The Impact of Transport on the EU Economy

BY ACHIM DIEKMANN, USINGEN

1. Background

1.1 The role of transport

Transport is a key element in the development of any society. Advances in transport technology have extended the range of markets, enabled new methods of production, fostered specialisation and strengthened social, political and economic ties between countries and major geographic areas. The Single European Market owes much of its impetus, strictly speaking even its existence, to the links provided by a well-established transport network.

Transport is not demanded in its own right. The demand for transport reflects the level of social and economic activities and the benefits it provides in their pursuance. But as these benefits are high, the role of transport has kept growing in production as in everyday life. Growing affluence (one of the causes of which is mobility) and improvements in transport technology have led transport to become a major component of national output and a major user of resources.

Transport, in the definition used in this paper, includes all activities related directly and indirectly to the use of vehicles, vessels, aircraft, and of related structures (highways, inland waterways, railways, pipelines, port facilities, airports, warehouses etc.) for the movement of goods and passengers. This definition covers *transport as an industry* (provision of transport and related services for hire or on own account for commercial purposes), *transport as a social activity* (transport activities conducted by private households), and *transport as a system* (infrastructure, transport equipment and other capital goods used in the provision of transport services as well as private and administrative services required to maintain the transport network and to control and police traffic flows). It includes intermediate purchases required in this context and thus covers the total use of resources transport demand relies upon.

Contact:
Prof. Dr. Achim Diekmann
Hardtstr. 1
61250 Usingen
e-mail: a.dkm@t-online.de

1.2 The focus of this paper

This paper focuses on transport in the European Union, which has been an engine of growth for many years. Much of this growth, if not all of it, was linked to a rising level in car ownership, a disproportionate growth in road haulage and a strong upward trend in air traffic. The democratisation of the motor vehicle and economic integration have allowed transport and related expenditure in Europe to grow faster than GDP for most of the period between the early sixties and turn of the century. But, although the long-term trend of transport would seem to be for continued expansion, more recently, the pace of growth in transport and related activities seems to have slowed down in a number of countries.

Table 1: EU 1961-2000: Transport and GDP Growth

Average growth per year	1961-1970	1971-1980	1981-1990	1991-2000[1)]
GDP (constant prices)	4,9	3,0	2,4	2,2
Transport (physical units)[2)]	7,0	3,6	2,7	2,1

1) Estimate
2) Transport units (Passenger-km + tonne-km)

Recent growth does not yet point towards saturation, particularly not in air traffic, but it indicates that a more moderate expansion of transport services might deprive transport of its privileged role as an accelerator of economic development in the future. Transport might actually start lagging behind GDP expansion instead of leading it. Rail transport has been declining for some time irrespective of whether measured in physical units or in monetary terms. Road transport still has a great potential in central and eastern Europe and is likely to benefit from the strengthening of ties between the accession countries and the rest of Europe. But eventually it will loose pace as well.

It should also be pointed out that, challenged by deregulation and growing environmental awareness, transport is about to move towards greater efficiency in the use of manpower, capital and nature, which means it will require less resources per unit of output. Advances in information and communication technology, the growing perception of logistics as an instrument of optimising supply chains, a more widespread use of electronic components and new materials in the production of transport equipment and in its use point towards a different future for transport. Everyday mobility, both real and virtual, may offer new options and is to modify the way we live, work and travel. Regional patterns of manufacturing and distributing goods may change as a consequence. Seen against this background, it was thought to be useful to take a closer look at Europe's present-day transport system and the contribution it makes to income and employment.

It is the purpose of this paper to help to better understand and assess the importance of transport as a source of demand and to provide a measuring rod for the changes likely to take place in terms of income and employment if Europe's transport engine were to lose steam. It

is no doom and gloom scenario which inspires this article, which would be in stark contradiction to current forecasts anyhow, but rather the desire to raise the awareness of what transport means to us today and what the implications might be if less resources were required to fulfil the transport needs of society.

The analysis to be carried out for this purpose uses input-output techniques. Input-output tables (I-O tables) add an extra dimension to national accounts. They focus on inter-industry transactions which are the intermediate processes that supply the economy with final goods from primary inputs. They link the components of value added, output and final demand. I-O tables can be used to model the economy through a disaggregated view of industrial behaviour.[1] They allow us to quantify the direct and indirect effects on the output of a specific commodity given an increase of a fall in final demand. They can be used therefore to illustrate the interdependence that exists between transport and the rest of the economy. Figure 1 provides a simplified picture of an I-O table showing the three interacting matrices or quarters we shall rely upon in our analysis.

In practical terms, this paper uses a set of I/O tables[2] which cover the EU both as an aggregate and on a country-by country basis. It also relies on the input from a number of national and international studies and statistical data from Eurostat and the national statistical offices.[3]

1.3 Measuring transport

The needs for transport differ in Europe for geographical and historical reasons. This is reflected by the idiosyncrasies of the transport systems the individual countries rely upon. They vary greatly. But before dealing with them in some more detail and as a kind of introduction to the subject, it might be useful to devote some thoughts to the issue of measuring transport *as an industry*, *as a social activity* and *as a system*.

Transport is usually discussed in term of its physical characteristics: miles travelled, tonnes moved, the length of roads and railway lines, the number of vehicles used etc. This paper refers to the economic criteria of the transport system instead, to the expenditure on roads, railway lines, waterways, vehicles, vessels and aircraft and the value created by their use. However, a table in the annex gives some information on the physical performance of

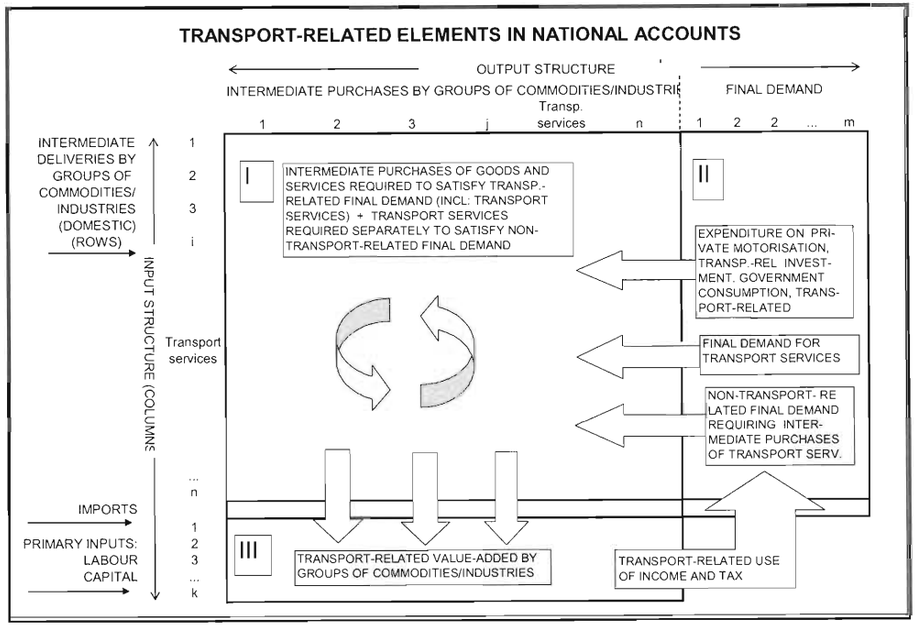
1 Central Statistical Office (1995), Input-Output Tables for the United Kingdom , London, HMSO, p V.

2 Eurostat (1999), 1995 Input-Output Tables for the European Union.

3 Han, X., Fang, B. (1998), Measuring Transportation in the U.S. Economy, *Journal of Transportation and Statistics January 1998.* Han, X., Fang, B., Lawson A.M., Lum, S.K.S. (1998), U.S. Transportation Satellite Accounts for 1992, *Survey of Current Business, April 1998.* Diekmann, A. 1999, Verkehr als Wertschöpfungsträger und Nachfragegrösse, *Zeitschrift für Verkehrswissenschaft, 70. Jahrgang, Heft 1.* European Commission (1999), EU Transport in Figures, *Statistical Pocket Book.* Eurogramme (1999), Study on the Economic Importance of the Transport Sector (Final Report). Eurostat "Comext"-Datenbank. Statistisches Bundesamt (2000), Volkswirtschaftliche Gesamtrechnungen, *Fachserie 18, Reihe 2, Input-Output Rechnung 1995, Wiesbaden 2000.*

Europe's transport system as well and occasional reference to it will be made as the analysis proceeds.

Figure 1



Using economic criteria, the most obvious way of looking at transport is in terms of the value it adds to GDP and to combine these data with data from the national economic accounts for industrial analysis. But this approach is not without problems. Advanced societies produce a great variety of transport services. Their abundance makes it difficult to adequately identify and categorise them and to attach a value to them and official statistics are of limited use when trying to do so.

Transport is a complex system of interlocking elements. Users of the system and operators of different modes of transport depend on an infrastructure designed to fit their needs when moving the transport equipment they use. Both fixed and mobile plant rely on supplies from other branches of the economy including the purchase of intermediate as well as capital goods.

Table 2: Measures of Transport

Measure I (Supply side)	Value added by transport as an industry in the provision of transport services	Measures transport (for-hire and own-account) by the value transport industries add to GDP
Measure II (Supply side)	Value added by all domestic producer units in the provision of transport services	Equals measure I but includes the value added by domestic producer units along the supply chain upon which industrial producers of transport services rely
Measure III (Supply side)	Value added by all domestic and foreign producer units in the provision of transport services provided by domestic transport industries	Adds to measure II the import requirements of industrial producers of transport services and their suppliers
Measure IV (Demand side)	Transport-related final demand	Includes the value of all goods and services delivered to final users for transport purposes regardless of where they are produced, but does not cover transport services consumed as an intermediate demand in response to non-transport-related final demand
Measure V (Combined)	Transport-related Gross Domestic Product (GDP)	Provides a full measure of the contribution made by domestic transport-related activities to GDP, includes transport activities (and their requirements) linked to non-transport-related final demand.
Measure VI (Combined)	Transport-related Gross Domestic Demand (GDD)	Measures domestic final demand related to transport regardless of who supplies the demand, domestic producers or imports. Includes transport services (and their requirements) as an intermediate product for non-transport-related final demand, but does not include transport-related exports.

Counting only the resources required for the current output of transport services would fall short of measuring the full impact of the system. The measures to be chosen for this purpose must be capable of capturing the interaction between the transport services industry offers, the transport services added by private households for their own use, the transport system society relies upon and the rest of the economy.[4]

Table 2 lists a number of measures that can be used in this context, either alternatively or in combination. Measures I, II and III measure transport from the supply side, putting the emphasis on the production of transport services, but disregarding the influence emanating from

[4] For comments concerning this issue see: Han, X., Fang, B. 1998, Measuring Transportation in the U.S. Economy, *Journal of Transportation and Statistics January 1998*.Han, X., Fang, B., Lawson A.M., Lum, S.K.S. 1998, U.S. Transportation Satellite Accounts for 1992, *Survey of Current Business, April 1998*.

the provision and maintenance of transport infrastructure and the purchase of transport equipment and related capital goods. In other words, they measure transport as an industry.

Instead of taking the supply-side approach, transport can be measured by identifying transport-related final demand. Corresponding measures would include consumers' expenditure on transport (produced for own use and purchased) expenditure on roads, railway tracks, harbours, pipelines, airports road vehicles, locomotives, railway wagons, ships, aircraft, office buildings, warehouses, office machinery, telephone networks, computers, and software used in transport, changes in stocks of transport-related goods and transport-related exports (measure IV). This would be a pure demand-side measure. It includes the value of all goods and services delivered to final users for transport purposes regardless of where they are produced.

Measure V seems to be the most comprehensive measure. It combines supply-side data with a demand-side approach by adding transport services consumed as an intermediate demand in response to non-transport-related final demand including their direct and indirect requirements to the intermediate purchases made to meet transport-related final demand. It does not include foreign supplies. Finally, measure VI is limited to measuring gross domestic demand. It excludes transport-related exports but includes foreign supplies.

We will use several of these measures in the course of out analysis.

2. Transport as an industry

2.1 Traditional transport industries

Taking a formal approach, national accounts identify transport services as a commodity to the extent these services are rendered against payment of a fee. The for-hire sector of transport comprises railways and related services, passenger ground transport by busses and light rail, motor freight transport and warehousing, water transport, air transport, pipelines, freight forwarders as well as a number of auxiliary and supporting services, such as those performed by travel agents and other agencies.

In 1995, the output of the 'traditional' transport industries in the European Union totalled 538 billion ECU (according to NACE-classification), to which railways contributed 8.1 per cent, passenger land transport other than rail 6.8 per cent, freight transport by road 24.7 per cent, air transport by air 11.5 per cent, transport by water 6.5 per cent and pipelines 0.2 per cent. 41.2 per cent of the total were accounted for by auxiliary and supporting activities.

Table 3: EU 1995: Traditional Transport Industries' Gross Production Value (Modal Shares)

Country	Railways passengers & goods)	Other land passenger transport	Freight transport by road	Pipelines	Water transport	Air transport	Supporting & auxiliary activities	Total
A	12,9	10,0	19,5	0,4	0,6	9,4	47,3	100,0
B	5,8	2,5	29,1	0,2	6,0	9,2	47,2	100,0
DK	7,3	2,2	21,6	0,7	30,3	13,4	24,5	100,0
FIN	5,5	8,7	25,1	0,0	17,3	12,8	30,7	100,0
F	9,6	8,9	25,8	0,3	5,0	11,4	39,0	100,0
D	9,5	7,1	26,4	0,3	3,5	7,2	46,0	100,0
EL	5,7	9,3	18,9	0,0	5,3	14,0	46,9	100,0
IRL	7,1	3,8	15,4	0,0	5,0	26,2	42,6	100,0
I	7,1	5,1	33,7	0,1	7,3	7,4	39,3	100,0
L	12,9	3,8	25,0	0,0	0,4	29,6	28,4	100,0
NL	8,3	5,5	26,3	0,9	13,4	17,7	27,8	100,0
P	4,4	13,7	15,7	0,0	5,3	14,0	46,9	100,0
E	4,9	9,6	44,6	0,0	1,4	16,6	23,0	100,0
S	0,1	11,7	19,4	0,0	13,7	9,5	45,5	100,0
UK	8,8	4,9	18,5	0,0	5,0	15,8	46,9	100,0
EU15	8,1	6,8	25,7	0,2	6,4	11,5	41,2	100,0

Source: Eurogramme (1999); Statistisches Bundesamt (2000).

EU I-O tables group the services produced by traditional transport under three headings: *inland transport* services, *maritime and air transport* services and *auxiliary transport* services.[5] This aggregation reduces the scope of analysis because the I-O data available do not allow to separate the main modes of transport (road and rail) from each other. On the other hand, trying to re-arrange them on the basis of estimates would have been unduly complicated and as this paper does not aim at entering the ongoing political debate on the receding role of Europe's railways or to substantiate the reasons for their failure in coming to grips with the changes in transport demand, the disadvantage resulting from this aggregation is limited.

Europe's transport system lacks uniformity. Tailored to national needs and reflecting differences in geography, land use patterns and population density, it is far from homogenous. A common feature, however, is the dominance of road transport in contrast to the position held by rail. Rail transport has not only lost ground to air traffic in passenger travel, but within the European Union it meanwhile runs the risk of losing its leadership in the carriage of bulk goods to intra-EU sea transport.[6] Another phenomenon characterising the development of transport in the European Union is the increasing role of all kinds of auxiliary and supporting

5 In the I-O tables used in this paper, the three sectors yield a total of 506 bn ECU which is 6 per cent less than indicated by the figures established according NACE-classification. Also there is disagreement in the distribution of the relevant activities. EU I-O tables attribute to auxiliary services only a share of 30 per cent instead of 41.6.

6 In physical as well as in value terms the movement of freight by rail tends to become a marginal phenomenon, in spite of the efforts railway companies have undertaken in the past. Losses suffered by and subsidies paid to Europe's ailing railways reduce the value inland transport adds to GDP.

services which accompany the physical movement of goods and persons. This process is more advanced in some countries than in others (see table 3).[7] Next to air traffic this is the most important growth factor in the system.

Table 4: EU 1995: Traditional Transport Industries – Output Structure

Country	Intermediate supplies							Final uses			
	Agri-culture	Energy	Manu-facturing	Con-struction	Distri-bution	Transport	Other Services	Private & govt. Con-sumption	Fixed Capital Formation	Exports	Total
Austria	0,3	2,2	9,2	6,4	1,6	8,9	4,2	35,5	2,0	29,8	100,0
Belgium	1,4	0,9	15,4	2,4	0,8	1,9	2,4	16,8	1,0	57,0	100,0
Denmark	0,9	0,6	8,3	3,4	11,5	15,7	7,6	15,1	0,0	36,8	100,0
Finland	0,1	1,9	20,8	4,2	12,0	5,1	5,4	20,8	7,6	22,2	100,0
France	0,6	1,9	21,1	4,8	17,2	12,0	9,7	22,1	0,0	10,5	100,0
Germany	0,4	0,7	13,0	1,3	1,7	26,5	4,3	33,3	2,2	16,6	100,0
Greece	2,1	2,8	3,4	10,9	1,8	7,3	11,7	59,4	0,0	0,6	100,0
Ireland	0,5	0,0	10,0	1,6	8,0	3,8	1,5	23,1	0,2	51,3	100,0
Italy	0,6	1,2	23,9	3,2	5,6	11,0	5,3	21,0	2,6	25,6	100,0
Luxembourg	0,3	0,2	19,9	1,8	0,4	7,4	3,0	28,6	1,6	36,7	100,0
Netherlands	0,1	0,9	1,3	0,6	25,3	6,7	2,7	15,9	0,9	45,6	100,0
Portugal	0,2	0,6	10,4	0,1	18,3	11,6	9,8	25,4	0,0	23,7	100,0
Spain	2,6	1,0	17,9	6,8	1,3	8,3	7,5	22,4	1,1	31,1	100,0
Sweden	0,2	0,1	12,4	3,6	15,8	12,4	7,7	17,5	0,0	30,1	100,0
UK	0,2	2,2	12,7	0,9	18,7	12,1	16,3	15,9	0,9	20,1	100,0
EU-15	0,6	1,3	15,3	2,8	9,5	14,5	7,6	23,7	1,5	23,2	100,0

Source: Eurostat

Table 4 illustrates the output pattern of the traditional transport industries distinguishing between intermediate output and final uses. Intermediate output reflects the purchases of transport services by individual industries or assigns them to different groups of commodities, whereas final demand is made up of consumers' expenditure, government final consumption, capital formation and exports. The relative importance of the various sectors of industries and of final users as purchasers of traditional transport services can be measured by output coefficients which relate these purchases to the total output of transport services.

The distribution of output mirrors major characteristics of the economies we look at. The share of exports of transport services, e.g., is twice as high in Belgium and the Netherlands than in Germany, where transport services produced domestically are predominantly used as an intermediate input to the production process. Divergent output structures can also result from the deregulation of the transport market which by 1995 was more advanced in some countries than in others. Deregulation causes road hauliers to look for more efficient ways of carrying goods and may have brought down the level of output in this sector in terms of value, reducing its share in the total. It would also affect the competitiveness of railways and tends to reduce their operating surpluses, if any. A major difference also lies in the amount of

[7] Auxiliary and supporting activities tend to grow with per-capita income and greater sophistication in production. Strategies to optimise supply chains have led logistics to become an increasingly important source of revenue in transport business.

transport services purchased by private households due to differences in availability and fares, topography and car ownership across the EU.

Given the diversity in the distribution of output and in the share of modes, it is hardly surprising that the input structures of the traditional transport industries differ as well between countries. Table 5 breaks down the inputs of the traditional transport industries by commodities and value-added showing that, with a few exceptions, intermediate purchases accounts for about half the value of output, with wide differences as far as reliance on imports is concerned. Input coefficients indicate the value of purchases from individual industries and factor income in relation to an industry's output. They are a measure of the transactions taking place between industries and the value which is added to the intermediate requirements of an industry.

Table 5: EU 1995: Traditional Transport Industries – Input Coefficients

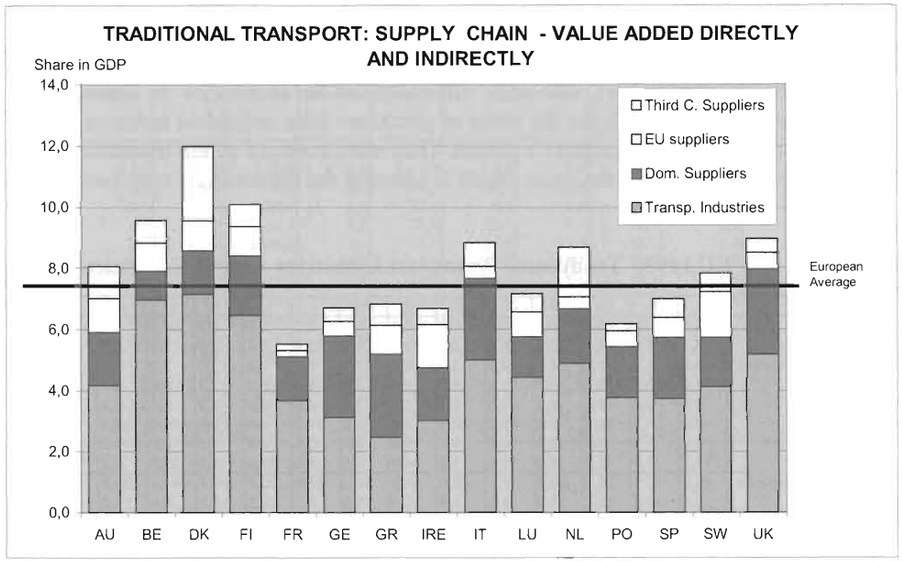
Purchases from:	A	B	Dk	FIN	F	D	EL	IRE	I	L	NL	P	E	S	UK
Agriculture	0,0	0,0	0,0	0,1	0,0	0,1	0,1	0,1	0,1	0,0	0,3	0,0	0,0	0,0	0,1
Energy, fuel	5,5	4,0	1,1	3,8	6,6	2,7	11,2	0,9	10,8	1,7	4,7	5,5	8,5	0,2	2,9
Manufacturing products	4,5	1,9	1,9	4,6	4,0	3,6	6,0	17,5	6,1	3,8	3,0	3,2	6,7	3,9	5,6
Construction	1,9	0,3	1,3	1,7	0,2	1,2	0,4	3,4	1,3	0,3	2,3	0,4	1,7	1,7	0,2
Retail, repair	1,9	2,6	3,9	6,4	3,5	4,1	7,5	2,0	4,8	2,3	3,7	5,4	6,4	4,5	4,7
Transport	8,9	1,9	15,7	5,1	12,0	25,5	7,3	3,8	11,0	7,4	6,7	11,6	8,3	12,4	12,1
Communication	1,0	1,4	0,5	0,9	0,6	1,2	0,8	0,9	0,9	3,4	1,3	2,0	1,3	2,5	1,1
Other services	11,1	3,9	3,8	6,0	10,9	11,2	24,9	8,5	8,5	11,5	8,5	13,3	6,9	9,1	16,7
Domestic intermediates	34,8	16,1	28,4	28,4	37,7	49,4	58,0	37,2	43,4	30,4	30,7	41,4	39,8	34,4	43,3
Imports	18,5	12,8	21,7	10,9	4,2	4,8	15,6	18,8	6,7	12,8	17,2	6,0	11,2	19,4	5,9
Total intermediates	53,3	28,9	50,1	39,3	41,9	54,2	73,6	56,0	50,1	43,2	47,9	47,3	51,0	53,8	49,3
Value added	46,7	71,1	49,9	60,7	58,1	45,8	26,4	44,0	49,9	56,8	52,1	52,7	49,0	46,2	50,7
Total input	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

The contribution traditional transport makes to GDP in the individual countries is relatively modest. With the exception of Finland, Belgium and Denmark, and to a lesser degree the UK, Italy and the Netherlands, where its share is in the order of 6 to 7 percent and 5 per cent respectively, value added to GDP by providers of traditional transport services tends rather to be between 3 and 4 per cent or less. This is what the industries concerned contribute directly. The actual impact of the provision of transport services is a source of demand greater. To measure it, value added along the supply chain on which transport industries rely would have to be included, at least to the extent this value is produced domestically.

A most helpful device allowing to assess the contribution made by suppliers to the industry both directly and indirectly is the Leontief inverse, conceived to provide a link between commodity output and final demand. It shows the total amount of a commodity needed to produce another. By multiplying each row of the inverse by the appropriate ratio of primary input to gross output for that commodity, it is possible to generate a picture of the demand for that commodity in terms of value-added needed to generate it, both directly and indirectly. What has to be avoided when starting this operation not from final demand but from the gross

output of commodity is double counting because this output would already contain some of the indirect effects one sets out to measure.

Figure 2



With the help of this technique the total value-added attributable to traditional transport can be estimated. As shown in figure 2, including the indirect effects related to the provision of traditional transport services raises the level of importance of this activity within GDP by another two percentage points for most countries. Figure 2 also indicates the amount of value-added embodied in imports from the European Union and from third countries, offering some idea of what would happen if this input were produced domestically.

This still leaves transport as a generator of wealth in a position which hardly corresponds to the general perception of its role transport in the economy. The explanation for this is simple. Except for air transport and the movement of goods by road, the importance of public transport services, as represented by the industries identified in national accounts, has been greatly reduced since the automobile is within everyone's reach as a comfortable, flexible and private means of transport, leaving little room for expansion to for-hire transport. Today, business units in all branches of industry run their own vehicle fleets and, over the past decades, traffic growth has for the most part been achieved by private households relying on their own transport equipment.

It should be noted, however, that even in their limited role, the traditional transport industries still employed 6.6 million persons across the EU in 1995, with Germany (1.5 m) ranking first, followed by Italy (1.1 m) and the UK (1 m). Employment was lower in France with about 850 000 persons. It totalled almost 600 000 persons in Spain and slightly more than 500 000 in the Benelux countries.[8] This is employment directly attributable to the traditional transport industries' activities. The total number of persons who owe their job to the demand these industries satisfy, including those working in related industries across the European Union, is to be put at close to 9.5 m.

2.2 The modified matrix

Although it was initially said that this paper is not concerned with the physical output of the transport system, reference to tonne-km worked, passenger-km travelled and the number of vehicles used for transport purposes can serve to illustrate why transport as defined in national accounts provides an entirely inadequate picture of the weight transport actually carries as a source of demand and a contributor to wealth. When trying to measure the full impact it has on the economy, transport services produced by non-transport industries and private households simply cannot be ignored. Although they are not directly visible in national accounts, not identifying them as a separate commodity to be added to the output of the traditional transport industries would lead to an under-representation of transport and to an underestimation of its effects on growth and income.

In 1995, the number of road vehicles registered in the EU totalled 204 million: 163 million passenger cars, 490,000 buses, 17.9 million light, medium and heavy goods vehicles, and 23.3 million powered two-wheelers. Out of this vehicle stock, less than 1 m passenger cars, approximately 400,000 buses and about 1.5 million goods vehicles were operated by the traditional transport industries - less than 1 1/2 per cent of the total. In the same year, the physical output of the transport system in the EU was 4.04 billion passenger-km and 1.15 billion tonne-km. Out of these, 3.7 billion passenger-km and 218 m tonne-km would be left unaccounted for, if only for-hire transport activities were regarded.[9] As can be gathered from these figures, the provision of own-account transport services is not only a widespread industrial and social activity but actually dominates the transport scene.

In order to provide a unified picture of the impact of transport on the economy, we shall therefore, as a first step, consider transport services produced by non-transport industries as a separate commodity. This concerns almost exclusively road transport although own-account activities through modes other than road transport, such as the use of aircraft and vessels

8 Using NACE-classification , the total is 5.6 million which, equivalent to 3.8 per cent of total employment in the EU.

9 Goods transport outside the traditional transport industries is even underestimated by these figures because most goods carried by light-duty vehicles operated on own account are not registered at all by official statistics).

owned by non-transport industries, exist as well. For lack of statistical evidence they shall however be omitted in this paper. Transport services produced by private households shall be dealt with later.

Transport activities carried out by non-transport industries can be broadly divided into two categories. The one nearest in character to the services offered by for-hire transport industries is own-account road haulage by heavy-duty vehicles. There can be different reasons for not outsourcing transport services.[10] The goods to be carried may require special handling, strict timing, sophisticated transport equipment and/or supporting activities not to be had in the transport market. Even if available, corresponding services by professional hauliers may involve transaction costs that would wipe out cost advantages for-hire transport might offer. As a rule, own-account operators therefore pay a premium in terms of costs for using their own staff and equipment to produce their own transport services. They also tend to spend more money on activities accompanying and supporting the act of transport.

The second type of transport activity pursued by non-transport industries is based on the use of light commercial vehicles and cars. In the EU in 1995 about 19m vehicles of this type were registered for wholesalers, retailers, farmers, manufacturing companies and businesses for carrying small quantities of goods, messages and people, in particular in the service industries. The uses these vehicles are put to show a great amount of variety: the grocer carrying goods back home from the market, the salesman visiting his customers, dial-a-pizza or repair services and senior executives driving to board-room meetings. Most of the users would find it difficult to substitute purchased transport services to using their own transport equipment because the latter provides far greater flexibility than any form of public transport. But the great variety of uses makes it difficult to put a value to them.

The method this paper relies upon to solve this problem is based on the relationship that exists between the number and category of road vehicles used by businesses, the type of activity for which they are used, the distances over which they are driven and the number of persons engaged in using them. This relationship allows to make a broad estimate of the value-added linked to this activity. It obviously differs between the use of heavy duty vehicles in manufacturing or distribution and the use of light duty vehicles for all sorts of purposes and finds its expression in specific vehicle-per-persons ratios. For heavy goods vehicles this ratio serving as a basis for estimating the relevant employment was put at 1:1.4, while in the case of cars and light-duty vehicles, whose use is less labour-intensive, the ratio applied was 1:0.25. What may seem an arbitrary assumption actually is substantiated by surveys of employment in own-account road haulage as far as the use of heavy goods vehicles is concerned.[11] In the case of cars and light commercial vehicles, the very low ratio of 1:0.25 reflects both the lower annual mileage performed by these vehicles and private uses of these vehicles.[12] It should be pointed out that the ratios applied represent an average to be modified according to different uses by the industries concerned.[13]

[10] Reasons for the maintenance and use of own-account fleet see also: UK Department of Transport 1979, Road Haulage Operators Licensing (Report of the Independent Committee of Enquiry into Road Haulage Operators' Licensing), London, HMSO.

In creating the database for the estimates mentioned, vehicle stocks had to be broken down by category and attributed to their users on a country-by-country basis. Unfortunately, for lack of adequate data a detailed approach of this kind has only been possible in the case of a few, though major, countries. For the rest of them, the pattern of distribution had to be assumed to be similar. Fortunately, Eurostat data on fixed capital formation by branches of industry provided some additional guidance in this process.

Table 6: Non-Transport Industries: Vehicle Stocks, Transport Services and Transport-Related Employment

Country	Vehicle stocks (1000)		Transport services (bn)		Employment (1000) related to the use of		
	Cars & light commercials	Heavy goods vehicles	Passenger kilometres	Tonne kilometres	Cars and LC	HGV	Total
Austria	786	28	14,0	4,7	118	37	156
Belgium	507	39	10,0	6,6	130	53	183
Denmark	268	14	4,5	2,2	128	19	147
Finland	199	13	4,7	2,2	60	18	78
France	2.945	175	62,0	29,7	639	211	850
Germany	5.623	426	99,0	72,1	1.480	618	2.097
Greece	274	17	5,5	2,8	43	22	65
Ireland	96	10	2,3	1,6	54	13	67
Italy	3.186	175	58,0	29,6	773	227	1.000
Luxembourg	22	2	0,5	0,4	10	3	14
Netherlands	803	37	18,0	6	269	51	320
Portugal	246	47	5,0	7,9	76	63	139
Spain	1.586	69	31,0	11,6	456	93	549
Sweden	369	15	8,4	2,5	103	20	123
United Kingdom	2.171	226	50,0	38,2	333	271	604
EU	19.084	1.291	372,9	218,1	4.672	1.717	6.390

Source: European Commission 1999, EU Transport in Figures; estimates

Table 6 lists the estimated vehicle stocks registered for businesses in non-transport industries, the estimated volume of own-account transport services (both passengers and goods) performed by them and the employment related to them on a country-by-country basis (6.4 million persons) across the EU for 1995.[14]

[11] Bundesamt für Güterverkehr 1996, Struktur der Unternehmen des gewerbliche Straßengüterverkehrs und des Werkfernverkehrs, Band USTAT, Stand: November 1996.

[12] For Germany the share of cars registered for commercial purpose also used for private purposes is put at slightly above 50 per cent. Hautzinger, H., Heidemann, D., Krämer, B., 1996. Inländerfahrleistungen 1993, *Berichte der Bundesanstalt für Straßenwesen, Mensch und Sicherheit, Heft M 61*, Bergisch Gladbach, p. 60.

[13] For further details see: Diekmann, A. 1999, Verkehr als Wertschöpfungsträger und Nachfragegrösse, *Zeitschrift für Verkehrswissenschaft, 70. Jahrgang, Heft 1*, pp.43 – 46.

[14] The plausibility of this figure can be tested by assuming that in terms of kilometrage about one-third of the transport services provided by passenger cars and light duty vehicles registered for non-transport industries

To translate these figures into the corresponding I-O structures, a two-pronged approach was taken. The costs of maintaining and running the estimated number of vehicles (expenditure on fuel, vehicle parts, tyres, automotive repair, maintenance services, insurance etc.) are usually well-documented for most countries, sometimes even by type of vehicle. Different sources, such as automobile clubs, national statistics and international studies were used to calculate the intermediate requirements of the transport activities in non-transport industries on an industry-by industry and on a country-by-country basis. In the course of this process, allowances had to be made for inputs that are not mainly used for transport, such as office supplies, accounting services etc., using the input coefficients of the traditional transport industries for guidance.

The value-added input components, representing factor income and depreciation, had to be considered next. Labour compensation and social contributions were estimated on a pro-rata basis in line with the share of transport-related employment in total employment per sector. For estimating depreciation, EU and national data on transport-related fixed capital formation and statistics on the average life of road vehicles were available. The crucial issue was profits. To what extent should operating surpluses achieved in the various industries be attributed to the transport activities performed by them. A widely-held view says that making estimates in that field would require market prices for similar services to compare with. Unfortunately, for most of the transport activities performed by non-transport businesses there are no services of a comparable nature. When business establishments choose to rely on their own transport capabilities this is either because they need highly specialised transport equipment not available on a for-hire basis or because the dependability required in moving their goods prevents them from outsourcing the services they need. In the case of passenger transport, purchased transport services can hardly be regarded as an equivalent to one's own car in terms of availability and flexibility, not to speak of prestige and comfort. But is there a need at all to look for market prices for similar services? Transport services provided on own account are so closely linked to the sales, distribution or production activities which they enable that there is no reason why they should not be assigned the same rate of profit as the non-transport activities they are related to, in which case the share of transport-related profits could, in broad approximation, be considered to equal the share of transport-related labour cost in the total labour costs incurred by non-transport industries.

These operations resulted in a set of input-coefficients and an estimate of gross output equal to the sum of intermediate inputs and value-added components which allowed own-account and business transport activities to be classified as market transactions to be separated from the rest of activities conducted by non-transport industries, commodity by commodity, country by country and for the European Union as a whole. The next step was to aggregate all own-account activities by adding up all transport-related inputs into the input column of a new sector representing the inputs required to produce own-account and business transport services across the entire economy.

would be of a private rather than commercial nature. The remaining kilometrage would then imply (on average) a 5 hours drive per person employed in pursuance of commercial activities over a distance of about 250 km a day. Considering that part of the workforce performs supporting activities, accompanying the driver on his route, working in the back office, doing maintenance work or planning the logistics of the use the vehicle fleets are put to, the estimate made concerning employment linked to the commercial use of passenger cars might even be too low.

Singling out the input requirements of a sector in its own right representing own-account and business transport activities would of course not be enough to move to a modified matrix with a new sector to be introduced. A corresponding operation was required on the output side. Unfortunately, the distribution of the output of own-account and business transport services by sector of destination is not very well known. The estimates that had to be made in this context are arbitrary to the extent that the transport services provided by non-transport industries cannot be automatically expected to follow the general output pattern of these industries. Exports of own-account transport services are known to be so small that they could be neglected. Long-distance, cross-border transports are the domain of professional road hauliers. On the other hand, a disproportionate share of transport services provided by non-transport industries is directed, and often separately billed, to private households. Private households must also be regarded as a major destination of own-account and business transport service for quite another reason. A number of vehicles registered by business units for commercial reasons are privately used as well although in many cases the costs of operating these vehicles remain within the responsibility of the business unit concerned. The services they provide can be considered as an output of the newly defined sector of production to private consumption.

Another sector of final demand which can be considered as a major consumer of own-account-transport services is fixed capital formation. Heavy goods vehicles owned by firms in the construction sector are frequently involved in the building of roads, railway lines, waterways and airports. The services they provide become part of the fixed capital formed by the economy.

In other words, transport services provided by non-transport industries are not just an in-house activity. They are 'sold' to third parties very much in the same way as would be the case with for-hire transport services.

When estimating the distribution of own-account and business transport services as an output allowances had to be made for a disproportionate part of them to considered as a final use supplied notably to private households and as an ingredient to fixed capital formation, while the rest was considered as an intermediate product whose distribution was likely to follow the general pattern of outputs for intermediate uses. The deviation from a linear relationship with the remaining output of the industries producing own-account and business transport services led to margin of error in estimating the new sector's output coefficients which is greater than in estimating the composition of its input. Given these qualifications however the estimated output structure should not be too far from reality.

This then puts us in a position to separate own-account and business activities from the rest of the activities of the sectors conducting them on the output side as well. Subtracting the columns and rows reflecting transport-related purchases from and sales of the non-transport sectors from the original I-O table leaves us with a residual table with residual cell values into which a new row, representing the aggregate of commercially-provided own-account transport services, and a new column, representing the new sector's input requirements, have to be inserted. This results in a modified matrix which gives us the opportunity to quantify the role the new sector plays in terms of intermediate transactions as well as in terms of final uses.

Adding the transport activities of the newly created sector to those of the traditional for-hire transport industries almost doubles transport-related employment in most countries. In terms of value-added, the increase in the weight of transport as an industrial activity is even greater. The inclusion of commercial transport services produced outside the traditional transport sector also smoothes out part of the differences in the contribution transport makes to GDP that would have persisted across the EU if only the output of the traditional transport industries had been considered.

Table 7: EU 1995: Value Added by Transport Industries to GDP

Country	Value-added by transport services (m ECU)				Share in GDP				
	Inland	Maritime & air	Auxiliary	Own-account, business	Inland	Maritime & air	Auxiliary	Own-acc business	Totai
Austria	4.645	626	1.198	7.638	3,0	0,4	0,8	4,9	9,1
Belgium	4.284	620	8.392	9.533	2,2	0,3	4,4	5,0	11,9
Denmark	4.992	1.983	1.373	9.265	4,3	1,7	1,2	7,9	15,1
Finland	3.285	1.002	1.099	3.938	3,9	1,2	1,3	4,7	11,2
France	22.827	3.292	14.017	42.899	2,1	0,3	1,3	3,9	7,6
Germany	29.777	8.552	16.718	122.575	1,8	0,5	1,0	7,2	10,5
Greece	892	519	454	2.250	1,2	0,7	0,6	3,0	5,4
Ireland	728	265	343	5.204	1,6	0,6	0,8	11,7	14,7
Italy	24.063	5.294	9.814	45.756	3,1	0,7	1,3	5,9	10,9
Luxembourg	244	0	280	917	2,1	0,0	2,4	7,8	12,2
Netherlands	6.702	3.036	3.864	16.275	2,4	1,1	1,4	5,9	10,8
Portugal	1.497	338	861	2.266	2,1	0,5	1,2	3,2	7,0
Spain	9.054	1.804	4.202	17.248	2,3	0,4	1,0	4,3	8,1
Sweden	3.676	1.651	1.505	4.644	2,2	1,0	0,9	2,8	7,0
UK	19.564	6.277	14.486	18.115	2,5	0,8	1,9	2,3	7,5
EU	136.232	35.258	78.605	308.522	2,3	0,6	1,3	5,2	9,4

Source: Eurostat; estimates

The figures in table 7 show that reliance on own-account transport services (which includes business use of cars) is far greater in Ireland, Germany, the Netherlands and Denmark than in the rest of the EU. While in the case of Ireland this may be partly attributable to errors in the process of estimation, a possible explanation for the more than proportionate contribution of own-account transport services to the value added to GDP could lie in the spatial distribution of cities and population in those countries which is far more homogeneous than in France or the UK with important agglomerations around their capitals. Spatial homogeneity usually implies more frequent trips over medium distances and thus involves a more widespread use of cars as a means of transport in their everyday activities. Lags in deregulation and a lower

level of outsourcing of transport services resulting therefrom could also explain some of the divergence. Still, with this divergence persisting it can be said that for most EU countries the total volume of commercially provided transport services is responsible for between 7 and 11 per cent of GDP.

3. Transport-related final demand

3.1 Transport as a social activity

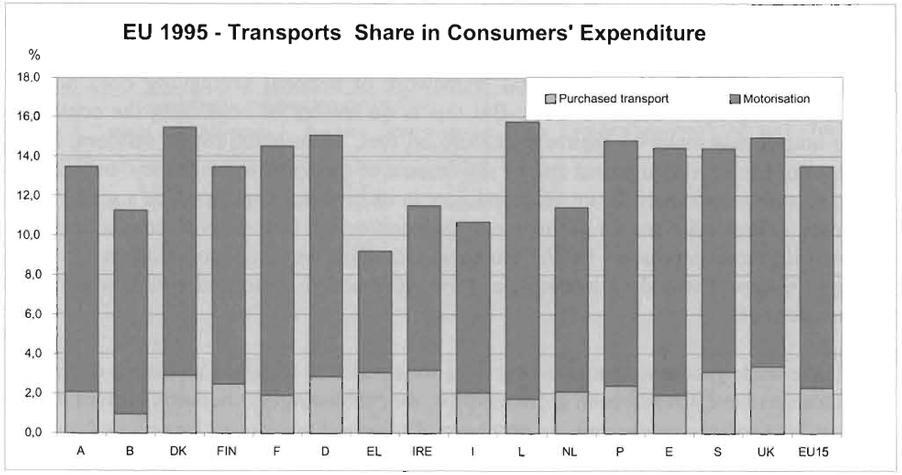
We have so far investigated the role of transport as an industry providing transport services for commercial purposes. However, a major part of the transport services society relies upon is non-commercial. In 1995, private households produced more than 70 per cent of all passenger-km within the EU, essentially but not exclusively for their own use. Although no value is attached to these self-provided services, they might well be regarded as equivalent to those provided by non-transport industries which we have specified as a separate commodity. If one were to value each hour individuals spent behind the steering wheel of their car in 1995 at 10 ECU on average, this would add up to a factor income of about 400 billion ECU. This is more than 1 ½ times the value-added contributed by traditional transport services in the European Union. The conventional framework of national accounting does not leave room for adding this amount to GDP. But this is no reason for neglecting the contribution private households make by their expenditure on fuel, spare parts, repair services, by their purchases of transport equipment and by the amount of transport services they 'outsource' by relying on public transport. If not as an industry in its own right, transport as a social activity represents an important source of income to the economy. It is an activity conducted in competition with those conducted by the transport industries we have looked at so far and the picture of transport would be incomplete if the value-added associated with it would not be taken account of.

If we leave aside purchased transport services for a moment which as an output of the transport industries have already been accounted for, we can distinguish between current inputs to transport as a social activity and the purchase of transport equipment by private households which under functional aspects would rather have to be considered as a kind of fixed capital formation. As to the current provision of transport services by private households, the fact that about half the time individuals spend in their cars is taken up by driving to work, carrying goods back home from retail outlets and using private cars for business purposes raises the question whether these private activities do not in reality constitute an input to the production process. Actually, the issue is very similar to the one we have encountered when dealing own-account transport in industry. The least that can be said is that the line between individuals producing transport services as an input to commercial activities and using them in their capacity as consumers is more difficult to draw than one might think. But following these thoughts further would change the traditional pattern of I-O tables, require more and rather detailed research and is well beyond the scope of this paper. We shall therefore stay

within the framework set by national accounting and consider the purchase and use of transport equipment by private households as a final, though transport-related, use.

Direct transport-related expenditure by private households consists of three components, the first two of which are rather obvious. They cover expenditure on self-provided transport services, which would include the purchase of transport equipment (motor vehicles, motor bicycles, bicycles and other), expenditure on public passenger transport and expenditure on transport services related to the general purchase of goods and services billed to private households or embodied in these purchases and treated as separate output to private consumption as a final use in I-O tables. The last-mentioned category of transport-related consumers' expenditure usually does not show up in statistics as a separate item but has to be covered when analysing the role of transport in private consumption, although it is not shown in figure 3 which is concerned with personal mobility.

Figure 3



Source: Eurostat; estimates

On personal mobility (own-account and purchased) private households in the European Union spent 520 bn ECU in 1995. Out of this total, 154 billion ECU were spent on the purchase of transport equipment, 258 bn ECU on using and operating this equipment and 98 billion ECU on the purchase of passenger transport services. These figures include trade margins, VAT and imports both from within the EU and from third countries. Germany (27 per cent) and France (19 per cent) together accounted for almost half of the total, the UK and Italy for somewhat more than a quarter. Figure 3 shows which share of their total expenditure consumers used for their own mobility. As can be seen, this share varies somewhat across the EU. It was below average in the case of Greece, Ireland, Italy, Belgium and the Netherlands

while for the rest of the European Union the share oscillated around 14 per cent. The EU average was 13.5 per cent.

Table 8

Transport-related Final Uses by Private Households (I)
(m ECU)

	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland
Agriculture, forestry and fishery products	0	0	0	0	0	0	0	0
Fuel and power products	1.851	1.522	1.115	627	10.422	4.962	926	194
Ferrous and non-ferrous ores and metals	0	0	0	0	0	0	0	0
Non-metallic mineral products	0	0	0	0	0	0	0	0
Chemical products	6	9	4	7	165	148	7	2
Metal products except machinery	13	7	10	11	173	52	7	1
Agricultural and industrial machinery	0	0	0	0	0	0	0	0
Office and data processing machines	0	0	0	0	0	0	0	0
Electrical goods	2	3	3	4	140	392	5	1
Transport equipment (incl. spare parts)	1.076	417	34	113	20.267	25.945	897	300
Food, beverages, tobacco	0	0	0	0	0	0	0	0
Textiles and clothing, leather and footwea	0	0	0	0	0	20	0	0
Paper and printing products	0	0	0	0	0	1.044	0	0
Rubber and plastic products	3	1	4	4	76	629	4	1
Other manufacturing products	0	0	0	0	0	0	0	0
Building and construction	0	0	0	0	0	0	0	0
Recovery, repair services, wholesale, reta	2.034	1.929	1.329	755	13.734	27.090	443	234
Lodging and catering services	0	0	0	0	0	0	0	0
Inland transport services	1.765	2.154	1.504	798	10.084	25.654	1.109	551
Maritime and air transport services	261	87	745	608	2.548	6.792	2.008	177
Auxiliary transport services	2.910	893	333	532	3.328	7.732	144	11
Virtual transport services	3.304	4.884	5.088	1.879	22.982	55.015	1.277	2.308
Communication services	0	0	0	0	0	0	0	0
Services of credit and insurance institutior	0	1.775	627	512	4.631	12.350	304	310
Other market services	1.429	944	639	316	2.949	8.320	186	9
Non-market services	80	50	41	18	156	1.389	10	1
Domestic purchases	14.736	14.675	11.475	6.183	91.654	177.533	7.327	4.100
Imports from EU countries	1.728	2.579	420	387	7.553	10.024	2.857	907
Imports from third countries	618	832	290	296	5.141	7.453	893	1.226

Transport-related Final Uses by Private Households (II)
(m ECU)

	Italy	Luxembourg	Netherlands	Portugal	Spain	Sweden	UK	EU15
Agriculture, forestry and fishery produc	0	0	0	0	0	0	0	0
Fuel and power products	10.397	22	3.283	1.042	6.603	2.313	14.439	59.717
Ferrous and non-ferrous ores and meta	0	0	0	0	0	0	0	0
Non-metallic mineral products	0	0	0	0	0	0	0	0
Chemical products	107	1	16	8	72	15	86	655
Metal products except machinery	22	10	6	16	30	28	33	419
Agricultural and industrial machinery	0	0	0	0	0	0	0	0
Office and data processing machines	0	0	0	0	0	0	0	0
Electrical goods	17	6	4	10	10	26	21	643
Transport equipment (incl. spare parts)	6.631	8	313	861	1.953	915	3.649	63.378
Food, beverages, tobacco	0	0	0	0	0	0	0	0
Textiles and clothing, leather and footv	0	0	0	0	0	0	0	20
Paper and printing products	0	0	0	0	0	0	0	1.044
Rubber and plastic products	9	5	5	5	5	9	23	785
Other manufacturing products	0	0	0	0	0	0	0	0
Building and construction	0	0	0	0	0	0	0	0
Recovery, repair services, wholesale, r	8.137	112	2.499	1.397	6.971	1.646	5.753	74.061
Lodging and catering services	0	0	0	0	0	0	0	0
Inland transport services	13.024	39	1.990	884	5.343	1.498	7.156	73.553
Maritime and air transport services	1.299	33	1.267	99	835	577	4.162	21.500
Auxiliary transport services	2.153	192	881	332	789	574	1.696	22.501
Virtual transport services	25.931	505	6.683	1.217	11.464	2.238	10.157	154.932
Communication services	0	0	0	0	0	0	0	0
Services of credit and insurance institu	1.720	124	1.755	599	1.080	704	6.562	33.052
Other market services	1.961	36	744	90	2.580	357	3.376	23.936
Non-market services	119	0	38	6	140	19	168	2.235
Domestic purchases	71.528	1.093	19.485	6.566	37.876	10.919	57.281	532.431
Imports from EU countries	5.663	129	3.253	1.247	5.335	1.262	9.684	53.028
Imports from third countries	3.428	208	1.008	458	1.221	510	8.019	31.601

If one deducts value-added tax, breaks mobility-oriented consumers' expenditure down by commodities and adds expenditure on transport incurred by private households in the purchase of goods and services one gets the pattern of purchases shown in table 8 on a country-by country basis. It is on the basis of this pattern that intermediate inputs dependent on transport-related private consumption can be calculated as well as the value-added content and indirect imports attributable to it.

3.2 Transport as a system

3.2.1 General remarks

Transport could not exist without infrastructure. Building, maintaining and running this infrastructure takes up a considerable amount of resources and forms part of the fixed costs the users of the transport system are supposed to bear. To these costs the investment in transport equipment and other capital goods made periodically and required for the provision of transport services has to be added. While the provision of infrastructure usually is in the responsibility of governments, mobile plant is to be taken care of by the operators of transport equipment. Taken together they constitute the system-related part of expenditure on transport.

3.2.2 Transport-related government expenditure

Final uses in terms of transport-related activities by governments consist of two elements. The first element covers purchases of transport equipment and of transport services, the second element is made up of government expenditure on transport infrastructure and on administrative services by the police and other bodies required to supervise and control traffic flows on roads, waterways and in the air.

By tradition, governments hold a key position in shaping the transport system. They are the main providers of infrastructure, they run the network of roads and inland waterways (in spite of some motorways being privately operated), sometimes even ports and airports and, most of them still own the national railway system. It is their task to control and police the flow of traffic and they set the regulatory framework according to which transport equipment is built and brought into circulation. Finally, they are users of the transport system and purchasers of transport equipment themselves.

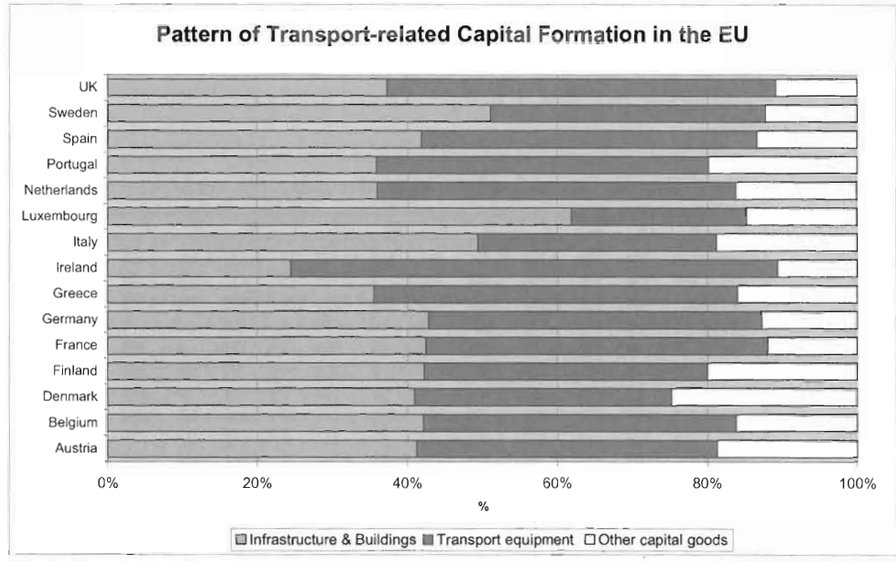
For the purpose of this paper, transport-related government activities will be broken down into expenditure on infrastructure and transport equipment, to be classified as fixed capital formation and treated accordingly, and administrative activities and the provision of transport services to be treated as government consumption. Transport-related government consumption is basically domestic in character. Direct imports, which certainly exist to a small extent, can be ignored.

The share of transport-related government consumption in total transport-related final demand is small. It adds up to a total of 65.6 billion ECU in the EU in 1995.

3.2.3 Transport-related fixed capital formation

Next to transport-related private consumption, transport-related fixed capital formation is the most important element of transport-related final uses. It can be broken down into three major categories: buildings and infrastructure (48 per cent), transport equipment (37 per cent) and other capital goods used in the production of transport services (15 per cent). In absolute figures, transport-related investment in the EU totalled 281.9 billion ECU in 1995. These figures include investments made by business units providing own-account transport services. It does not include purchases of transport equipment made by private households. Figure 4 indicates the share of each of the three components in total transport-related fixed capital formation for each of the 15 EU countries.

Figure 4



Source: Eurostat

Investment expenditure on infrastructure expanded vigorously throughout the eighties in most EU countries. In total, it was twice the 1980 level in 1990, at current prices. Investments in Europe's railway systems even trebled and in the case of airports they had by 1990 reached four times their 1980 level. But led by a decline in road building, the pace of growth in expenditure on infrastructure slowed down in the last decade of the past century. With national

road networks nearing completion and railways concentrating their services on the more highly frequented part of their network, there appears to be less need for net investment in transport infrastructure than one or two decades ago when infrastructure had to catch up with the growth of traffic flows.. This does not mean that there will be no further expansion. There are still projects forming part of the envisaged Trans-European Network which are to be realised, but on the whole the building of transport infrastructure in the European Union will be increasingly selective and capital outlay in this domain will tend to go into repairs and replacement of the existing network rather than into new building activities.

Expenditure on transport equipment, on the contrary, still seems to have preserved some of its dynamics, particularly as far as road vehicles and aircraft are concerned. But this seems to be more true in terms of value than in terms of physical units. Partly because of more stringent legislation, partly reflecting more exacting demands by operators and users of transport equipment, there has been a trend for vehicles and aircraft to become more sophisticated and, as a rule, more expensive. This is certainly the case with motor vehicles where environmental legislation, comfort and prestige have been major driving forces in pushing related expenditure to a higher level. The figures for 1995, the year chosen for the present analysis, may be misleading, because it was a year with a low sales record. Since then, new vehicles registrations in the EU have expanded substantially to flatten out again by the turn of the century. Table 9 provides an overview of transport-related fixed capital formation in the EU in 1995 by categories.

Table 9: Fixed Capital Formation by Categories: EU 1995 (m ECU)

	A	B	Dk	FIN	F	D	EI	IRL	IT	L	NL	P	E	S	UK
Infrastructure	1.338	2.179	702	515	8.784	26.586	461	432	12.437	183	2.328	1.148	5.406	2.460	8.779
- railways	475	699	150	234	1.290	5.489	102	7	2.123	23	432	109	174	1.121	1.091
- roads	708	1.023	361	186	4.942	16.656	359	356	9.207	159	1.356	868	4.253	1.119	4.999
- inland waterways	13	112	0	9	122	581	0	0	19	0	157	0	0	0	0
- airports	128	38	49	39	501	1.795	0	45	501	1	174	0	307	63	848
- metro, tram,	14	150	46	14	1.626	1.550	0	0	215	0	96	110	104	129	1.673
- ports	0	157	97	34	304	515	0	25	373	0	114	62	568	26	168
Transport equipment	2.148	2.791	1.207	656	13.229	38.338	1.836	2.569	9.849	81	5.316	1.809	7.210	1.858	13.339
- rolling stock	280	276	174	29	830	1.641	83	40	537	8	227	133	240	105	64
- road vehicles	1.868	2.474	1.033	627	12.294	36.599	1.754	2.529	9.301	73	4.924	1.677	6.970	1.753	13.275
- vessels (inland)	0	41	0	0	105	98	0	0	11	0	166	0	0	0	0
- vessels (sea-going)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
- aircraft	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other	2.568	2.371	2.316	800	9.291	28.651	1.903	1.143	13.275	164	4.481	1.506	4.709	1.182	4.729
- buildings	1.584	1.401	1.353	469	6.438	19.291	1.302	748	7.429	114	2.747	657	2.793	759	2.422
- machinery	984	970	963	332	2.853	9.360	601	395	5.846	51	1.734	849	1.916	422	2.307
Total	6.055	7.341	4.225	1.971	31.304	93.576	4.200	4.144	35.561	428	12.125	4.464	17.325	5.499	26.847

Source: Eurogramme 1999, Study on the Economic Importance of the Transport Sector (Final Report); estimates.

It should be pointed out that system-related expenditure on transport differs in its effect on the business cycle and on long-term growth from that of current expenditure on transport

services, in particular as far as investment in infrastructure is concerned which tends to be a major driving force in the take-off phase of a every new transport technology. As a rule, when the production system nears completion, be it rail or road, expenditure on infrastructure loses much of its impetus and becomes irregular. There is less need for expansion and repairs and replacements can be put off, at least for a while, without putting the basic functions of the network at a risk. In other words, the system-related part of transport-related expenditure becomes susceptible to cyclical fluctuations once the system has been established. Current transport activities, on the other hand, serve basic everyday needs of society. Although they may react to a slowing down in economic activities, they show a greater degree of stability than capital outlay. When analysing the economic impact of transport, it makes sense therefore to distinguish between the two transport-related components of final demand.

Across the EU, the share of transport-related investment in total fixed capital formation was almost 25 per cent. In the wake of reunification, Germany was by far the most important investor and accounted for 37 per cent of EU total in 1995, with Italy and France ranking second with 13 per cent each, followed by the UK (10 per cent). For two-thirds of transport-related investments, EU countries relied on domestic supplies. Imports from other EU countries accounted for 1/5 of the total.

3.3 Transport-related exports

While the transport-related content in the components of final demand discussed so far could be identified on the basis of fairly reliable data, it was more difficult to quantify the transport-related share of exports. There are, of course, export goods whose affinity to transport is obvious, such as transport equipment and transport services. But beyond these, there is a wide range of goods and services entering transport-related production processes as intermediate products which could just as well be used for other purposes. For most raw materials and semi-finished goods it is difficult to tell to which extent they will be used as an input to transport-related production processes abroad. When trying to isolate the transport-related share of these exports to other EU countries, it was found easier to tackle the problem from the import side. As within the European Union one country's imports from the EU must automatically be another EU country's exports, at least as an aggregate the composition of transport-related imports by commodities must be identical with that of transport-related exports. The problem was to link exports and imports on a commodity-by-commodity and on a country-by-country basis. To solve this problem, a number of assumptions had to be made regarding the pattern of trade flows for those commodities where obvious links to transport-related production did not exist. In those cases, it was assumed that transport-related trade in these commodities followed the general pattern of intra-EU trade as to origin and destination. This approach inevitably results in some margin of error which concerns about one-third of the total volume of intra-EU transport-related trade. It was not possible, however, to rely on the same kind of approach for estimating transport-related exports to third countries, except in a number of obvious cases, the result being that the volume of transport-related exports to third countries might be underestimated by the present analysis.

What became clear however when making the estimates was that transport-related supply chains reach well beyond the boundaries of a country and show a rather complex pattern. They consist of a network of interdependent sales and purchases between countries comparable to the interdependence of supplies and purchases between industries reflected by the intermediate quarter of the I-O table. Exports from country A to country B usually lead to imports from country B, which may at a further stage cause the level of exports from A to B to rise in turn. Therefore, the volume of transport-related exports provided by table 10 is the result of an iterative process and takes into account direct as well as indirect exports involving a multiplier to be applied to first-tier exports. Technically, the problem of taking account of the indirect or secondary effects of transport-related exports can be solved by linking the total requirements tables of the countries involved with the relevant trade statistics.

In 1995, first-tier transport-related exports within the EU totalled about 250 million ECU leading to an aggregate of indirect requirements originating from within the EU worth 112 million ECU, raising the transport-related total in intra-EU trade to 362 billion ECU and yielding an export multiplier of 1.4. This amounted to a share in total intra-EU trade of 31 per cent.

Table 10: EU 1995 -Transport-Related Intra-EU Trade (m ECU)

Supplies from:	Deliveries to															
	A	B	DK	FIN	F	D	EL	IRE	I	L	NL	P	E	S	UK	EU-15
A		1.156	237	195	1.390	5.184	84	147	1.302	53	985	106	857	679	1.129	13.503
B	1.837		698	647	4.673	13.023	199	359	3.720	498	3.803	430	2.555	2.063	5.344	39.849
DK	291	611		139	570	1.579	57	78	554	60	515	66	342	518	673	6.053
FIN	449	807	294		902	2.047	100	123	725	56	656	113	583	1.312	1.004	9.171
F	1.695	4.918	814	552		11.447	247	417	5.146	228	2.360	685	5.391	1.627	6.215	41.742
D	6.839	10.023	2.301	1.522	14.873		950	975	11.571	257	7.420	1.157	7.966	4.757	14.933	85.543
EL	68	227	17	25	145	354		13	126	19	85	15	76	67	135	1.371
IRE	160	272	72	69	342	1.078	18		329	20	237	44	247	149	1.253	4.288
I	1.731	3.513	741	531	6.083	9.642	485	422		174	1.982	821	3.002	1.396	3.937	34.460
L	137	413	25	29	335	724	12	28	241		137	26	193	146	198	2.643
NL	1.403	4.801	740	586	2.318	8.136	198	347	2.346	762		348	1.755	1.490	3.783	29.012
P	129	287	66	51	437	1.054	17	40	303	39	206		389	144	472	3.635
E	820	1.508	320	257	9.978	7.120	310	268	4.019	666	1.579	1.451		681	3.974	32.952
S	564	3.046	677	705	1.368	1.971	112	140	998	93	1.594	149	662		2.021	14.099
UK	1.688	6.556	989	945	5.248	9.985	459	1.617	5.136	420	3.691	945	3.802	2.081		43.562
EU-15	17.811	38.139	7.992	6.253	48.660	73.343	3.249	4.975	36.516	3.343	25.248	6.354	27.820	17.109	45.072	361.883

Source: Eurostat; estimates

It seems that Germany, mainly owing to a high level of exports of motor vehicles and components, benefited most from transport-related demand across the European Union. Spain and the Netherlands turned out to be a major net exporters of transport-related goods and services as well, while France, Italy and the UK were running deficits in transport-related intra-EU trade.

The volume of transport-related exports to third countries was about half as high as the corresponding volume of intra-EU trade. Again Germany held by far the largest share, the UK and Italy ranked second.

Table 11: Components and value-added content of transport-related final demand

Country	Value-added attributable to transport-related final demand (m ECU)	Components of transport-related final demand				
		Private Consumption %	Government Consumption %	Fixed Capital Formation %	Exports to EU %	Exports to third countries %
	1	2	3	4	5	6
Austria	26.775	40	5	17	30	8
Belgium	40.677	23	4	10	50	13
Denmark	19.785	40	4	18	22	16
Finland	13.971	35	5	15	44	21
France	164.732	46	3	17	19	15
Germany	332.734	43	4	20	21	12
Greece	9.658	62	4	22	8	4
Ireland	9.393	36	4	19	25	16
Italy	143.317	42	6	22	18	12
Luxembourg	2.772	23	7	8	59	3
Netherlands	48.594	29	6	17	41	7
Portugal	11.804	43	6	24	19	8
Spain	74.733	41	2	19	31	7
Sweden	26.590	31	3	15	34	17
UK	122.633	42	3	16	24	15

3.4 Value-added content of transport-related final demand

Summing up the chapter on transport-related final demand, we can measure its relevance for the economy of each member state of the European Union. This can be done by multiplying transport-related final demand as a vector singled out from the total with the Leontief inverse thereby generating the gross output of each commodity required to satisfy this demand, both directly and indirectly. Multiplying the gross output thus generated by the appropriate ratio of value-added to gross output for each commodity then yields the absolute value-added content of each vector of transport-related final demand. The result is shown in terms of each component's share in total value-added by transport-related demand in table 11 on a country-by country basis. For most countries transport-related private consumption was the most important contributor usually accounting for 40 per cent of the total. Exports as a total reached a similar share which in the case of some countries even went even beyond that of private consumption due to high exports to other EU countries.

4. Taking a consolidated view

4.1 Aggregating national I-O tables

This chapter takes the analysis from the national to EU level by aggregating the modified national I-O tables, containing an extra row and an extra column for own-account and business transport services, into a consolidated EU I-O table. For aggregation, exports destined to other EU countries and imports from them had to be 'internalised' raising thereby the value of the cells in the in the intermediate quarter of the I-O table as well as in its final demand quarter. What remained were imports from and exports to third countries. The aggregation of the national tables, essentially done on the basis of Eurostat data[15], provides us with the opportunity to summarise and discuss the influence of transport as a source of income and employment for the European Union as an entity. The analysis to be carried out for this purpose will essentially be based on the Leontief inverse of the consolidated EU table. We shall turn to the supply side first and analyse the transport industries, then look at transport-related final demand and finally deal with transport as a whole, using the measures proposed in the first chapter.

4.2 Transport industries

As has been pointed out earlier, the gross production value to be attributed to commercially provided transport services in the EU (for-hire and own-account) was close to 1 000 billion ECU in 1995, split almost evenly between the traditional transport industries and non-transport industries. However, in terms of value-added traditional transport was in a much weaker position, which is to a large extent due to the poor performance of Europe's highly subsidised railways. Table 12 gives a overview over direct and total requirements transport industries in the EU relied upon and compares them to the EU-wide output of each input category. About 12 per cent of the gross output of transport services result from deliveries to business units within the transport sector itself. This has to be taken into account when calculating total requirements in order to avoid double counting.

As can be seen from the table, upstream activities raise the value-added attributable to transport services from 562 billion ECU, which is what the transport industries contribute themselves, to 779 billion ECU. Also in terms of employment the contribution suppliers to the industry make is by no means negligible. It adds another 3.4 m jobs, taking the total number of people directly and indirectly employed in the provision of transport services to 17.5 m. In terms of value, transport industries in the EU consume about 14 percent of the output of fuel and power products and 9.1 per cent of the output of the manufacturers of transport equipment (mainly consisting of spare parts). Also, their reliance on services is quite high.

[15] Eurostat 1999, Input-Output Tables for the European Union (1995). The exception was Germany. Instead of using the estimated 95 Eurostat version , this paper relies on the new 1995 I-O table published by the German Statistical Office.

Table 12: EU 1995: Transport Industries – Direct and Indirect Requirements

At producers' prices (net of all VAT) Mio. ECU	Inland transport services	Maritime and air transport services	Auxiliary transport services	Own-account & business transport services	Transport industries - Direct requirements	Transport industries - Total requirements w/o double counting	Share in total (%)
	1	2	3	4	5	6	7
Agriculture, forestry and fishery products	115	155	58	660	988	3.529	1,2
Fuel and power products	19.073	7.042	2.522	20.251	48.889	70.875	14,0
Ferrous and non-ferrous ores and metals	517	29	11	1.021	1.578	8.718	4,4
Non-metallic mineral products	294	49	52	1.099	1.494	7.582	4,3
Chemical products	513	192	185	2.003	2.893	11.205	3,1
Metal products except machinery	846	192	520	679	2.236	9.199	3,5
Agricultural and industrial machinery	664	116	333	1.055	2.169	5.988	1,8
Office and data processing machines	154	66	253	200	673	1.575	2,1
Electrical goods	1.181	193	189	1.724	3.287	8.548	3,3
Transport equipment	4.973	5.674	280	17.326	28.254	35.107	9,1
Food, beverages, tobacco	280	767	145	1.022	2.213	5.296	0,9
Textiles and clothing, leather and footwear	299	168	110	627	1.204	2.838	1,2
Paper and printing products	1.625	616	1.613	2.146	6.000	14.980	5,3
Rubber and plastic products	3.705	274	284	1.397	5.659	10.223	7,2
Other manufacturing products	320	104	124	426	973	3.154	1,5
Building and construction	2.547	390	1.863	758	5.559	12.046	1,6
Recovery, repair services, wholesale, retail	14.845	2.155	3.424	16.591	37.016	50.234	4,2
Lodging and catering services	1.364	1.354	1.252	608	4.578	6.426	2,0
Inland transport services	5.340	883	3.748	3.319	13.291	.	.
Maritime and air transport services	705	4.445	2.343	88	7.581	.	.
Auxiliary transport services	14.113	16.991	31.946	29	63.079	.	.
Own-account and business transport services	3.194	1.091	1.615	5.740	11.640	.	.
Communication services	2.054	1.084	2.261	5.014	10.412	15.791	8,9
Services of credit and insurance institutions	5.438	3.322	2.845	5.917	17.522	50.158	7,9
Other market services	14.830	9.516	11.592	30.055	65.994	107.216	5,6
Non-market services	1.194	350	684	1.024	3.252	6.773	0,4
DOMESTIC GOODS AND SERVICES	100.182	57.218	70.251	120.782	348.433	.	.
IMPORTS OF GOODS AND SERVICES	4.466	15.736	2.427	8.712	31.341	50.497	7,1
TOTAL INTERMEDIATES	104.647	72.955	72.678	129.494	379.774	.	.
Gross wages and salaries, social contributions	103.499	20.665	39.276	144.094	343.244	414.974	12,1
Net operating surplus	17.034	6.573	27.770	120.052	171.429	233.796	14,4
Consumption of fixed capital	42.261	8.428	10.891	39.146	100.727	132.085	18,4
Taxes linked to production minus subsidies	-26.562	-408	667	8.728	-17.575	-2.978	-1,9
GROSS VALUE ADDED AT MARKET PRICES	136.232	35.258	78.605	312.020	562.115	777.877	13,1
Non-deductible VAT	3.275	318	1.996	3.853	9.441	12.838	13,1
ACTUAL OUTPUT	244.154	108.530	153.279	445.368	951.331	.	.
Total transfers at basic prices	242	-123	1.439	2.213	3.771	6.277	.
DISTRIBUTED OUTPUT	244.396	108.407	154.718	447.581	955.102	.	.
EMPLOYMENT (1.000 persons)	*4.455*	*686*	*1.469*	*6.485*	*13.095*	*17.496*	*11,6*

4.3 Transport-related final demand

Moving to the demand side give us some idea of how closely final uses of goods and services are directly linked to transport. Transport-related final demand accounts for 17,4 per cent of total final uses. The share related to transport is particularly high in exports where transport-related goods and services account for more than a quarter of the total. Fixed capital formation and private consumption are linked to transport by one-fifth. Even without transport services required to meet non-transport related final demand, transport-related final uses would be an important factor in shaping output of Europe's economy. In 1995, private households alone spent 676 billion ECU on the purchase and use of transport equipment. Out of this amount 186 billion ECU were spent on transport services linked to the purchase of general, non-transport goods and services. The major part of these transport services was

provided by non-transport industries. Table 13 gives a detailed account of which were the industries most favoured by the transport orientation of final users.

Table 13: EU 1995: Transport-Related Final Demand

At producers' prices (net of all VAT) Mio. ECU	Final consumption of households	Collective consumption of government	Gross fixed capital formation	Change in stocks	Exports of goods and services	Total final uses
Agriculture, forestry and fishery products	0	0	0	0	0	0
Fuel and power products	64.058	0	0	0	8.766	72.824
Ferrous and non-ferrous ores and metals	0	0	0	0	3.317	3.317
Non-metallic mineral products	0	0	0	0	0	0
Chemical products	872	0	0	0	5.984	6.856
Metal products except machinery	555	0	0	0	2.166	2.721
Agricultural and industrial machinery	0	0	14.231	0	5.544	19.776
Office and data processing machines	0	0	3.640	0	0	3.640
Electrical goods	891	0	2.429	0	3.527	6.847
Transport equipment	106.704	12.785	74.702	6.617	71.154	271.963
Food, beverages, tobacco	0	0	0	0	0	0
Textiles and clothing, leather and footwear	21	0	0	0	1.451	1.472
Paper and printing products	1.030	0	0	0	0	1.030
Rubber and plastic products	893	0	82	0	3.954	4.928
Other manufacturing products	0	0	59	0	879	939
Building and construction	0	0	89.271	0	0	89.271
Recovery, repair services, wholesale, retail	75.632	0	8.674	0	2.267	86.573
Lodging and catering services	0	0	0	0	0	0
Inland transport services	92.734	136	1.675	0	9.552	104.097
Maritime and air transport services	46.086	101	76	0	32.633	78.897
Auxiliary transport services	30.568	2.876	24	0	7.640	41.107
Own-account and business transport services	154.932	11.778	21.578	0	0	188.289
Communication services	0	0	0	0	0	0
Services of credit and insurance institutions	33.435	0	53	0	0	33.488
Other market services	24.162	0	2.859	0	906	27.928
Non-market services	1.429	37.961	568	0	0	39.958
DOMESTIC GOODS AND SERVICES	634.001	65.637	219.924	6.617	159.742	1.085.920
IMPORTS OF GOODS AND SERVICES	41.625	0	24.288	3.761	14.727	84.400
TOTAL TRANSPORT-RELATED FINAL DEMAND	675.626	65.637	244.211	10.378	174.468	1.170.319
Share in total final demand	*18,6*	*5,2*	*21,3*	*38,4*	*26,2*	*17,4*

4.4 Value-added embodied in EU transport-related activities

As we have seen earlier, not all transport-related activities depend directly on final uses. Intermediate demand for transport services is also generated by non-transport final demand. If one wants to measure the impact transport has on the economy all transactions in the intermediate sector linked to transport would have to be included. This involves looking at the entire transport-related supply chain. As however all transport-related activities are driven by final demand, be it directly or indirectly, transport can best be measured by the transport content of final demand or rather by the value-added this content represents.

Transport services are a core element in this content but the value-added they contribute directly is relatively modest. It totalled 562 billion ECU in 1995, most of which was attributable to private consumption as can be seen from table 14(I). Suppliers added another 216 billion ECU (table 14(I), second column). The transport content of final demand measured by the transport services its components generate can therefore be put at 778 billion ECU, which

is 13.1 per cent of GDP. The last column in table 14(I) has been added for mere information. It indicates the level of foreign supplies required directly and indirectly in the production of transport services within the European Union.

Table 14: EU 1995: Measuring transport in the EU

(I) Transport services provided by Industry

Embodied in:	VA by Transport industries (TI)	VA by domestic supplies to TI	Imports (TI and suppliers)
Transport-related FD			
- Consumer exp	231.177	90.399	21.858
- Government Cons	12.643	4.111	769
- Fixed Capital Form	28.773	9.740	1.842
- Stocks	467	168	33
- Exports	34.125	17.859	7.341
Non-transport-related FD			
- Consumer exp	128.740	47.371	9.435
- Government Cons	35.044	12.937	2.754
- Fixed Capital Form	64.174	23.160	4.462
- Stocks	933	338	67
- Exports	26.039	9.637	1.928
Total Final Demand	**562.115**	**215.719**	**50.488**
Share in GDP (%)	**9,5**	**13,1**	

Value added by transport industries and their domestic suppliers

777.834 m ECU = 13,1 per cent of GDP

(II) Transport-related final demand

Embodied in:	Transport-related VA by: Transport industries (TI)	Other sectors	of which: Supplies to TI	Tr.related Imports (dir. + indir.)
Transport-related FD				
- Consumer exp	231.177	341.648	90.399	102.801
- Government Cons	12.643	49.588	4.111	3.405
- Fixed Capital Form	28.773	170.408	9.740	45.030
- Stocks	467	5.371	168	4.540
- Exports	34.125	104.041	17.859	36.302
Total	**307.185**	**671.056**	**122.276**	**192.079**

Value of all goods and services delivered to final users for transport purposes

1.170319 m ECU of which domestically relevant 978.240 m ECU = 16,5 per cent of GDP

(III) Transport-related Gross Domestic Product (GDP)

Embodied in:	Transport-related VA by: Transport industries (TI)	Other sectors	of which: Supplies to TI
Transport-related FD			
- Consumer exp	231.177	296.606	90.399
- Government Cons	12.643	49.588	4.111
- Fixed Capital Form	28.773	170.408	9.740
- Stocks	467	5.371	168
- Exports	34.125	104.041	17.859
Non-transport-related FD			
- Consumer exp	128.740	93.285	47.371
- Government Cons	35.044	12.937	12.937
- Fixed Capital Form	64.174	23.160	23.160
- Stocks	933	338	338
- Exports	26.039	9.637	9.637
Total Final Demand	**562.115**	**765.371**	**215.719**

Total value added by transport-related activities

1.327.486 m ECU = 22,4 per cent of GDP

Table 14(I) provides us with rather detailed information on the role the components of final demand play in creating demand for transport services. Each of them can be split into a transport-related and a non-transport related element. More than 40 per cent of the transport services industry produces are generated by non-transport related demand. In the case of fixed capital formation the amount of transport required by the non-transport related element is about twice as high as the contribution made by the transport related element.

Table 14 (II) measures transport-related final demand. It includes some but not all transport services provided by industry. The 'transport content' of it seems to be 100 per cent at first sight because all of it is transport-related. However, this is only true if one includes foreign supplies. In order to determine the value transport-related demand adds to domestic GDP, direct and indirect imports have to be deducted. This leaves the transport content at of 978 billion ECU equivalent to 16.5 per cent of EU GDP. Although this measure yields a higher percentage than the isolated look at the commercially-provided transport services, it is not yet a full measure of the transport content of GDP because it ignores transport services provided in response to non-transport related final demand. The measure proposed in table 14(III) adds these, while cutting out foreign supplies, and is the most comprehensive measure of the impact of transport-related activities in the EU. The total of 1 327 m ECU worth of transport-related value-added table 14(III) provides equals 22.4 per cent of EU GDP. This is the amount of economic resources transport required in 1995. Again, almost 57 per cent of the total are directly or indirectly attributable to consumers' expenditure. 22 per cent of transport-related value-added were generated by fixed capital formation and 13 per cent by exports.

4.5 Non-transport industries' dependence on transport

The measures used so far were of a general nature, They did not deal explicitly with the dependence of individual industries on transport. This dependence is of a dual nature. It concerns transport as a source of output as well as its use as an input. In order to illustrate to which extent individual industries benefit from transport and to which extent they rely on it at the same time, we shall, for a moment, go back to the original, unmodified I-O table where transport services still form a part of the output of non-transport industries.

As shown in table 15, the benefit individual sectors derive from transport in terms of output consists of two components. One is the production of own-account and business transport services which has been split in the table depending on the kind of vehicle used (columns 1 & 2), while the second component consists of direct and indirect supplies driven by transport-related demand (column 3). The output-related columns of the table show the highest degree of dependence on transport as a source of demand for fuel and power products, rubber and plastic products, metals as well as metal and mineral products. They confirm the role of transport as a major consumer of energy and they show its reliance on raw materials, iron and non-iron metals in particular. Unsurprisingly, the manufacturers of transport equipment depend almost totally on transport-related demand, leaving a share of about 5 per cent to uses

not covered by the definition of transport used in this paper. When comparing the first two columns of the table, it can be seen that as far as the production of transport services is concerned, the use of cars and vans by non-transport industries is of far greater importance for most sectors than own-account road haulage with heavy goods vehicles.

Table 15: EU 1995 - Non-Transport Industries' Dependence on Transport

Non-transport industries	Transport-related output (m ECU)					Transp.services required per 100 units of output supplied to final demand	
	Output of transport services using		Transport-rel. supplies	Transport-rel. output	Share in Total (%)		
	cars & vans	HGV				directly	in total
	1	2	3	4	5	6	7
Agriculture, forestry and fishery products	7.528	2.199	6.693	16.420	5,6	3,7	8,4
Fuel and power products	9.176	6.516	194.516	210.208	40,4	3,3	6,4
Ferrous and non-ferrous ores and metals	2.731	2.466	53.898	59.095	29,0	9,3	17,4
Non-metallic mineral products	6.286	4.727	33.068	44.082	23,5	8,6	14,0
Chemical products	3.489	903	46.451	50.843	13,8	4,8	10,4
Metal products except machinery	4.878	1.445	56.780	63.102	23,5	4,3	9,9
Agricultural and industrial machinery	5.554	3.230	46.944	55.728	16,5	5,5	10,9
Office and data processing machines	2.953	295	8.756	12.004	16,0	5,1	9,8
Electrical goods	5.740	3.457	43.257	52.454	19,8	5,0	9,9
Transport equipment	7.941	2.738	366.746	377.425	94,7	4,9	11,3
Food, beverages, tobacco	24.133	10.196	9.762	44.090	7,3	5,5	11,1
Textiles and clothing, leather and footwear	3.851	1.693	10.101	15.646	6,6	4,2	9,3
Paper and printing products	5.365	562	34.341	40.268	13,9	4,9	9,7
Rubber and plastic products	2.479	718	41.373	44.570	30,9	4,0	9,1
Other manufacturing products	3.923	3.921	14.640	22.484	10,6	5,2	10,3
Building and construction	9.625	14.452	119.299	143.376	17,8	4,3	9,4
Recovery, repair services, wholesale, retail	58.106	19.122	185.197	262.425	20,5	6,4	9,2
Lodging and catering services	11.644	279	11.491	23.414	6,9	3,4	7,4
Communication services	9.407	1.239	28.280	38.927	21,2	3,0	4,5
Services of credit and insurance institutions	6.360	30	155.416	161.806	25,2	2,7	9,7
Other market services	108.718	46.106	251.403	406.227	19,8	2,0	3,9
Non-market services	18.842	3.298	59.263	81.404	4,9	2,1	4,8

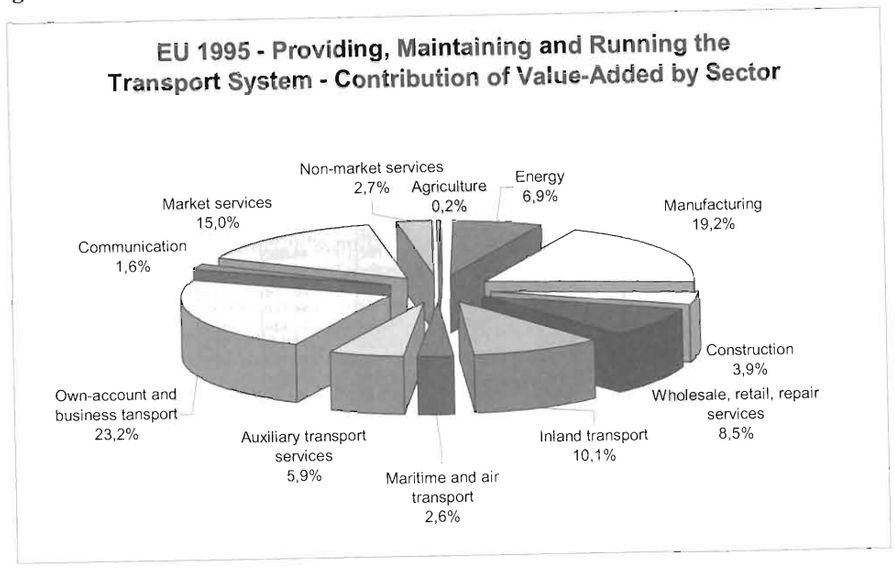
The last two columns of the table take a different perspective. They provide the amount of transport services each sector consumes directly and indirectly per unit of output supplied to final demand. Dependence on transport as an input is greatest in the production of raw materials, semi-finished goods and in the construction sector. For most sectors the total requirements coefficients are in the order of 10 per cent, which means that an increase in the costs of production of transport and related services by 10 per cent would, other things being equal, lead to price increase for most goods in the order of one percent.[16]

Providing, maintaining and running Europe's transport system and transport-related exports to third countries not only contributed 1 327 bn ECU to the Union's GDP but created more the 30 m jobs, using about a quarter of the European Union's capital resources. Figure 5 indicates the value-added contributed by the main sectors of the economy involved in transport-related production processes. It does not come as a surprise that manufacturing holds a major stake as a supplier to current transport-related activities as well as a provider of transport equipment and other transport-related capital goods. But the large contribution that

16 It should be kept in mind that this refers to total costs of operation, not just to fuel, repairs and maintenance costs of vehicles.

comes from the service industries should be noted as well. The traditional transport industries, on which statistics usually focus when talking about the importance of transport in the economy, accounted for less than 19 per cent of the transport content of GDP, less than own-account and business transport services we have identified in the course of our analysis. It will be interesting to watch how these contributions will change in the future and it will be of particular interest to see whether transport can maintain its unique role as a source of growth.

Figure 5



Projecting some of the trends visible today would lead to the assumption that new technologies will continue to shape the future world of transport. Some of these technologies may however reduce the need for physical transport. New information and communications systems have already transformed planning, design, management and maintenance of the transport system. As infrastructure nears capacity, particularly in urban areas, these technologies are likely to support growing demand by making the use of existing networks more efficient. The computer, the Internet and cellular telephones, are providing opportunities to work anywhere, anytime. Telecommuting will change the way people live and work, including how, when, and where they travel. New technologies are also likely to enhance the efficiency, capacity, and safety of the existing railway system, provided Europe's railways stop thinking national. On the other hand, the automation of highways is but a question of time. The use of advanced materials, of energy-efficient and low-pollution power plants and growing differentiation in vehicle use will create new opportunities in the construction of motor vehicles while aircraft are likely to become more efficient and quieter. All this does not suggests that transport as a technology is likely to run out of steam. But the overall trend behind transport's dynamic drive towards a low- pollution energy-saving future is for electronic devices and software and new materials to take a continuously growing share in the input of the transport system at the expense of energy and raw materials. Also, jobs seem to be moving away from transport as its production becomes more efficient, they are moving to support communication which has overtaken transport in terms of growth already.

I-O analysis is an instrument capable of 'tracking and tracing' these changes as they work their way through the transport system, cutting, at least relatively, the production costs or transport services. The impact this process has on the EU economy can be measured by using different criteria, some of which have been described in the present paper. But in order to use them, greater awareness of transport as a generator of income and employment is required. It was with the purpose of raising this awareness that the present paper was written.

Table 16

EU 1995 - Physical Characteristics of the Transport System

	A	B	Dk	FIN	F	D	EL	IRL	I	L	NL	E	P	S	UK	EU
Number of Enterprises																
- Railways	21	11	14	2	27	99	1	2	29	1	1	49	1	11	114	383
- Other land transport	11.255	12.322	11.887	19.286	81.662	89.317	20.000	2.252	102.165	505	10.949	185.332	13.566	22.918	48.078	631.494
- Water transport	110	2.415	876	290	2.010	2.413	175	43	565	39	4.870	379	70	318	1.194	15.767
- Air transport	112	197	169	78	575	408	57	38	164	6	65	194	15	91	1.083	3.252
- Auxiliary transport services	2.419	4.344	2.894	1.287	11.620	33.511	5.157	752	19.201	136	4.740	16.833	1.552	2.210	10.581	117.237
Infrastructure (length of lines; km)																
- Railways	5672	3368	2349	5880	31039	41719	2474	1947	15998	275	2739	12280	28850	9782	16999	156271
- Urban rail	310	336	0	32	418	3181	26	0	555	0	490	536	102	258	599	6903
- Roads (1000 km)	129,9	144,1	71,7	77,7	971,1	660,7	115,2	91,5	312,2	5,3	127,1	164,6	118,9	139,2	392,9	3.310,0
- Pipelines	777	294	409	0	4.830	3.318	0	0	4.235	0	391	3.691	0	0	2.602	20.547
- Inland Waterways	351	1.531	0	6.245	5.962	7.343	0	0	1.466	37	5.046	0	0	0	2.353	30.334
Transport equipment																
- Rail: passenger transport veh.	3.287	3.271	1.534	947	15.764	18.163	869	334	13.068	146	2.691	4.448	1.394	1.589	8.000	75.505
- Rail: goods transport wagons (1000)	27,1	19,6	4,1	13,7	112,2	240,5	11,1	1,6	80,6	2,3	5,8	28,7	4,2	19,9	14,0	585,3
- Passenger cars (m)	3,6	4,3	1,7	1,9	27,8	40,4	2,2	1,0	31,7	0,2	5,6	14,2	2,6	3,6	21,9	162,7
- Light goods vehicles (1000)	90	247	180	220	3.409	1.250	708	60	1.905	5	5	2.348	331	242	2.072	13.072
- Heavy goods vehicles (1000)	213	178	140	43	765	1.030	178	87	1.152	18	595	459	298	72	519	5.643
- Buses and coaches (1000)	9,8	14,6	13,5	8,1	80,0	86,3	24,6	0,4	77,2	0,8	12,0	47,4	15,0	14,6	80,0	490,0
Transport services																
- Passenger-kilometres (pkm)																
- Passenger cars	68,1	91,2	61,0	50,1	664,5	730,8	58,8	42,4	614,5	4,7	146,8	99,5	328,3	87,0	609,0	3.656,1
- PTW	1,3	1,4	0,6	1,0	16,7	12,8	8,6	0,3	53,1	0,0	2,8	4,0	13,7	0,7	4,4	121,3
- Buses and coaches	10,5	12,5	10,6	8,0	41,0	68,5	20,2	5,2	85,9	0,4	14,5	13,1	40,2	8,8	44,3	383,6
- Tram and Metro	1,5	0,8	0,0	0,4	9,0	8,5	0,7	0,0	5,2	0,0	1,4	0,5	4,3	1,4	6,8	40,6
- Railways	9,8	6,8	5,0	3,2	55,3	63,5	1,6	1,3	52,4	0,3	14,0	4,8	16,0	6,2	30,2	270,3
- Waterborne	0,0	0,4	1,8	2,9	2,0	1,1	4,8	1,1	3,5	0,0	0,4	0,1	0,2	4,5	4,5	27,3
- Bicycle	1,2	3,3	4,7	1,3	4,4	23,5	0,3	0,7	9,0	0,0	13,3	0,3	0,8	2,4	4,5	69,6
- Air (Intra-EU)	6,9	9,8	7,9	4,0	24,5	43,2	13,1	9,6	10,9	1,0	14,9	8,5	48,2	8,7	61,6	282,5
- Total	99,3	126,2	91,6	70,8	817,4	951,9	108,1	60,5	834,6	6,5	208,0	130,8	451,6	119,7	765,3	4.851,3
- Tonne-kilometres (tkm)																
- Haulage on national territory	14,9	36,6	14,7	23,2	232,8	279,7	14,8	5,4	194,8	1,9	42,2	13,0	94,6	29,3	146,7	1.144,6
- National haulage by vehicles register	11,3	19,0	9,3	21,3	135,3	201,3	12,4	4,5	162,4	0,5	27,0	11,1	78,7	27,8	143,7	865,6
- International haulage by vehicles regi	15,5	24,1	12,4	2,3	21,8	34,6	0,9	0,2	12,0	3,3	38,7	1,9	23,1	2,0	14,4	207,4
- Railways	13,2	7,6	2,0	9,6	48,1	68,8	0,3	0,6	21,7	0,5	3,1	2,0	10,4	19,4	13,3	220,6
- Inland waterways	2,0	5,8	0,0	0,4	5,9	64,0	0,0	0,0	0,1	0,3	35,5	0,0	0,0	0,0	0,2	114,3
- Pipelines	6,8	1,4	2,9	0,0	22,2	16,6	0,0	0,0	12,8	0,0	5,3	0,0	5,9	0,0	11,1	84,9
- Sea (Domestic)	0,0	0,1	2,3	2,6	6,2	0,8	7,1	0,3	35,3	0,0	0,0	1,4	37,2	7,9	52,5	153,7
- Sea (Intra-EU)	0,0	57,6	18,1	98,6	86,1	83,8	56,0	11,3	132,5	0,0	89,1	27,1	76,6	21,7	158,1	914,0
- Total	48,8	115,6	47,0	134,8	325,6	469,9	76,7	16,9	376,8	4,6	198,7	43,5	231,9	78,8	393,3	2.560,5

Abstract

The definitions presently used in national accounting lead to an under-representation of transport as a source of income and employment. The ubiquity of the motor vehicle and the flexibility it affords have led to a shift in the centre of gravity of transport away from the traditional for-hire transport industries (formally identified as such) to transport activities conducted by business units and individuals on own account which remain virtually invisible in national accounting, although physically and in terms of value, their weight is greater than that of the services provided by the traditional transport industries. Transport services reflect only part of transport's impact transport on the economy. Any useful measure of the importance of transport would have to include transport-related final demand, covering consumers' expenditure on motorisation, transport-related expenditure on infrastructure, transport equipment and other capital goods as well as transport-related services provided by the administration. In 1995, these components of final demand and the transport services provided by industry accounted for 22.4 percent of GDP in the European Union and more than 30 m jobs.

Eisenbahninfrastruktur in Deutschland: Öffentliche oder private Bereitstellung?

VON RÜDIGER MUNZERT, DARMSTADT

1. Einleitung

Mit dem Erscheinen des Schlußberichts der Kommission Verkehrsinfrastrukturfinanzierung („Pällmann-Bericht") hat die Diskussion um die institutionelle Ausgestaltung des deutschen Schienennetz neuen Auftrieb erhalten. Der Bericht macht einige – mehr oder minder konkrete –Vorschläge zur Neugestaltung der Netzbereitstellung. Die politische Umsetzung dieser Vorschläge ist allerdings noch sehr unsicher: Wird das Netz nun doch aus der DB AG ausgegliedert und somit die ursprünglich für eine dritte Stufe der Bahnreform angedachte institutionelle Trennung von Netz und Betrieb vollzogen? Bleibt das Netz eine Einheit, oder werden aus dem heutigen DB-Netz Strecken abgespalten, um Regional- und Lokalnetze zu bilden? Und bleibt das Netz in öffentlichem Besitz, oder wird es ganz oder teilweise privatisiert?

Im Gegensatz zu den ersten beiden Fragen (vertikale Trennung, horizontale Trennung) gibt die Regierungskommission auf die Frage der öffentlichen versus privaten Netzbereitstellung keine klare Empfehlung. Sie spricht zum einen davon, daß Regional- und Lokalnetze „an Länder/Kommunen, Verbünde oder Private" [1] abgegeben werden sollten. Zum anderen deutet sie für das Fernstreckennetz, welches nach Abgabe solcher regionaler Netzteile verbleiben würde, die Möglichkeit einer partiellen Privatisierung an. Dazu verweist sie auf die Grundgesetzbestimmung des Art. 87e Abs. 3. Dessen heutiger Fassung zufolge kann eine Minderheitsprivatisierung (bis zu 49% der Anteile) zu gegebener Zeit erfolgen. Unter welchen Bedingungen private Eisenbahninfrastrukturunternehmen (EIU) öffentlichen Trägern vorzuziehen sind, ist allerdings noch nicht genauer untersucht worden. Im folgenden sollen daher grundsätzliche Überlegungen zu dieser Thematik angestellt werden.

Die Basis für solche Überlegungen muß dabei die in der Bundesrepublik Deutschland getroffene Grundentscheidung für ein privatwirtschaftliches, über Märkte geregeltes Wirtschaftssystem bilden. Diese Entscheidung impliziert a priori eine Überlegenheitsvermutung zugunsten privater Produktion im Vergleich zu staatlicher Güterbereitstellung.[2] Ein Abweichen vom

Anschrift des Verfassers:
Rüdiger Munzert
Adelungstraße 35
64283 Darmstadt

1 Kommission Verkehrsinfrastrukturfinanzierung, S. 48.

2 Insofern handelt es sich um eine Art ökonomisches Subsidiaritätspostulat (vgl. Müller/ Vogelsang 1979, S. 313).