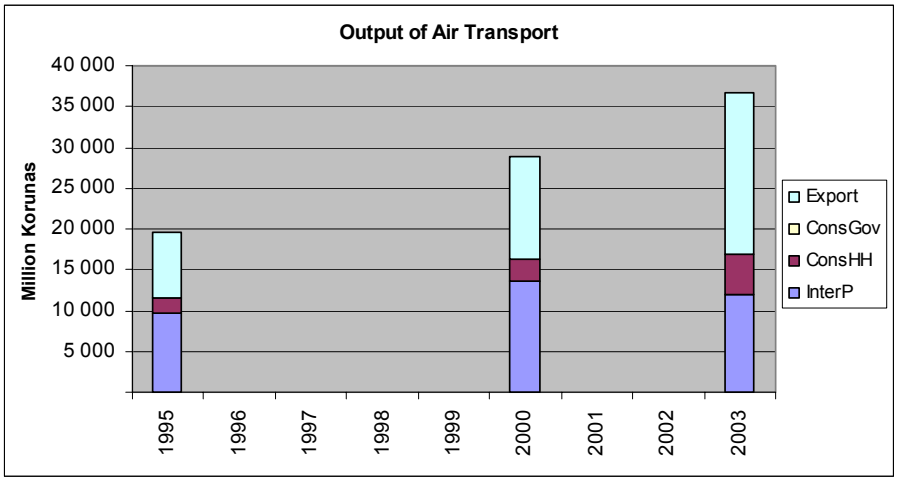


Source: own elaboration from Eurostat, IOT system database

Figure 127: Czech Republic, output of the **Rail Transport** sector (evolution)

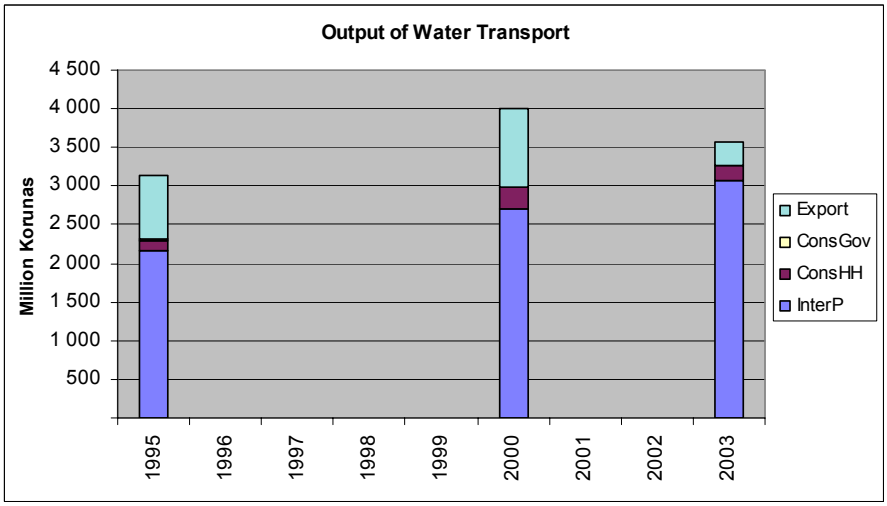
In what concerns air transport, the analysis of Figure 128 allows to conclude that this economic sector has increased 87% in nine years (from 1995 until 2003). Regarding the consumption of its services, one can observe that the exports category has grow nearly 150%, intermediate production increased 23% and households grew approximately 160%. In the most significant transport sectors (road and rail), exports are only a minor part of the total consumption (24% in 2003).

Finally, the water transport sector (of course, only inland waterways), although with a minor contribution when compared with the other transport modes, has registered a relatively significant growth between 1995 and 2000 (28%), and a lighter increase if the larger period between 1995 and 2003 is considered (14%). Concerning the consumption of the services produced by this sector, one can observe that this increase is mainly due to the growth of the intermediate demand from other economic sectors (see Figure 129).



Source: own elaboration from Eurostat, IOT system database

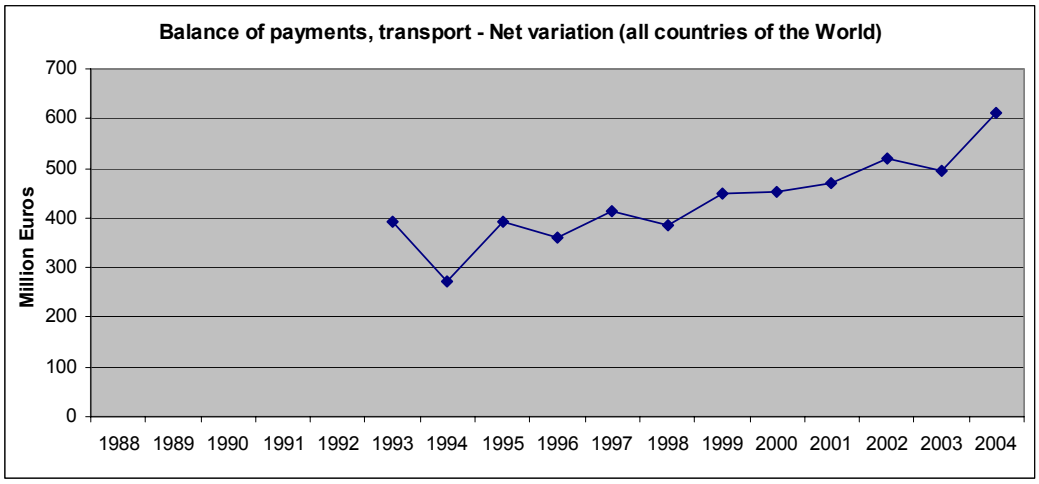
Figure 128: Czech Republic, output of the **Air Transport** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 129: Czech Republic, output of the **Water Transport** sector (evolution)

In Figure 130, it can observe that the net variation in the transport balance of payments has remained positive throughout the analysed period and generally increasing. In fact, in the year 1993 the balance was nearly 400 million Euros and increased approximately 50% until 2004, when it reached more than 600 million Euros. In a first analysis we could remark the important international participation of all transport modes, only taken as reference the figures presented. We can also remark the importance of the Czech Republic as main economic actor between the NMSs and its closeness in geographical and economic terms to the first European economy, Germany, its first commercial partner.



Source: own elaboration from Eurostat, ITS database

Figure 130: Czech Republic, **Balance of Payments** of transport services (evolution)

4.9.2 Transport Production Sectors

The transport equipment production sectors have a very high importance for the Czech economy. In terms of proportion of GDP, they represent around 3.2% with a steep growth rate since the early 90s (see Figure 58 in page 101). The investment rate is also very high (the highest of the countries analysed) with a peak of 5% in 2001 and a more recent value of 4.1% in 2004 (see Figure 60 in page 102). The growth rate of the two previously referred indicators steep up during the late 90s, as well as the consumption of intermediate inputs from the economy, that rises to its maximum in 2001 with 8% (see Figure 62 in page 104).

The analysis of Figure 131 depicts the high level of internationalisation of the Czech Republic motor vehicles production sector, with over 50% of its output value devoted to the external sector. On the other hand, importance should be given to the internal market, particularly intermediate production which represents nearly 27% of the total motor vehicle national production, followed by investment (17%) and households (6%). Also noteworthy is the high overall growth of this specific sector registered from 1995 until 2003 (285%) due to an increase in all categories.

In what concerns the other vehicles economic sector (see Figure 132) one can observe a steady growth since 1995 until 2003 (89%), due to the increase observed in all categories: exports (50%), investment (293%), intermediate production (81%) and households (28%).

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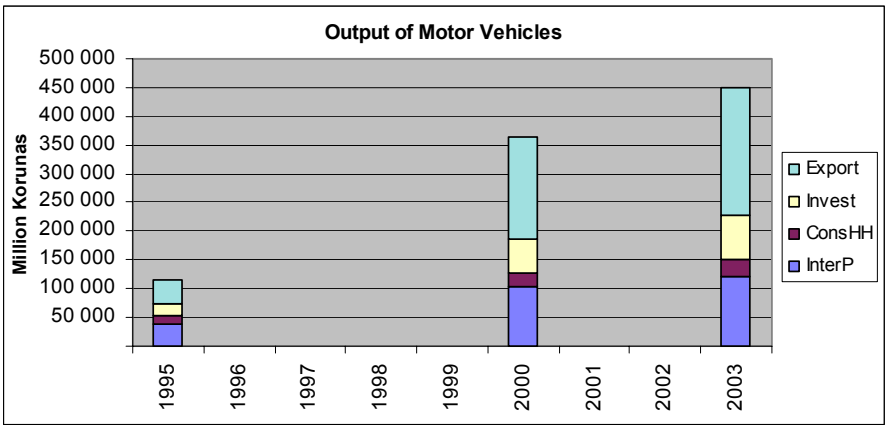
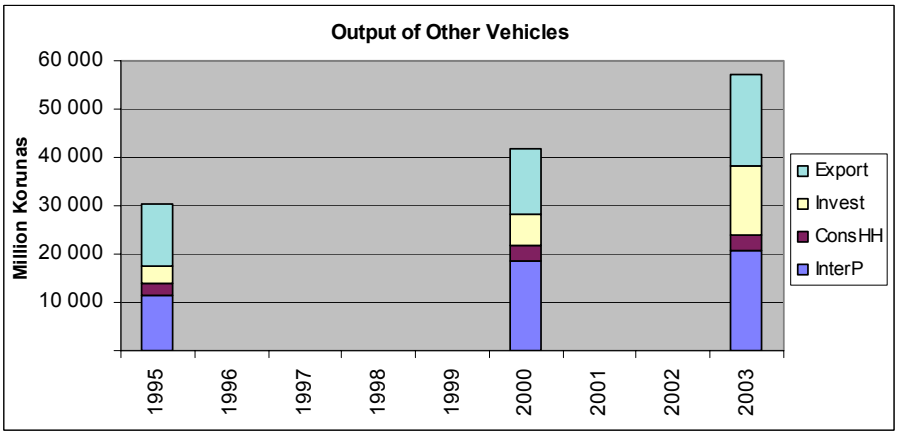


Source: own elaboration from Eurostat, IOT system database

Figure 131: Czech Republic, output of the **Motor Vehicles** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 132: Czech Republic, output of the **Other Transport Equipment** sector (evolution)

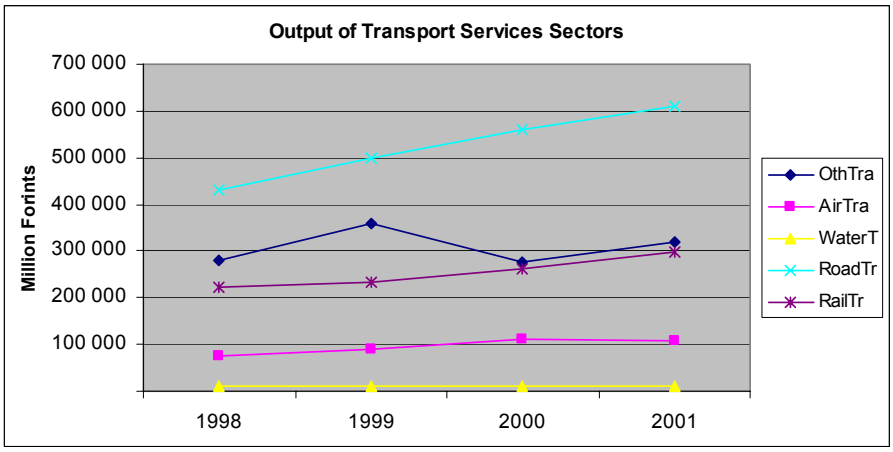
4.10 Hungary

4.10.1 Transport and Storage Sectors

The data available for Hungary only allows covering a period of four years, between 1998 and 2001. Nevertheless, there is a stable and significant growth in the most contributor transport service sector: road transport (431.552 million Euros in 1998 to 610.431 million

Euros in 2001, which represents a growth rate of 41%), as presented in Figure 133. Concerning other transport it can be observed a decrease in the year 2000, while all the remaining years register a positive growth. The overall growth rate for the period 1998-2001 for this sector was 14%. Moreover, the rail transport has been growing steadily since 1998, registering an overall growth rate of 32% for the period analysed. In what concerns air transport, the sector has grow from 1998 until 2000, occurring a slight decrease in the last year analysed. The overall growth rate for the all period was 42%. Finally, the less significant sector, inland waterways, has decreased from 1998 to 1999 and increase in the remaining time period. The overall growth rate in the entire period was 24%.

The transport and storage sectors have had a strong decreasing trend in the period analysed (see Figure 57 in page 101), from 7% to less than 5% of the total GDP. The data concerning the consumption of intermediate inputs over the total intermediate inputs of the economy varies during the period, following a slight trend for reduction, as showed in Figure 61 in page 104. There are no data concerning the investment rate of the sector.

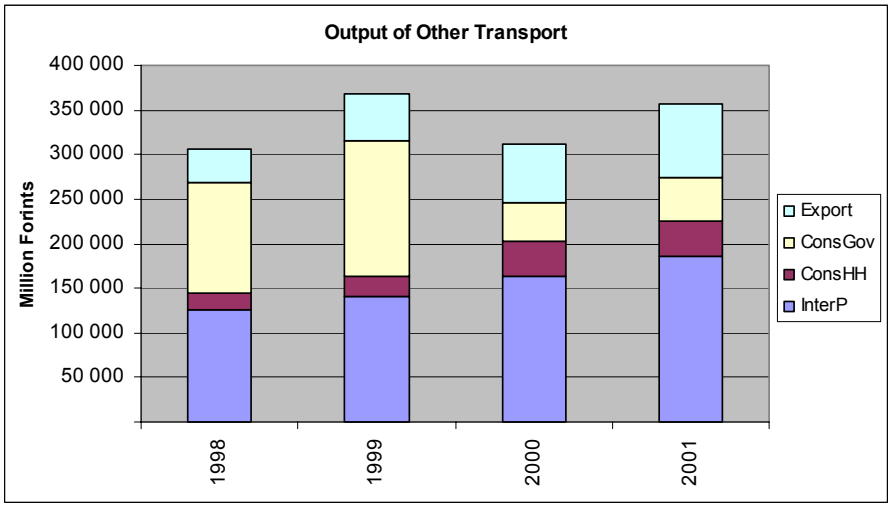


Source: own elaboration from Eurostat, IOT system database

Figure 133: Hungary, output of all **Transport Services** sectors (evolution)

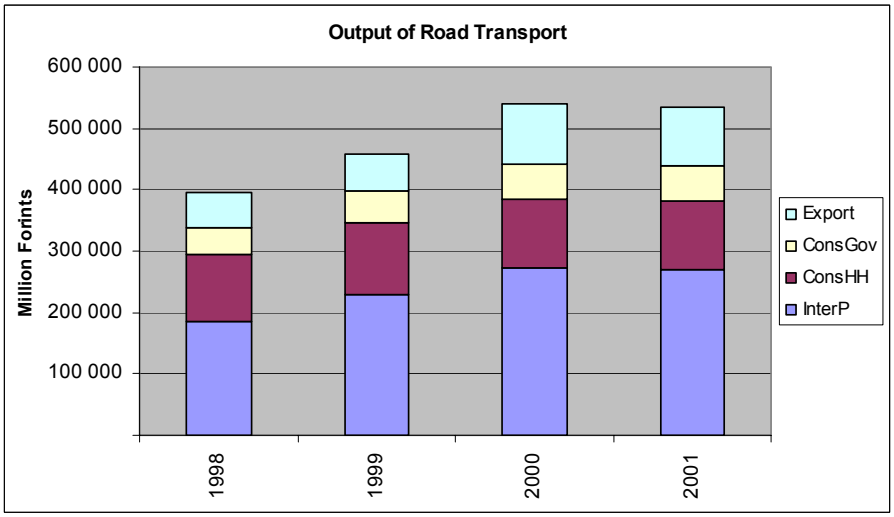
The output value of the road transport production sector presents a reasonably stable evolution in the period under analysis (see Figure 135) except in the final year when a slight decrease was registered in all consumption categories. The category with the highest share in all the four years studied was the intermediate production (50% in 2001) followed by households (21% in 2001), exports (18% in 2001) and finally government (11%).

In what concerns the supporting transport activities, Figure 135 illustrates the irregular evolution of this sector: growth from 1998 to 1999 and again from 2000 to 2001, while from 1999 to 2000 this sector has registered a decrease in its overall value. In terms of consumption, the most significant category in 2000 and 2001 (52%) is the intermediate production, which has been growing during the entire period under analysis. On the other hand, government consumption, which was the most significant consumption category in 1998 and 1999, has suffered a very strong decrease from 1999 to 2000 and kept low in 2001 (11%). The households category has also been growing during the entire period of analysis (11% in 2001).



Source: own elaboration from Eurostat, IOT system database

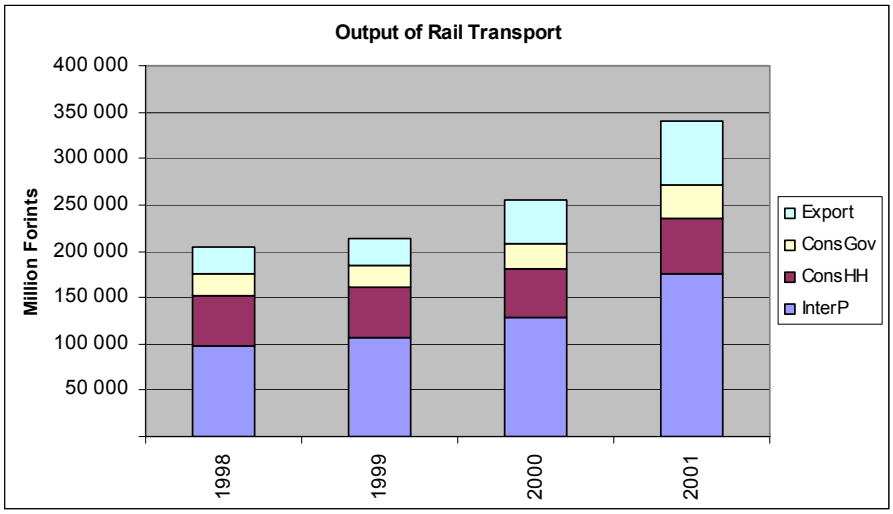
Figure 134: Hungary, output of the **Supporting Transport Activities** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 135: Hungary, output of the **Road Transport** sector (evolution)

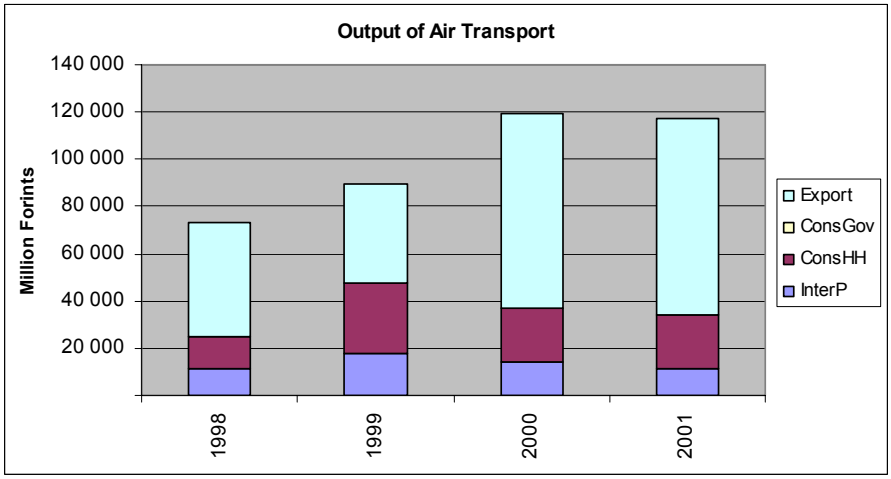
Regarding rail transport (see Figure 136), it is interesting to note the steady and strong overall growth of this sector. Regarding its consumption, the category responsible for the highest share is intermediate production, which has always registered growth during the entire period of analysis, totalising more than half of the sector total production in 2001. The weigh of the external dimension demand (exports) has also been growing reaching 20% of the total in the year 2001, closely followed by household consumption (17% in that same year). Finally, the government consumption, which has been kept at stable levels in absolute terms, represents 11% of the total services production in 2001.



Source: own elaboration from Eurostat, IOT system database

Figure 136: Hungary, output of the **Rail Transport** sector (evolution)

The air transport sector has grown during the entire period of analysis, except in the final year (see Figure 137). In what respects the consumption distribution, the most significant category was always exports (71% of the total sector production in 2001), followed by households consumption (19% in that same year)) and intermediate production (nearly 10% of the total production in 2001). The government consumption category has registered no values during the period analysed.

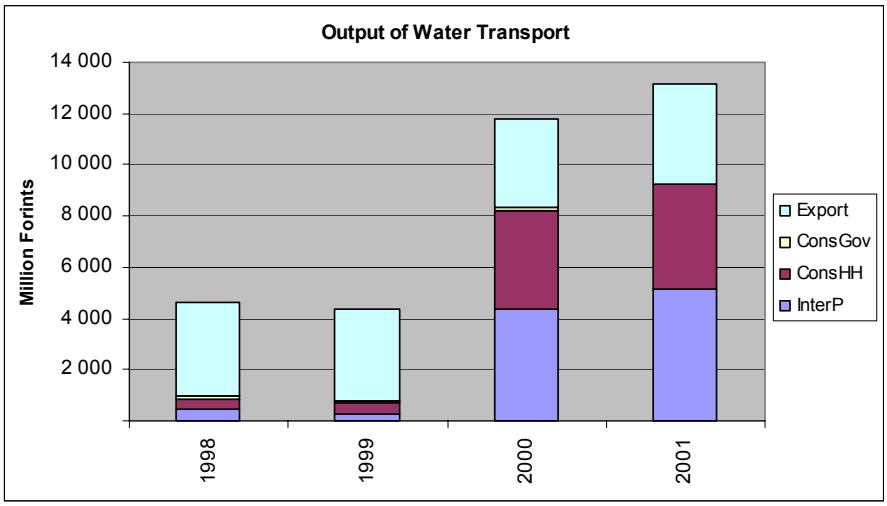


Source: own elaboration from Eurostat, IOT system database

Figure 137: Hungary, output of the **Air Transport** sector (evolution)

Finally, in what concerns the water transport services sector (see Figure 138), the first consideration that must be produced is the very strong growth registered from 1999 to 2000 (approximately 170%) and maintained in 2001. This significant increase was mainly due to the growth in the intermediate production category (275 million Euros to 4 390 million Euros corresponding to a 1500% overall growth rate). The exports category has been relatively

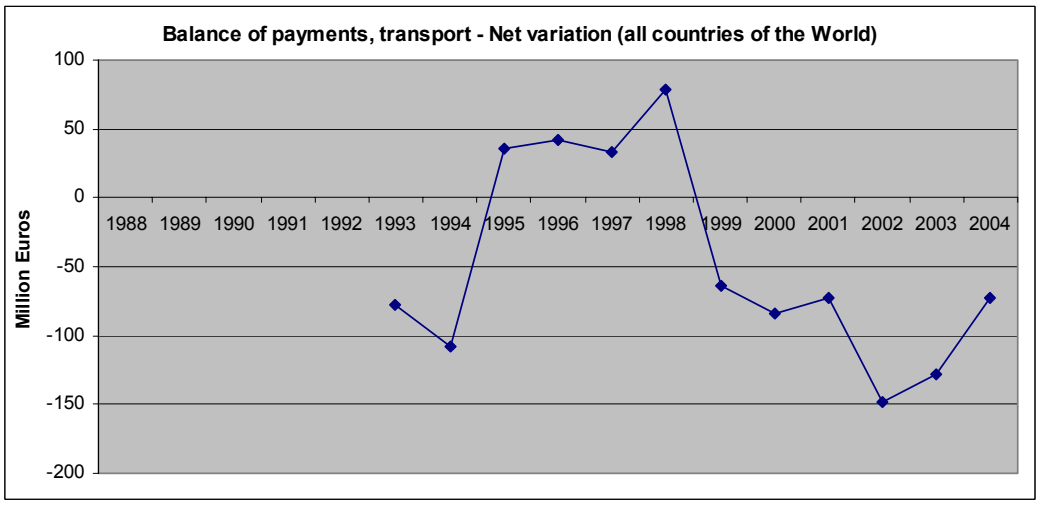
stable during the entire period of analysis, while the households consumption category has also suffer a very strong increase from 1999 to 2000 (780%).



Source: own elaboration from Eurostat, IOT system database

Figure 138: Hungary, output of the **Water Transport** sector (evolution)

In Figure 139, one can observe that the net variation in the transport balance of payments can be characterized by a quite unstable pattern, presenting positive values from 1995 until 1999, reaching its lowest value in 2002, when it started to grow again the end of the analysed period, although keeping negative values. The highest value was reached during the year 1998 (nearly 80 million Euros).



Source: own elaboration from Eurostat, ITS database

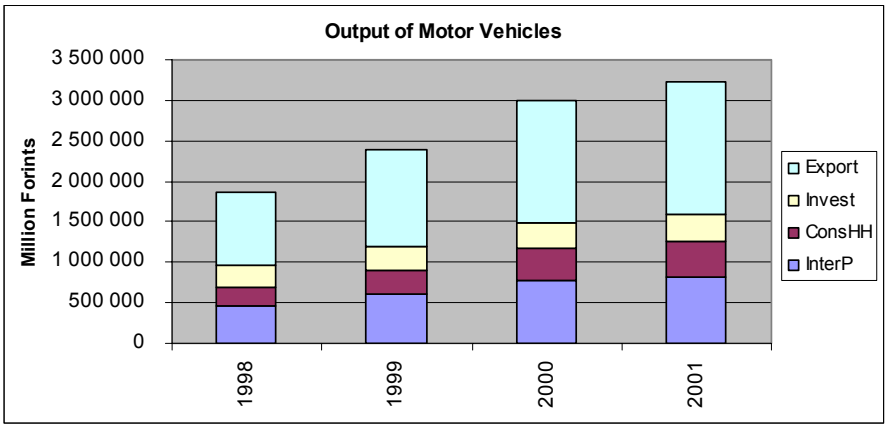
Figure 139: Hungary, **Balance of Payments** of transport services (evolution)

4.10.2 Transport Production Sectors

The analysis of Figure 140 suggests the high level of internationalisation of the Hungarian motor vehicles production sector, over 50% of the total output of the sector. This category has been the most significant one for this specific sector from 1999 until 2001. It is followed

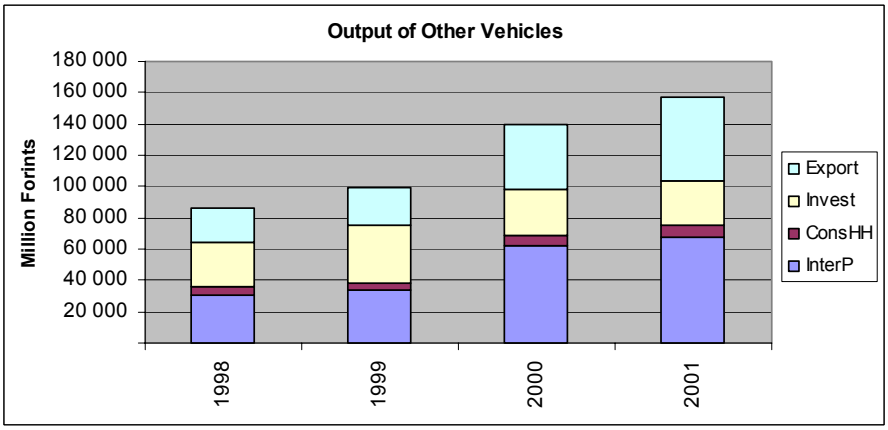
by the intermediate input to other sectors, which grew during the entire period analysed, reaching 25% of the total consumption in the year 2001. The third most significant sector demanding motor vehicles production is households, although with a relatively low share of the total consumption (14% in the year 2001). Finally, the investment category only represented 10% of the total in that same year.

In what concerns the other vehicles economic sector (see Figure 141) one can observe a steady growth since 1995 until 2001 (82%), due to the increase observed in all categories: exports (147%), intermediate production (122%) and households (46%) except investment which essentially kept stable during the period analysed.



Source: own elaboration from Eurostat, IOT system database

Figure 140: Hungary, output of the **Motor Vehicles** sector (evolution)



Source: own elaboration from Eurostat, IOT system database

Figure 141: Hungary, output of the **Other Transport Equipment** sector (evolution)

4.11 Conclusions on impacts of structural change on transport in selected countries

This section presents a resume of the most important issues concerning the structural analysis of the transport related sectors per country. This is a systematisation of the main points that will help to construct the indicator for the measure of the potential for bottlenecks on transport and logistic systems in Europe in the following chapter.

Denmark: The total output of the supporting and auxiliary transport activities does not have so much weight as other developed economies of the EU, which means that the Danish logistic sector still has room to grow and to catch up with the figures and values of other countries, in terms of transport share. The positive growth of the net result of the transport services balance of payment is provoked by the strong export orientation of the maritime transport, as the other transport sectors are more oriented to internal economic activities. The two transport equipment sectors have a quite low contribution to the Danish GDP, therefore, while transport services sectors were of prime importance for the Danish economy, transport equipment sectors have a low overall importance.

Finland: The transport activities are based mainly in the road and complementary transport activities, being the latter the maximum value-creator of all transport-related sectors, which is a characteristic of highly developed transport and logistic systems. It is important to remark the important growth of the InterP category for the water transport sector since 1999, which reveals a trend for the increase of the maritime sector as intermediate input for the rest of economic sectors. Between 2000 and 2002 rail and road figures present important increases in the share devoted to exports, which grow more than 100% in each case. The lack of data from 2001 and after 2002 does not allow confirming if this is a structural trend or a temporary effect. The contribution of the two Finish transport equipment production sectors for the total GDP is amongst the lowest in percentage of the countries analysed, together with the Netherlands and Denmark. These figures, as in the case of Denmark, provide a scenario of high contrast between the importance of the transport services sectors in terms of contribution to the GDP and a low weight of the transport equipment sectors.

France: The transport related sector with higher share of the total output value is the complementary transport activities sector. This means that the French transport sector has a very important development of the logistics sectors, a characteristic of the European most developed economies. As the rest of transport services sectors have a low implication in exports that has maintained fairly constant, the only contributor to this improvement of the net result of the transport services balance of payments has been the maritime sector. It can be said that logistics has a very important penetration in the French economy with a growing role since the mid 90s and is nowadays the main source of value creation of the French transport service sectors. The transport equipment sector has as well a high importance for the French economy.

Germany: Compared to the rest of countries analysed, the German economy is the one with the highest portion of output value related to transport created by the supporting transport activities sector. Despite of the high level of evolution of the transport sector in Germany and the high implication of the supporting transport activities sector in the creation of value, the economic indicators of the transport and storage sectors show a low contribution to the formation of the GDP. In fact, the total value added of the sector has varied during the period around 3.4% in annual average terms, a low contribution only higher than the one from the USA. The transport equipment sectors have a very strong presence in terms of GDP, investment rate and total inputs consumed from other sectors of the economy.

Netherlands: The clear "exports orientation" of the transport sector in general and the maritime and waterways transport in particular can be confirmed with the net result of the

transport services balance of payments: it has been clearly positive since the beginning of the 90s. The Dutch transport sector has been characterized by intense import and export activities as well as in distributing these goods throughout Europe. The transport sectors with higher value created are the road and supporting transport activities. In parallel, it can be said that the importance of the transport production sectors for the Dutch economy is quite limited.

Spain: It can be detected an on-going progressive process of internalisation by the road sector, accompanying its overall growth. All the shares of the sector have grown during the period, which indicates a process of integration of the sector both in the national and international fronts of the economy. Maritime and air transport are the most internationally oriented transport modes in Spain. Not only the contribution to exports grow, also the implication of the sector as provider of intermediate inputs for other sectors of the economy has grown substantially, confirming a trend for further integration of the sector in all aspects of the economy. The net result of the transport services balance of payments has change from positive to negative during the period under analysis. This means that despite the strong internationalisation of most of the Spanish transport sectors, there is a strong trend to contract foreign transport services. The transport production sector have a quite high contribution to the Spanish GDP, around 2% in average annual value, that is amongst the highest of the countries analysed. The evolution of the inputs consumed by the sector over total inputs of the economy follows a different trend: since 1993 it has experienced a steep growth, which means that the sector has increased its demand of internal inputs. For motor vehicles, the consumption of households has also a key role, as well as the investment of the public sector in the case of other transport equipment.

UK: Despite the steady evolution of all transport services related sectors in the United Kingdom, the economic indicators of the transport and storage sectors show a decreasing contribution to the formation of the GDP. Although their absolute growth from 1995 until 2000 has been positive, it was not enough to maintain its proportion in the wider national economic context. In 2000, the British air transport presents a significant proportion of its output value devoted to households consumption (45%), followed by intermediate inputs for the other economic sectors (31%) and by exports (24%). It is interesting to note that although the overall production from the air transport sector in the UK has been growing from 1995, the consumption distribution structure has been kept relatively stable during this period. The significantly negative net result of the transport services balance of payments reveals a certain dependence of external transport providers, allegedly for import and export products. Although negative, this value was increasing until 1995, when it reached an almost positive value. In 2002, a new inversion was detected which continued until the end of the period analysed. It should also be stressed the relatively low level of internationalisation of the British motor vehicles production sector (25%). Also noteworthy is the inversion of the overall growth trend in this production sector registered from 1995 until 1999 due to a decrease observed in all categories except in exports.

Czech Republic: The road transport sector has experienced a very strong growth during the period from 1995 until 2004, being also the most export oriented sector. Also interesting is the significant growth in the output of rail transport services from 2000 until 2003. In what concerns air transport, this economic sector has increased 87% in nine years (from 1995 until

2003). The net variation in the transport balance of payments has remained positive throughout the analysed period and generally increasing. In fact, in the year 1993 the balance was nearly 400 million Euros and increased approximately 50% until 2004, when it reached more than 600 million Euros. The analysis highlighted the high level of internationalisation of the Czech Republic motor vehicles production sector (50%). In what concerns the other vehicles economic sector it can be observe a steady growth since 1995 until 2003 (89%).

Hungary: there is a stable and significant growth in the most contributor transport service sector: road transport (431 552 million Euros in 1998 to 610 431 million Euros in 2001, which represents a growth rate of 41%). In what concerns the supporting transport activities, the irregular evolution of this sector should be pointed out: growth from 1998 to 1999 and again from 2000 to 2001, while from 1999 to 2000 this sector has registered a decrease in its overall value. The net variation in the transport balance of payments can be characterized by a quite unstable pattern, presenting positive values from 1995 until 1999, reaching its lowest value in 2002, when it started to grow again the end of the analysed period, although keeping negative values. The highest value was reached during the year 1998 (nearly 80 million Euros). The analysis suggests the relatively high level of internationalisation of the Hungarian motor vehicles production sector (50%). In what concerns the other vehicles economic sector one can observe a steady growth since 1995 until 2001.

Additionally, one general recommendation should be elaborated concerning future data collection and statistical treatment with respect to IO tables. In fact, each transport mode should be considered individually, particularly: i) land transport should be segregated in road, rail and pipeline, as well as ii) maritime should be separated in inland waterways, short sea shipping and deep sea, and iii) the supporting and auxiliary transport activities should also be separated into their several categories. Nevertheless, for the sake of time series consistency, aggregated data could continue to be produced. The future adoption of this recommendation would allow a much more accurate analysis in terms of transport policy and potential impacts.

5 Bottlenecks in future logistic system of the EU

Following the structural analysis in the previous sections the main conclusions concerning potential bottlenecks in the European transport system affecting the development of logistics are presented. In general terms, we can separate the national specific effects or local bottlenecks from regional or modal bottlenecks. The first type is out of the scope of the present study, as it requires the analysis of the national and local transport networks in order to identify the "black spots" and circumstances hindering the development of logistics and transport. The second group, regional and modal bottlenecks are presented in the following pages in a synthetic manner, trying to provide a general vision of the most important obstacles for smooth transport and logistics between the countries analysed.

For the presentation of the evaluation of the potential bottlenecks per region, an approach based in three parameters and implemented in two stages was used. The 3 parameters are:

- The evolution of the structure of the transport sectors from the IOT and STAN data, in qualitative terms, taking as base the trends identified in the analysis and the expected evolution in the near future;
- The evolution of the trade flows derived from the analysis undertaken previously;
- The state of the networks in qualitative terms, an issue not analysed in this project and that will be taken as exogenous data.

This three parameters will be combined in an approach with the objective of identify the main regional bottlenecks per transport mode and the main causes under them. The two stages of the approach are the following:

1) Clusterisation of the European countries analysed into groups according to criteria concerning their tight commercial relationships, the volume of the trade exchanged, the result from the analysis of the trade flows (see Figure 55 in page 93), their mutual integration of transport networks and the nature of the (potential) common transport problems and. The same country can belong to several clusters, as can have with different countries strong commercial links or different "network problems". The clusters selected are: Southwest EU (Spain and France), Central EU (France, Germany and the Netherlands), Eastern EU (Germany, Poland, Hungary and the Czech Republic), Inland Baltic (Finland and the Russian Federation) and Baltic & North Atlantic (all ports in those areas). Afterwards, the description of each cluster is presented, the state of the network and the main expected potential bottlenecks for logistics. Figure 142 shows the different clusters for further analysis;
2) Characterisation for the potential for congestion of the national and regional (supranational) networks within each cluster defined previously, attending to two criteria:
    - **Quality of the network** under stake, in terms of overall geographical density, continuity between countries and state of conservation (physical quality). The "quality of the network" will be measured using a 3 degree scale from 1 (high quality) to 3 (low quality), according to the following criteria:

3 = low quality of the network: some basic connections between major cities, ports or between borders still missing, frequent discontinuity of network in technical terms and frequent conservation problems;

2 = medium quality: isolated problems concerning missing major connections, continuity, missing links and conservation;

1 = high quality: uncommon situations regarding missing major connections, continuity and conservation.

- **Demand for transport services** in the mode under stake, measured with reference to the expected development of the demand in the short term according to the analysis of the national transport sectors evolution. The "demand for transport services" will be measured using a 3 degree scale from 1 (low demand) to 3 (high demand), according to the following criteria:

  1 = low demand: transport mode with no or weak growth expected and/or low modal share;

  2 = medium demand: transport mode with positive growth expected, but its modal share is not amongst the highest;

  3 = high demand: transport mode with a strongly positive growth expected and/or with a high modal share.

The combination of both indicators will produce a third indicator, the **bottleneck potential indicator**, which will be the final synthesis of the expected network congestion and bottleneck problems derived from trade, transport and logistic flows. The indicator will consist as well of a three points scale:

1 = low potential: isolated bottlenecks will occur namely in terms of interoperability problems, some intermodal operations and congestion in high demand links;

2 = medium potential: some bottlenecks in ordinary operations occur in the network;

3 = high potential: frequent bottlenecks in ordinary operations occur in the network, jeopardising the normal flows or goods and passengers in a systematic manner.

The indicator is derived from the results of the "quality of network" and "demand for transport services" indicators. The result is derived calculating the mean of both results. For instance, values 1 and 3 would result in a 2 for the "bottleneck potential indicator". In case the average value has a decimal case (for instance, values 2 and 3 result in a 2.5) the number would be rounded to the upper case (in the example, 3).

The assessment of the situation of the networks in the clusters selected is done through the observation of the situation of the Trans-European Networks in the first place and through expert opinion. The TEN-T were selected as a proxy for the quality of the networks because a high density of TEN-T in a country implies an overall good quality of the transport network

and the existence of major links to the most important cities, ports and other connection points. We include the maps of the TEN-T in Figure 143, Figure 144 and Figure 145.

Table 19 presents the resume of the values of the "bottleneck potential indicator" for the five clusters considered.

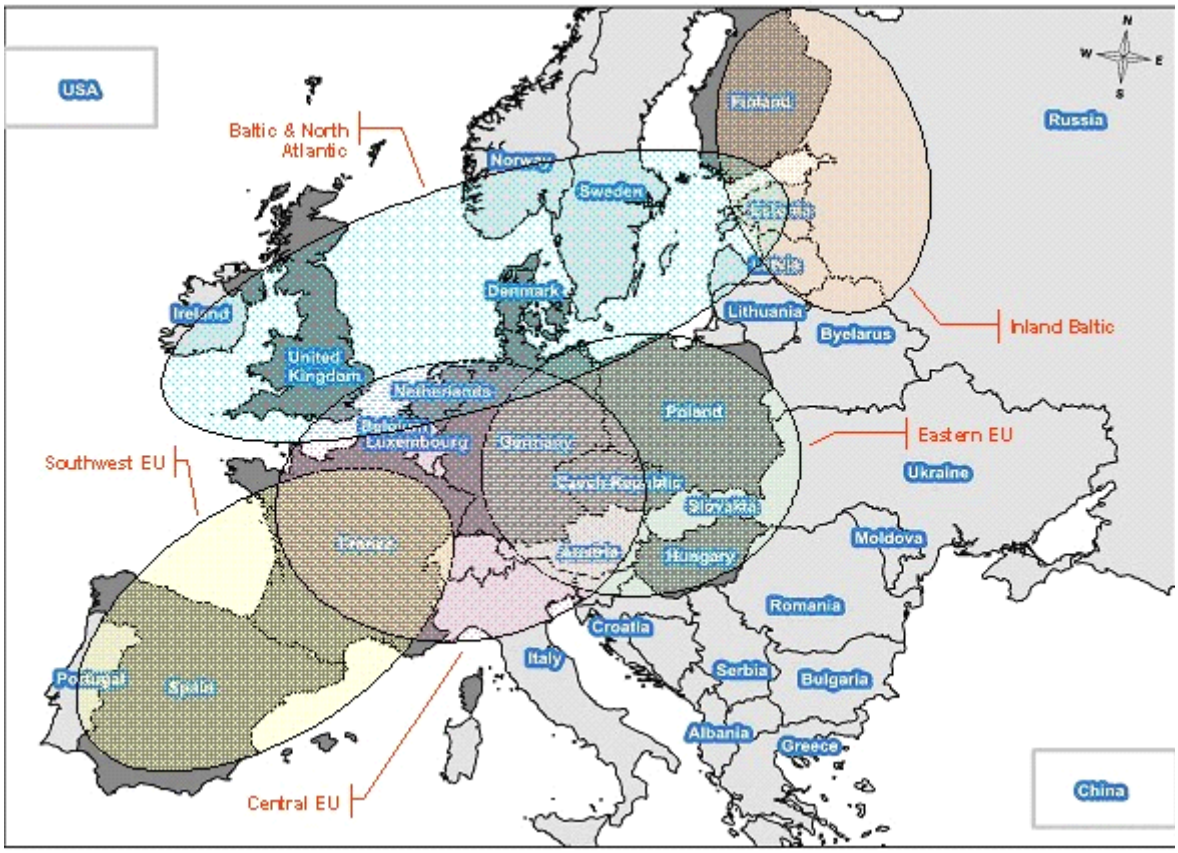
Table 19: Resume of potential bottlenecks per regional cluster

CLUSTER: Southwest EU		
Network	**Description**	**Bottleneck potential**
Roads	1) Quality of road network (density, continuity, conservation): **1** 2 3 **Observations:** ▪ Will continue to increase length and extension in the short/ medium term, mainly highways in Spain (TENs category); ▪ The conservation state is good (important highway network already in place); ▪ Good international highway links. 2) Demand for road transport services: 1 2 **3** **Observations:** demand will continue to increase (short term) due to: ▪ Overall growth which has characterized this sector in Spain (first transport mode in output value) and France (second transport mode in output value); ▪ Low quality and severe interoperability problems of rail network, concerning international links.	Potential 1 **2** 3
Railways	1) Quality of rail network (density; continuity; conservation): 1 2 **3** **Observations:** ▪ Low quality of the Spanish network with real improvements concerning freight operations only in the medium term (due to large investments planned); ▪ International interoperability very difficult, with gauge, signaling and power problems. 2) Demand for rail transport services: **1** 2 3 **Observations:** ▪ Reduced interest of international operators due to network quality and interoperability problems yet to be solved; ▪ Potential rise of demand only in the medium term after significant improvement of the overall quality of the network and respective services.	Potential 1 **2** 3
Ports	1) Quality of maritime infra-structures (capacity; accessibility and services): 1 **2** 3 **Observations:** ▪ Some accessibility problems persist in some ports concerning the links to land transport networks; ▪ In general, the operational capacity is good and has grown in the last decade, specially in Spain, with large investments underway concerning handling capacity (quays, warehousing facilities, etc). 2) Demand for maritime transport services: 1 **2** 3 **Observations:** ▪ Mode highly devoted to international trade and long intra-EU connections, being the first mode for external trade of both Spain and France; ▪ With a potential to grow, due to the environmental issues and transport policy agenda of the EC; ▪ Still, maritime not amongst the main transport modes in terms of tones transported and output value.	Potential 1 **2** 3

CLUSTER: Central EU		
Network	**Description**	**Bottleneck potential**
Roads	1) Quality of road network (density, continuity, conservation): **1** 2 3 **Observations:** ▪ Very good quality and continuity of the network, with no missing links and with high density in geographical terms. 2) Demand for road transport services: 1 2 **3** **Observations:** ▪ Will continue to grow in the short term taking into account the overall growth of the sector in the countries of the area; ▪ Important international transport activities mostly carried out by road; ▪ Intermodal transport highly developed (high output value figure in all countries) with intensive use of road legs.	Potential 1 **2** 3
Railways	1) Quality of rail network (density; continuity; conservation): **1** 2 3 **Observations:** ▪ The quality of the network is good in terms of density, continuity and conservation; ▪ Some interoperability problems persist, especially for long course transnational trains (power, signaling, etc). 2) Demand for rail transport services: 1 2 **3** **Observations:** ▪ High demand both for passenger and freight services, with special demand on the latter; ▪ Countries with well developed logistic sectors and intermodal specialized operators integrating rail legs in their operations; ▪ Demand expected to grow due to increasing use of rail freight.	Potential 1 **2** 3
CLUSTER: Eastern EU		
Network	**Description**	**Bottleneck potential**
Roads	1) Quality of road network (density, continuity, conservation): 1 **2** 3 **Observations:** ▪ Quality of network quite variable, with some links still missing in the NMSs and a low density network, compared to the EU15; ▪ Some local bottlenecks exist. 2) Demand for road transport services: 1 2 **3** **Observations:** demand will continue to grow due to: ▪ Overall growth of the sector in the NMSs; ▪ Increasing commercial flows between the countries of the cluster.	Potential 1 2 **3**
Railways	1) Quality of rail network (density; continuity; conservation): 1 **2** 3 **Observations:** ▪ Good quality network in Germany but rather variable in the NMSs; ▪ Interoperability can be difficult but it is expected an improvement in the short term due to investments underway. 2) Demand for rail transport services: 1 **2** 3 **Observations:** ▪ Overall demand is growing in the NMSs due to the increasing trade flows between the countries forming the cluster; ▪ Increasing involvement of private multimodal and logistics operators; ▪ Traditional high use of rail transport with high shares in some countries of the cluster, although decreasing in some cases;	Potential 1 **2** 3

CLUSTER: Inland Baltic		
Network	**Description**	**Bottleneck potential**
Roads	1) Quality of road network (density, continuity, conservation): 1 **2** 3 **Observations:** ▪ Quality of the network is variable as well as the network density; ▪ Continuity of networks is high but local bottlenecks exist; ▪ Winter condition have strong negative influence. 2) Demand for road transport services: **1** 2 3 **Observations:** ▪ Growing international trade in the area (especially Finland-Russia) but flows still not too high.	Potential 1 **2** 3
Railways	1) Quality of rail network (density; continuity; conservation): 1 2 **3** **Observations:** ▪ Low quality of the network is in some areas; ▪ Expected increase of quality and interoperability in the medium term due to large EU investments (including EC's Priority Projects). 2) Demand for rail transport services: **1** 2 3 **Observations:** ▪ Growing international trade in the area (especially Finland-Russia) but flows still not too high.	Potential 1 **2** 3
CLUSTER: Baltic & North Atlantic		
Network	**Description**	**Bottleneck potential**
Ports	1) Quality of maritime infra-structures (capacity; accessibility and services): **1** 2 3 **Observations:** ▪ Good capacity of ports with on-going investments in some to improve handling and storage capacity (keeping up with demand growth); ▪ In general, well developed links to road and rail networks with only specific or local bottlenecks. 2) Demand for maritime transport services: 1 2 **3** **Observations:** ▪ Mode highly devoted to international trade and intra-EU connections, traditionally strong in the area in all countries of the cluster; ▪ Some ports are real gateways for Europeans trade flows and entry door for imports, concentrating large amounts of cargo; ▪ Increases in extra-EU trade (both imports and exports) will provoke immediate increases of the demand.	Potential 1 **2** 3

Source: own elaboration

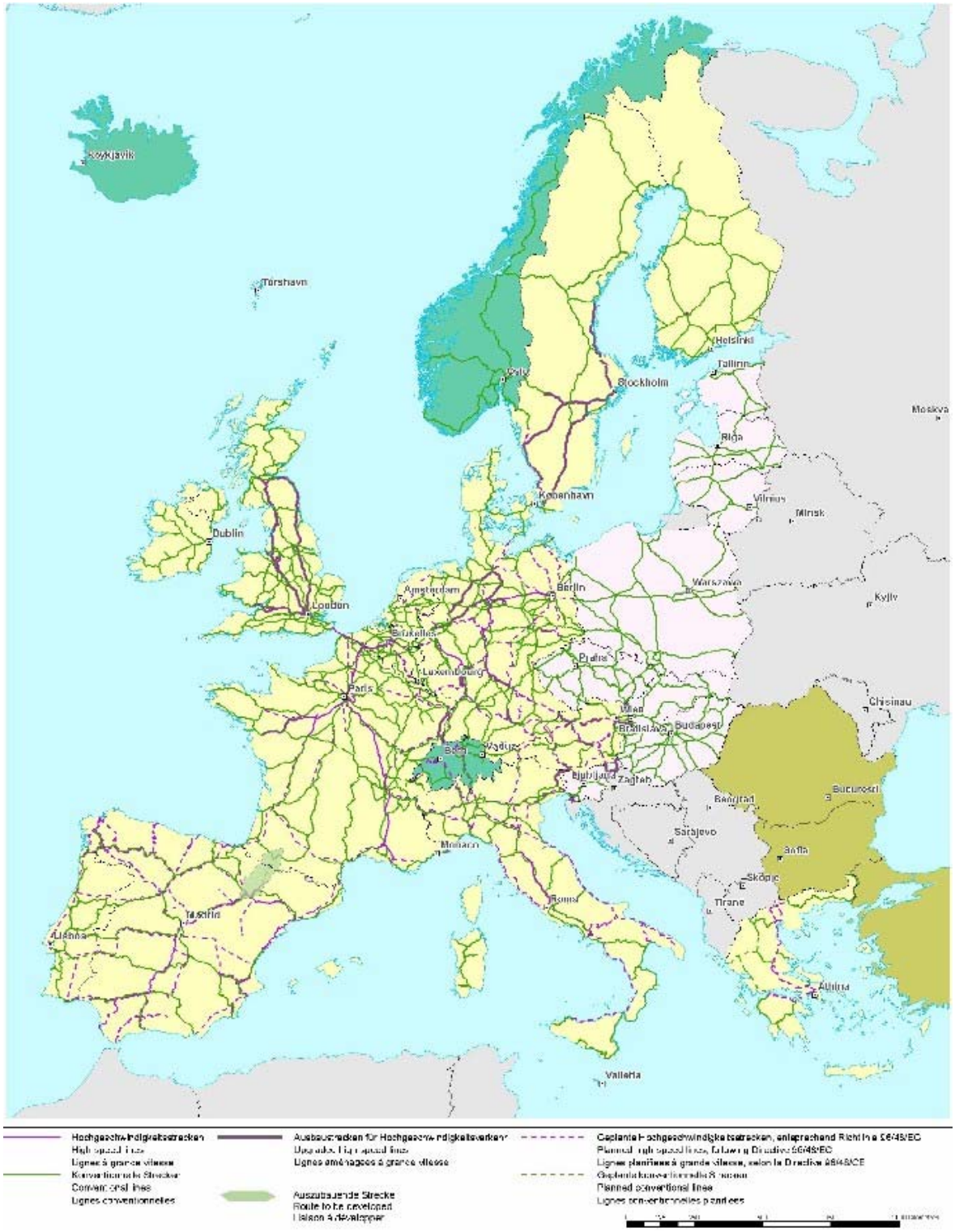


Source: own elaboration

Figure 142: **Clusters of regions for analysis** of potential congestion and bottlenecks in transport and logistics

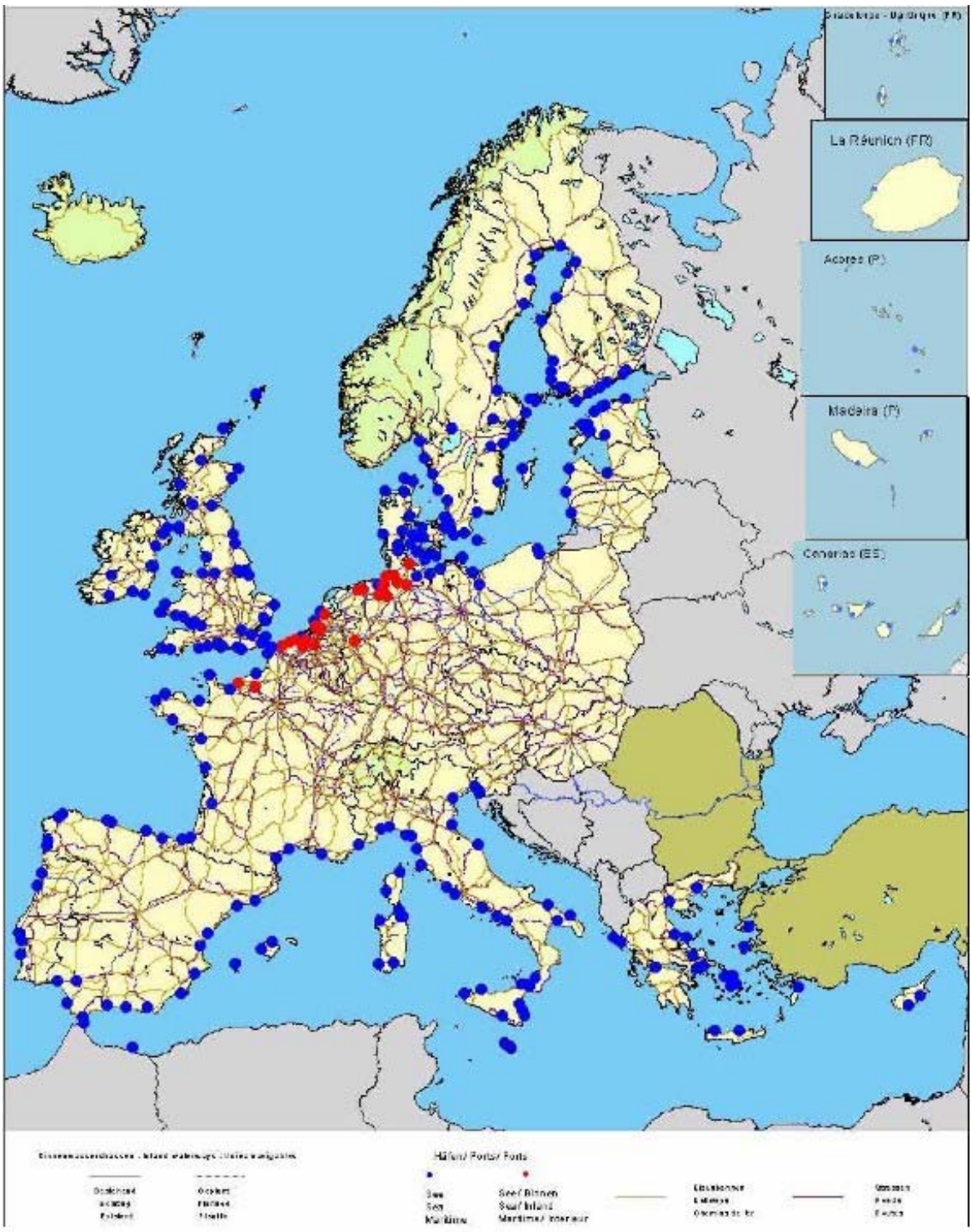
Source: European Commission, DG TREN

Figure 143: Trans-European road network in 2004



Source: European Commission, DG TREN

Figure 144: Trans-European rail network in 2004



Source: European Commission, DG TREN

Figure 145: Trans-European port network (category A) in 2004

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