How can Liberalisation of Transport Contribute to Sustainability ?

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1 - SYNOPSIS

The paper discusses the risks and opportunities of liberalisation in transport systems for further achievements in making transport sustainable, notably through energy efficiency measures.

2 - ABSTRACT

Similar to the conversions of ownership and management of telecommunication infrastructure and energy infrastructure (public) transport facilities are facing significant changes in ownership and management in the EU and adjacent countries. Various countries, for example the UK and Sweden have already changed a great deal. Other EU countries hardly started yet.

The motivations behind liberalisation of infrastructure are totally detached from sustainability objectives. The liberalisation process itself is fuelled by the hopes for reduction of public transport subsidies and better utilisation of the growth potential of air transport in a modern society. Well, at least the latter has certainly come true.

Liberalised markets will only contribute to sustainability of the objectives happen to coincide. Provided countries take sustainability objectives seriously and observing the far from automatic sustainability trends in liberalised markets, sustainability should receive extensive and explicit attention in and after the conversion process. Interestingly, the transport sector can also draw on the experiences of the energy sector.

The base line is that liberalisation in itself may be a good thing. However, both from a social-economic point of view and a sustainability point of view it depends on what public authorities allow to happen. In fact it is about re-regulation instead of deregulation.

This paper will describe the potentially good and bad things of liberalisation. The paper will argue that proper reregulation and smart use of new technologies may bring about a much larger coincidence of objectives without giving up the original idea of obtaining a more efficient and flexible transport infrastructure. Some international comparisons and potentials will be shown.

3 - INTRODUCTION

As for many other kinds of public infrastructure the transport sector faces a period of major changes in its ownership and management structures. This applies - at least in theory - to all countries of the European Union, while similar changes can be witnessed in many other countries. It seems to be even the kind of change that receives the most attention and has strong impacts on other aspects of the transport system. The introduction of liberalisation implies we need to rethink issues such as safety, security, environment, etc.

So, next to the challenges generated by the liberalisation process other challenges continue to be important as well. Examples are:

- the ongoing technical and organisational development in logistics, leading to large cargo handlers;
- the continuous precarious position of public passenger transport compared to the private car;

- the enormous growth of air travel and the formation of global airline associations;
- the increasingly important role of information technology (IT) in transport.

It is fair to say that the developments in the airline business are influenced by the liberalisation of some airline markets. From the point of view of enhancing the functioning of markets IT is very promising as it can improve the effectiveness of pricing policies.

A quite different challenge is rooted in the environmental policies of many countries. This leads for example to policies regarding ever stricter exhaust regulations. Despite the large range of measures aiming at improvement of the environmental performance of the transport sector[1] the overall picture is that transport is a sector in which the aggregate environmental load, including CO2, still tends to increase, whereas decreases of various environmental pressures are called for. For example, in many countries one can witness decreases of emissions from the industry and the residential sector, but ongoing increases in the transport sector.

This paper discusses whether liberalisation could enhance the possibilities for cleaner transport, in particular with respect to greenhouse gases. My position is that it could, but only if certain conditions are fulfilled. First the concept of liberalisation will be explained in section 2. Subsequently, in section 3 the several levels of the transport system will be discussed in terms of the kind of policy instruments related to them and the extent to which these policies are still applicable in a liberalised market. Section 4 looks at actual performance of transport systems in terms of productivity, modal split, and availability of infrastructure. Section 5 presents conclusions and recommendations. This paper will focus both on road transport and public transport. Occasionally, developments in other segments of the transport market will be touched upon as well.

4 - LIBERALISATION - WHAT DOES IT MEAN ?

Liberalisation in general means that a public authority decides to reduce or even abolish interventions on a market. Interventions can comprise of minimum or maximum prices or price increase prescriptions, quota of volumes sold or produced, entry barriers to new producers, and the government ownership of transport companies. In most European countries transport infrastructure and the exploitation of public transport has seen heavy intervention of governments, through monopoly concessions, subventions for exploitation and investment, safety and security regulations and spatial planning legislation, etc.

Liberalisation of public networks started in the eighties under the influence of ‘Reaganism’ and ‘Thatcherism’. Proponents of these political currents claimed that the private sector could provide such services better and cheaper, while furthermore these political ‘philosophies’ displayed a general dislike of state intervention. When the liberalisation of various public networks got actually momentum and other countries considered comparable changes in public infrastructure policy, the awareness grew that liberalisation could take many shapes. Gradually liberalisation became more like an interesting option for a management problem instead of an action driven by conviction. To a significant part these differences in governance philosophy, i.e. free market convictions versus pragmatism, are reflected in the way the different European countries implement liberalisation of transport infrastructure and services, even though it is guided by the same directives of the European Commission. As regards, transport infrastructure and the operation of public transport services various ‘models’ can be distinguished, being:

- the English model - vigorous liberalisation; national motorways
- the Scandinavian model - pragmatic attempts to maintain quality in auction system; national motorways
- the French model - main railway lines still national, preferably one railway company but room for regional initiatives; privately financed toll road system;
- the (expected) Dutch model - probably Scandinavian auction system but with more degrees of freedom, still battle about core network for NS; national motorway system but possible increase of private finance (PPP).

Unlike in the liberalisation of energy networks the German approach is similar to the French approach as regards public transport. Table 1 below gives an overview of some main features regarding liberalisation and finance of infrastructure and public transport. Please note also that high purchase taxes for cars coincide mostly with a modest presence of car manufacturers in the relevant countries.

Table 1 Overview of liberalisation tendencies in various European countries

	cars and motorways	railways	local public transport
Belgium	Under responsibility of Flanders, Wallonie, Brussels	Shares owned by state, subsidised, only separation of track and train in name	National and local
France	Toll roads in private consortia, also public motorways in / around cities, moderate car purchase prices, higher prices on diesel	Shares owned by state, subsidised, only separation of track and train in name; provincial service contracts for secondary lines, TGV investments are crowding out other necessary efforts	Local public companies and private intercity bus companies
Germany	Federal (national) system, moderate car purchase prices, higher prices on diesel	Shares owned by state, subsidised, only separation of track and train in name; provincial service contracts for secondary lines, various small local private railway companies	Mostly regional public multi-modal companies, some market elements within this public system
Italy	Toll roads in private consortia, also public motorways in / around cities, moderate car purchase prices, higher prices on diesel	Shares owned by state, heavy losses, subsidised, only separation of track and train in name; provincial service contracts for secondary lines, various small local private railway companies	Local public companies and private intercity bus companies
Netherlands	National system, some examples and attempts for private finance and PPP, and high taxes on car purchase, high fuel prices for private cars, lower diesel prices	Shares owned by state, diminishing subsidies, build up of regional and national public service contracts, separation of track and train and third part access are becoming more accepted by all parties, prices went up - notably in rush hours	So far, a publicly owned holding company of regional bus companies + local public companies; the auctioning areas of connections started, should become new principle
Sweden	National system, high fuel prices	Second after UK in complete separation of tracks and trains, no subsidies, once state company (SJ) is loosing market share to newly entering companies, less deregulation regarding quality standards, prices went up and down	Local public companies, but mainly private intercity bus companies (partly foreign owned)
United Kingdom	National system, high fuel prices for private cars	BR split up in various companies and track company, partly foreign owned, deregulation also affected negatively quality standards and price transparency to customers, prices went up	Intercity bus and greater part of metropolitan bus services is liberalised, initially with very little quality requirements, apart from some public service contracts no subsidies

Obviously, governments wish to reduce or at least to level off the public funding of infrastructure and public transport. Furthermore, information technology also makes it much more feasible to charge infrastructure users exactly for their amount of use. This was impossible or at best impractical 20 years ago. Yet, the idea that users should charged as closely as possible to the costs they inflict, causes a lot of changes in relative costs and the distribution of costs and benefits over stakeholders. Furthermore, a strict application of the concept may threaten the safeguarding of qualities of the transport system itself and the environment around it. This is indeed an important difference between the approaches in various countries. As long as environment and landscape as well as safety and security are not fully reflected in prices and costs additional regulation is necessary, partly this can be achieved by introducing performance requirements for emissions, casualties, etc.
Two shifts stand out, being a shift toward wholly or partly private ownership and/or financing of infrastructure and a shift towards openness of markets for more than one operator. The larger involvement of the private sector is especially evident in case of privatisation of infrastructure. In addition third party financing and the

broader concept of Public-Private Partnerships (PPP) are examples of the privatisation trend. The opening up of former monopolies rests upon two phenomena, being 'unbundling' and 'third party access'. Unbundling refers to the separation of the network management proper (e.g. the tracks and the signalling of railways) from network based services (e.g. operating scheduled train services). Third party access means that more than one operating agent (e.g. a domestic and a foreign railway company) provide services on the same (parts of) the network.

From the point of view of enhancing the 'natural efficiency drive' of competitive markets[2], the shift towards openness is more important than the privatisation shift. The privatisation is mainly needed to take care that no back door options are used to depend on subsidies as well as to bring about a cultural change in the management in favour of looking for competitive edges and customer orientation. All in all it means that a social responsible liberalisation process requires much more a so-called *reregulation* instead of a deregulation of transport markets. Regardless of the philosophy of governance the role of central and local government needs to change significantly to arrive at effective reregulation.

Sustainability or more specifically energy efficiency is dependent on a range of characteristics that are active at various levels in the transport system. We first introduce these levels to the transport system.

These levels need to be addressed through one or several instruments. The problem of liberalisation that it supposes the abolishment of direct intervention. For example, instead of prescribing or granting privilege to a particular kind of technology, liberalised market instruments have to use incentives that incite companies to achieve the intended environmental quality as well as stimulate customers to choose products with less environmental impacts. One first needs to know what instruments are available and to what extent they are still applicable in a liberalised market. These two aspects are introduced subsequently in 3.1. and 3.2. Finally in 3.3 the applicability, the interrelatedness and likely effectiveness are discussed.

5 - DEFINITIONS AND OVERVIEW - WHAT INSTRUMENTS ARE LEFT

5.1. Levels at which efficiency can be addressed

The transport system consists of many layers, e.g. the engine, the vehicle, the road or rail, the entire network, competing networks (road versus rail and water), nodal points, the spatial system, and (the often almost overlooked) users. In turn the users can be distinguished in travellers, staff, shippers, service providers, etc. In the explanation below I will use the word 'level', which in the first place denotes a physical connotation referring at what level of aggregation the transport system is addressed (the individual car, a road segment, the network, etc.). These physical levels however often coincide with the institutional framework(s) for building, maintenance, operation, etc.

As regards the mitigation of greenhouse gas emissions from transport physical 'levels' can be distinguished as shown in table 2 below. The instruments that are marked with # are usually incompatible with liberalised market concepts, whereas the instruments marked with (#) are potentially conflicting with liberalised market concepts. The relevance of the category of potentially conflicting instruments depends on whether some reregulation is accepted from other policy areas. In principle it can be solved, but it requires complicated participative structures when designing the integrated set of policy instruments.

Table 2. Instrument levels for targeting the transport sector

system level	kind of instrument
1. improving the *utilisation rate* (load factor) of the active *vehicle stocks*	• (road) taxes/excise duties that increase variable costs # • intensifying competition by enhancing market transparency • IT facilities for logistic chain management
2. *traffic flow optimisation* (constant speeds, shortest routes)	• dynamic traffic management technology • congestion tax
3. *maintenance* monitoring	• mandatory annual inspection system
4. advances in engine technology and vehicle design resulting in better *fuel efficiency*	• higher fuel prices (taxes) (#) • R&D support / technology purchase schemes • environmental performance benchmarks
5. *fuel switching* (e.g. towards natural gas or bio-diesel)	• differentiated fuel prices/taxes (#) • emission standards
6. *entirely new propulsion* (e.g. fuel cells and electric cars)	• R&D basic, and applied in co-operation with manufacturers
7. shifts in *modal split* to the benefit of the most energy extensive modes	• pricing (taxes and subsidies) # • internalisation of external cost • (local) spatial planning (#)
8. *network design and spatial planning* that stimulate the choice of energy extensive modes	• R&D (on evaluation and planning) • Policy concertation and integrated planning (#) • New participative structures including PPP (#)

Measures at the levels 1, 2 and 3 aim at the optimal use of existing infrastructure and vehicle stock. However for level 1 and notably 2 no reduction of aggregate emission levels may occur in case of latent demand for transport services, which materialises as soon as there is space for it. Furthermore, unsophisticated taxation can lead to reduced influx of new vehicles. The next three levels (4, 5 and 6) aim at a more thorough technical solution. In as far as CO2 free transport systems can be developed, for example based on fuel cells, this would be a genuine solution to the greenhouse gas problem. It requires that this solution is not traded for a new problem, e.g. regarding (toxic) waste materials and their recycling possibilities. One of the side effects that seems to materialise is the emergence of small relatively clean city cars. Though they are better - in environmental terms - than their larger brothers and sisters, they tend to compete just as much with public transport and non-motorised modes as with conventional (larger) cars. For the transport system as a whole this would mean an increase instead of a decrease of emissions. A proliferation of city cars at the expense of public transport and bicycles would certainly have impacts on future urban structures and the position of urban transport. This issue also shows the interrelatedness of the various approaches. It underlines that the impact assessment of measures needs to be carried out with a eye to the larger context.

The last two measures (7 and 8) are at the system level and beyond. Although some change in modal split can be achieved with pricing it must be regarded as a strategic choice to stimulate certain modes over others. As a consequence of such a choice not only pricing policies but also (physical) accessibility through proper network design and integrated spatial planning are needed. To achieve price differentiation in a liberalised market only full integration of external costs seem to be a viable option, otherwise it easily leads to direct intervention. Obviously it takes a long time before such measures are fully yielding. In practical politics these lead times could be too long. Furthermore, even in countries with rather strict and comprehensive spatial planning, such as the Netherlands, the economic dynamics puts limits on the malleability of functional organisation of space. Synthesis solutions can be found, but they take time to be created and the slow pace of comprehensive spatial planning is often felt as a threat towards competitiveness.

5.2. Instrument Options

Basically the following types of instruments are available in order to activate change on one or several of the levels listed above:

- fiscal measures (levies, taxes, exemptions, amortisation schemes, etc.)
- subsidies (investment subsidies, quality premiums, pro rate, loan guaranties)
- regulations (minimum quality standards for technology and service)
- voluntary agreements (kind of package deal)
- RD&D (research investments/subsidies/loans, demonstration programmes)
- awareness campaigns

In a liberalised (public) transport market detailed input and throughput directives cannot be used, while fiscal and pricing policies can only be used on a non-discriminatory basis. Nevertheless, a consequent application of the integration of external costs is compatible with a liberalised market. Furthermore, in a competitive environment operators will be very selective in the application of technical innovations and even more so in financing R&D. On the other hand profitable innovations may be expected to be adopted more quickly than in a monopoly situation (cf. the airline industry the energy sector (Perrels and Lako 1998).

In a well established market, which enjoys sufficiently competent institutions, a voluntary agreement[3] can work well. However, it will be very risky to use this instrument in markets that are in a transition situation, such as public transport. Presently, in most countries both public (transport) authorities and the private players have to acquire sufficient competence to understand the rules of the (new) game. Notably, the public authorities have to take care a set of rules is consistent and complete. Please, distinguish between the transport market as such and several relevant adjacent markets such as the oil industry and the car industry, in which voluntary agreements are feasible.

In summary in a liberalised market it is still possible to use the following instruments:

- some generic - non discriminatory - fiscal arrangements, e.g. amortisation schemes that stimulate investment
- lump sum subsidies for infrastructure construction for regulated natural monopolies under certain conditions
- operating subsidies within a repetitive auction system and exploiting the contestability of public transport markets
- a bonus system tied to quality benchmarking (small price incentive + regulation)
- prescriptions about the (consequent) application of once selected pricing methods (e.g. including external costs)
- minimum quality standards (violation leads to exclusion)
- R&D subsidies in relation to quality improvement schemes

5.3. Applicability of Instruments

Technology push …..

Some of the levels mentioned start outside the transport sector, e.g. in the energy sector and the car industry. For these sectors that are supplying to the transport sector energy efficiency and in a wider sense sustainability is a matter of the right product development. Two kind of instruments stand out here:

- minimum standards for new vintages of vehicles (e.g. the Californian ZEV regulation)
- target related R&D subsidy for a sector wide programme (implying free dissemination of new insights throughout the sector), the R&D assessment should have enough context, taking into account system wide effects also in spatial, economic and social sense; a voluntary agreement could provide the right framework for strictly targeted R&D (see Geerlings, 1997)

These kind of semi mandatory technical support programmes are only relevant in countries with significant car industries. However, given the spill over to other countries such programmes are worthwhile to be taken up in for example a European framework. This is already happening in the car industry, but could be intensified in the industry for public transport vehicles.

……and Demand pull,
The technical R&D programmes for manufacturing need a counterpart at the user side, which addresses uptake of new technology. In a liberalised market transport companies will usually give no priority to energy saving with the exception of the airline industry. Therefore, it is necessary to apply quality requirements and bonus systems tied to regularly updated benchmark systems. It will take time to learn what is an optimal quality requirement level and what is the minimally sufficient bonus to trigger at least one operator to adopt new energy efficient technologies in a specific transport market.

but what does optimal mean ?
The optimality is hard to assess, as there is a multitude of influences at various aggregation levels. First, in the transport market itself a too strict standard might result in wiping out operators from that market. The consequence could be less public transit services and less competition. Second, the investments needed for the introduction of the energy efficient technology can also be used to improve other features of the transport system, which for example cause a shift in modal split to the benefit of public transport while reducing car travel.

Pricing of road infrastructure is indispensable
All in all technology development and enhancing technology take up are necessary, but insufficient ingredients of an energy efficiency policy in the transport sector. The modal split should change as well, while at the strategic level it requires the supply of good quality public transit and safe non-motorised modes, as well as an urban design which is conducive to the use of public transport. However, in a liberalised market the supply of (new) infrastructure is very hard to regulate. First, within one network the decision rules can easily lead to inconclusive results about when capacity should be expanded. The point at which expansion gets attractive depends on current and expected levels of utilisation in combination with current and expected price (fare) levels (ignoring other external influences). Second, transport markets are quite closely linked. Especially liberalised public transport companies not only have to take care of competition inside the own system, but also of competition with private cars. It is therefore *indispensable* that the different types of transport infrastructure apply comparable pricing systems, not only in terms of its accounting base, but also in terms of the actual way of payment by the customer. From the many feedback experiments concerning residential energy use (e.g. Wilhite, these proceedings; Arvola et al, 1994) it has become clear that preferably the payment is per transaction or otherwise the billing system should work at fairly high frequencies. This applies not only to end users, such as final customers in the passenger market, but also intermediate parties such as the train operators in relation to the rail network company. In a fully fledged liberalised market this latter kind of feedback can be continuous, if auctions for different time frames exist (long term market, e.g. one year ahead; seasonal market; spot market for short term free space). Several studies (CPB 1998; SPARTACUS, 1998) even indicate that the pricing of road use seems to be more crucial to public transport than the pricing of public transport itself.

This still leaves urban form and spatial planning as areas that large long term influence on transportation flows and mode choice, but which are harder to match with the workings of liberalised transport markets. A possible direction would be that local and regional authorities will get an assignment to geographically specified targets regarding sustainable transport. Assuming that usually local and regional authorities are involved in contracting public transport services, they are in a position to translate the planning obligations into quality requirements for the transportation companies, while strategic long term area plans are preferably designed in participative structures.

The significance of IT
The emergence of IT can enhance intermodality and interoperability regardless of the exact way in which the transport market is organised. Yet, it may be expected that liberalisation is conducive to the spread of IT products in the transport market, since it enhances responsiveness towards customer demands. Since the unattractiveness of public transport is partly attributable to the limited transparency of travel and price alternatives to customers, IT products for customised services (including routing advice, ticket selection, etc.) will support the position of public transport relative to car and truck.. Another important IT application is the development of dynamic traffic management (DTM). DTM can be compared to demand side management (DSM) in electricity networks, but its potential has only just started to be exploited. It opens up entirely new policy options and renders an excellent platform for (shadow) pricing policies. In that sense it is likely to pave the way for liberalisation tendencies in the management of road infrastructure. In this respect the indirect

energy requirement of transport infrastructure (construction and maintenance) should not be underestimated. Bos (1998) calculates the indirect energy requirement for goods transport by road at approximately 15% and at 25% for goods transport by rail.

Next to smoothening the transport market itself there are also possibilities in the use of teleworking and other teleservices as a substitute travel. The empirical studies are somewhat mixed about the net results of teleworking on transport demand. For example reduced trip frequencies may be compensated by longer distances due to relocation (See for example the SPARTACUS and SESAME projects).

Observing the various ways in which technology can contribute to more sustainable transport, one tends to conclude that for the short and medium term the impacts of IT are much more important than the impacts of RTD aiming at energy efficiency. A significant market introduction of carbon free propulsion, notably based on fuel cells, should not be expected before 2010 (Geerlings, 1997). Large scale introduction in buses could be earlier however.

6 - EVIDENCE FROM EVALUATION STUDIES AND STATISTICS

Liberalisation of transport markets is still in its early stages of implementation in most countries. The UK has been a forerunner and therefore one of the few countries where more extensive evaluation studies have been carried out. The liberalisation in continental Europe may be expected to differ from the British model. The Nordic countries have set an example. The difference is that competition is not fought 'on the street' to get the customer into you vehicle as in the UK, but competition is about competitive bidding for concessions. It means that results in one country cannot be straightaway translated to another country. Regulation may differ, availability of transport alternatives may differ and the social cultural valuation of the various transport options may differ. In Japan there has been quite some attention for analysis of productivity differences between public and private railway companies. Yet, the overall information available is limited, especially if one intends to derive conclusions from an sustainability perspective. Therefore the conclusions drawn below are definitely of a very preliminary nature.

First the impacts on productivity are discussed, since this can be relevant for energy efficiency (and sustainability) in two ways:

directly:
a more efficient use of the means of production (personnel, buses, fuel, infrastructure, etc.) expressed in higher utilisation rates, could lead to lower energy intensities (in MJ/pkm);

indirectly:
an increase of productivity will somehow result in a release of money that was wound up in the system, subsequently it depends on what happens with the 'released' money:

- lower subsidies -> lower cost to (local) government;
- lower fare prices -> possibly more demand, which is a positive effect if it means substitution of car travel;
- investment in quality & quantity of supply -> one can think of higher frequencies, new amenities, improved security (e.g. in evening hours), energy efficient technologies.

After scanning for productivity effects the developments of the modal split in EU countries are briefly discussed. This section concludes with a summary concerning the impacts on energy efficiency the effectiveness of several policy routes to achieve more efficiency.

6.1. Productivity among trains and buses

The prime goal for liberalisation in (public) transport is improvement of the productivity of several elements within the (public) transport system. Subsequently, a part of the released budgets could be used to improve the quality of public transport and thereby increase its market share.

As indicated above it is not easy to find comprehensive data about the social-economic performance of transport systems and even less with respect to energy and emission data. Nevertheless based on a mixture of books, articles and a picture can be sketched.

The European Commission had commissioned a first trial study on economic performance of railway companies in Europe (Deloitte and Touche, 1997)[4]. Some main finding are shown in table 3.

Table 3 Productivity Indicators of Trains 1995

Railway Companies[5]	Country	Government support in % of turnover *	cost recovery in %	Load factor in % (pkm/seatkm)
BR (1993)	UK	0	107	25
FS	Italy	39	50	44
RENFE	Spain	33	80	37
SJ	Sweden	0	104	36
SNCF	France	0	74	33
NS	Netherlands	36	108	36

*) does not include financing of infrastructure source: Deloitte & Touche, CBS, V&W-DGP

The liberalised companies in Sweden (SJ) and the UK (BR) perform better than average in financial terms, but as regards utilisation of its rolling stock no conclusions can be drawn. Please notice on the other hand however that publicly owned companies such as RENFE and FS even manage to have operating losses (cost recovery) despite subsidies. In such circumstances the budgets needed to invest in quality improvement will be hard to get. What it means for the modal split will be shown in the next section. The load factor may be a good indicator for utilisation of rolling stock it is by no means an appropriate indicator for quality performance. The NS has suffered many complaints from travellers that train capacity is insufficient within the 'Randstad' (Rimcity) during rush hours (e.g. web site Rover[6]). Thanks to expansion of the rolling stock in recent years the rush hour problems are somewhat alleviated. Indeed the load factor went down several percent points in recent years. However, the extra costs of new rolling stock may be more than compensated by the prevention of loosing many customers due to lack of quality. Meanwhile the amount of support from the Dutch government to the NS went down between 1994 and 1998. The lump sum amount for loss compensation was gradually changed into (cheaper) service contract arrangements. In all countries investment in new rail infrastructure is normally still funded by the government, though prefinancing by private parties occurs.

A large comparative study in the UK (Pickup et al, 1991) show that bus companies in metropolitan areas managed to increase productivity. That is to say operating costs per vehicle kilometre went down by 30% on average during the early years of liberalisation. This was preponderantly achieved by switching to minibuses and reducing the wage costs. Similar results are reported by Martin (1998). Also in the greater city area of Helsinki productivity increased. The total annual costs of regional bus transport in the metropolitan area went down by 29 % (YTV, 1996). Ticket prices were reduced by 8%, while the total supply of bus kilometres roughly remained the same. The average age of the bus fleet has dropped, though the variations in the several waves of auctions are remarkable. In the most recent auction for the first time one bus company introduced environmental features (CRT filters) as a means of distinction. Initially, the auctions and the resulting changes in market shares of companies caused difficulties concerning the transferability of labour contracts.

As far as the figures and preliminary reports permit, we carefully conclude that labour productivity and profitability have improved, but up to recently it did not result in better quality performance of public transport. In the most recent years there are signs of technical quality improvement in some liberalised markets not the least due to additional regulation or incentives, at least that is my personal observation in the UK and Finland (liberalised bus market) as well as that of local experts. Various bus companies in the UK and Finland have started to introduce new buses with new features (e.g. low floor and kneeling buses). Still, in for example not so much deregulated Germany new technological features for public transit equipment seem to spread just as well (see e.g. a magazine such as 'Bus & Bahn) and as regards energy efficiency technology the German transit vehicle industry *and* the local transport authorities are relatively active.

The overall picture is that new energy efficient technologies are far from prominent in public transport in most countries. In as far as new energy technologies are introduced in (public) transport it is usually on an experimental basis[7], while the incentives are mostly created by an energy policy programme. Sustainability does not seem to be genuinely internalised in public transport policy. In as far as it does it is a mixture of social amenity issues and some environmental aspects. For example, in such a context noise gets a more important sustainability feature than energy use and given the scarce means available this might even be a wise decision.

6.2. Modal split and the provision of infrastructure

Figures 1shows some developments in the modal split of goods transport in most EU countries [8]. In virtually all countries except Finland rail is loosing share in the cargo market. Inland water is important in Germany and the Netherlands and not insignificant in Belgium. The markets shares are decreasing significantly, though the reduction is smaller in absolute terms as the total goods transport market is growing. Please notice that the loss of market share of rail in the UK and Sweden is not systematically larger or smaller than in the other countries.

Other reasons why these shares change is the restructuring of the economy. By and large heavy industries either stagnate or grow not as fast as 'light' high tech industries and services. Given the current inability to accommodate large amounts of containers rail and inland water automatically loose market share. Recent changes in the market structure of inland shipping in the Netherlands (abolishment of the mandatory queuing system) demonstrate promising signals. The first new inland large container ships (400 TUE)[9] have been taken into operation, while more are expected to be launched this year and next year. Changes in the modal split have substantial influences on the overall energy use of the transport system. The specific energy consumption (fuel/tonkilometre) of trucks is about 2 - 4 times as large as that of cargo trains, and 3 - 6 times as large as barges.

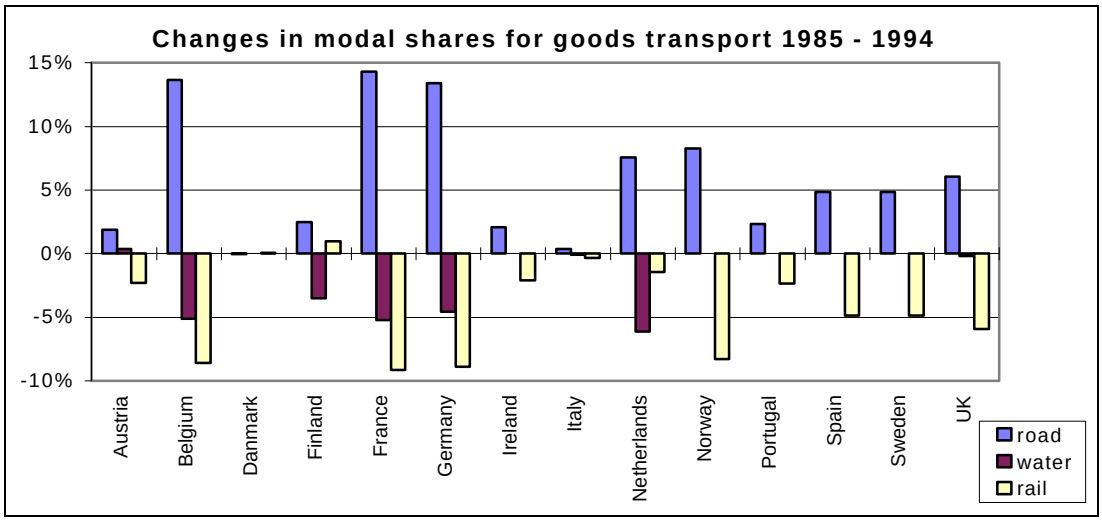

Figure 1. *Percentage change in modal shares for goods transport (ECMT figures)*

In terms of modal split the private car is dominant in all countries as is shown in figure 2. By and large the energy consumption per passenger kilometre of private cars is about twice that of public transport. Intercity buses usually have lower energy consumption per passenger kilometre than trains. Remarkable is the variation in market share in figure 2 of all public transport together (rail and b/t/m (=coaches + local public transport). In the UK it is approximately 11%, while in Denmark and Spain it comes close to 20%. In France and the Netherlands rail is twice as important as in the UK. If coaches + local public transport (b/t/m) have a large share, such as in Norway, Sweden, Finland, Portugal and Spain, it can be largely attributed to coaches.

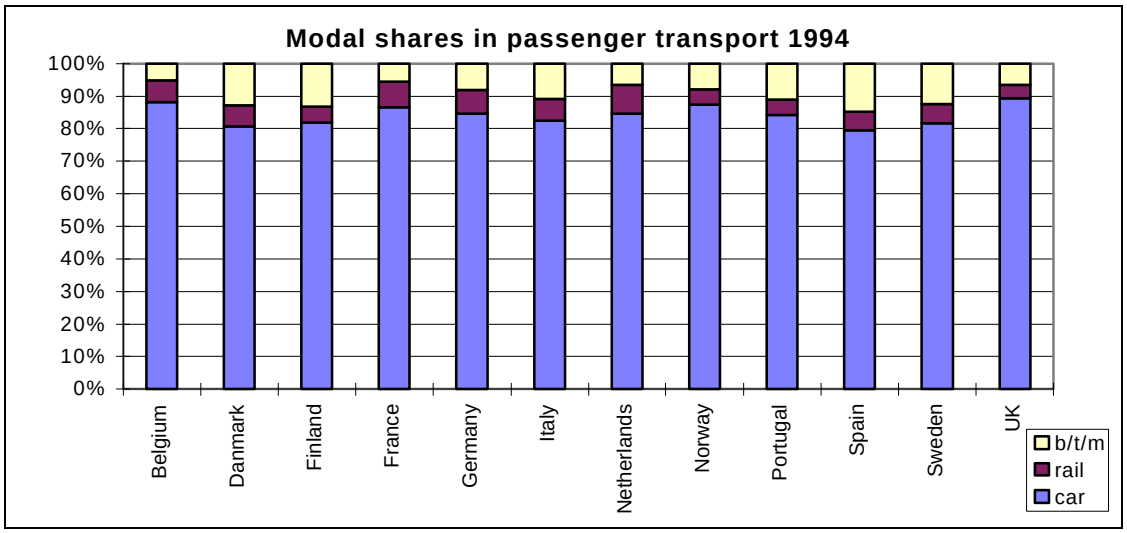

Figure 2. *Shares of passenger transport modes in EU countries (ECMT figures)*

Figure 3 illustrates the change in modal split for passenger transport between 1990 and 1994. Contrary to goods transport the dynamics is less uniform. Moreover, the growth rates of private car transport are far smaller than of trucks. The UK and Sweden, the countries in which liberalisation of public transport is most developed, show very different developments. Among others this can be attributed to the different ways in which the liberalisation has taken shape in these countries. It should be noted that the car stock is still expanding rapidly in Portugal and Spain, which influences the results in figure 3

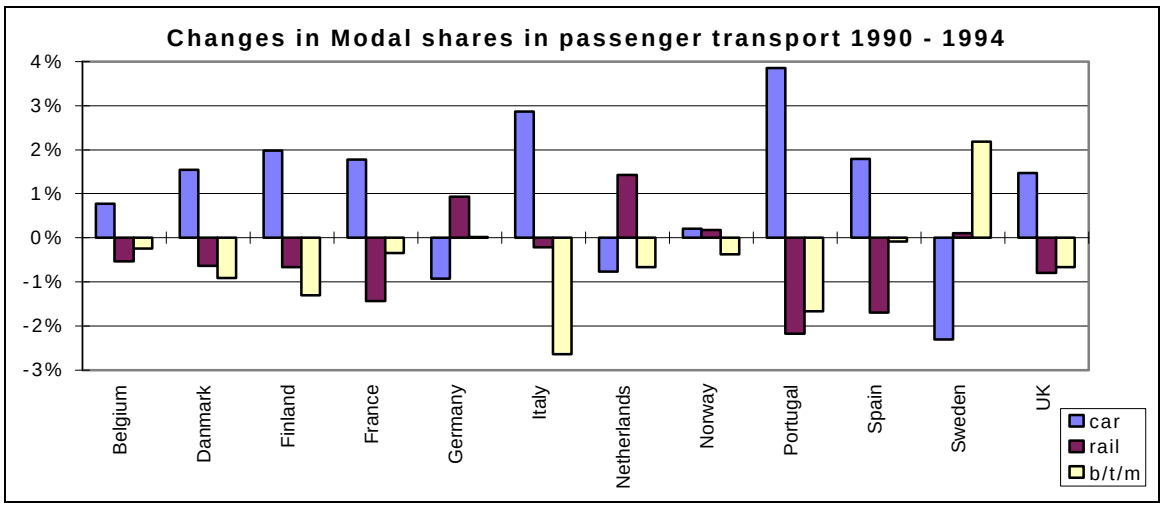

Figure 3. *Changes in modal split of passenger transport in EU countries (ECMT)*

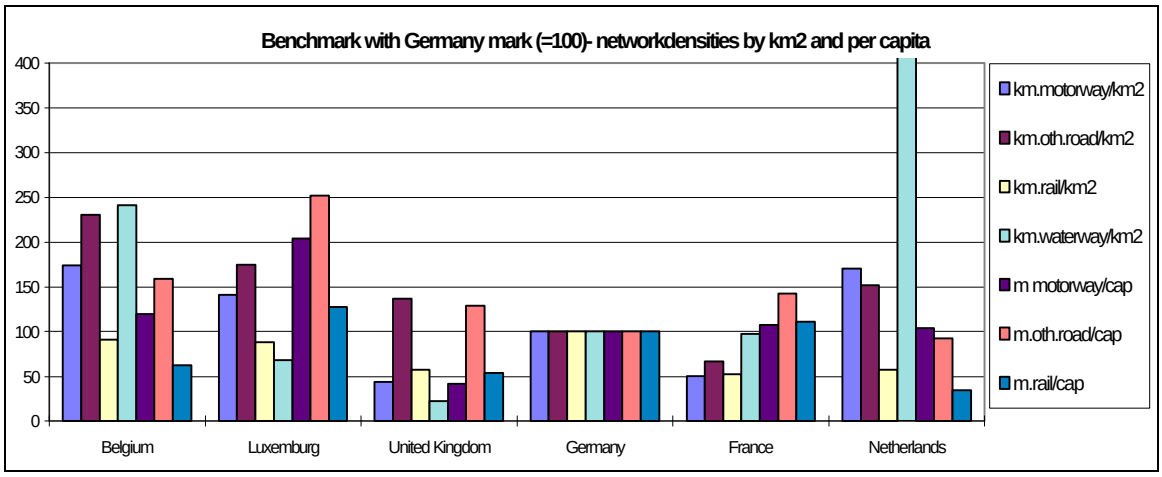

Figure 4. *The spatial density of infrastructure supply in some EU countries (source: TNO Inro)*

Figure 4 shows the availability of infrastructure in terms of spatial density (kilometres network per km^2 land) and in terms of capacity per capita (meters network per capita). The capacity per capita of motorways is remarkably uniform in the various countries except the UK. Rail infrastructure per capita is less evenly spread. France has a figure which is 3 times the Dutch capacity indicator. The market share of rail (passengers) is however almost equal in both countries (8% to 9 %, see figure 2), consequently the intensity of use in the Netherlands must be much higher, although in France goods transport by rail is more important. Not shown but also known are the differences in physical accessibility. The number of motorway exits per km^2 shows much less difference across countries than the similar index for railway stations does. For example, it is much better in Belgium and Germany than it is in France and the Netherlands. This reflects different eras of planning of roads and railways. It also shows that railways in the Netherlands are more focused on intercity transport and not on commuting, and transport within larger conurbations, although that would be very attractive from a traffic management point of view and energy efficiency point of view. The very good availability of waterways in the Netherlands (index reaches 532) does reflect in the modal split of inland goods transport by water. It appears to be not very easy to relate infrastructure availability to actual use. Than much more and more detailed data are necessary. For example, Hilbers et al (1997) demonstrates the importance of spatial dispersion of principal economic activities as well as the way infrastructure is fitted into the spatial organisation of a region.

6.3. Energy use

As already noted in section 3.1 the bus system in the UK produced more vehicle trips but attracted less customers over the past 12 years. During the period 1985 - 1997 the amount of vehicle kilometres for all bus services in the UK went up by 28% (Martin, 1998). Though this is partly caused by the intensified use of minibuses, it is highly likely that the overall fuel use of bus stock in the UK increased. Since the number of bus passenger kilometres went down by over 10% in the same period, fuel efficiency in terms of MJ/pkm must have decreased, unless the fuel efficiency of the active bus stock increased with more than 30%[10].This impact can be largely attributed to other operating practices and hardly to technology changes.

For the Netherlands the specific energy use of the national rail system and private cars can be calculated. In 1985 it amounted to approximately 0.123 kWh/pkm for the national rail system while in 1996 this figure had dropped to 0.111 kWh/pkm. Also in this case the change may be largely attributed to changes in operations resulting in higher load factors of trains. The percentage change in specific energy use is almost equal as the percentage change of the load factor, but with opposite sign. In primary energy requirement terms the improvement of aggregate energy efficiency would be even slightly better, since the electricity generation became more efficient in this period. Still that remains an technological improvement outside the transport sector. The private car stock needed 287 MJ per 100 km in 1985 and 270 MJ per km in 1996, which implies an improvement of 5,5% for the entire stock. However, almost the entire efficiency improvement of the car stock was realised prior to 1991. After 1990 the stock of petrol and diesel cars (over 90% of the total stock) has constant or even slightly decreasing fuel efficiency. Improvements in engine technology are compensated by on

average larger cars and more features per car such as air-conditioning. LPG cars show improved fuel efficiency in recent years, but the share in the car stock decreased in the nineties.

Despite the significance of energy technologies, notably breakthroughs such as fuel cells, the experiences sofar indicate that organisational changes in public transport are far more important to energy efficiency (and any other efficiency) than direct interventions in technologies used. As regards technological aspects the use of IT seems much more important as an indirect way to enhance the system efficiency of transport systems. This will contribute to improved energy efficiency as well. On the one hand this means that organisational aspects should become an integral and prominent!! element of energy efficiency and sustainability policy in the transport sector. On the other hand it also points at a lack of technological and product innovation in public transport or at least the take up of it. Quality considerations in the next stages of liberalisation in various EU countries should be extended in order to substitute car travel and haulage by truck and to quicken the uptake of energy efficient technologies in public transport.

7 - CONCLUDING REMARKS

Liberalisation is often perceived as a threat to the achievement of sustainability goals. A lack of sustainability achievements would happen if liberalisation is implemented primarily for the sake of reducing the costs to local and central governments. There is however sufficient leeway to shape liberalisation in environmentally more benign ways. The choices depend on the political philosophies governments are adhering to. If liberalisation is perceived pragmatically as a way to achieve a transport system that makes better use of the various resources (labour, capital, space and energy) sustainability goals can still be achieved. The management risks shift from lack of resources, slowness and marginalisation to finding the right specification for quality requirements and the right reallocation of resources as regards investment opportunities.

Liberalisation in transport can be used to reallocate and intensify investments in quality and sustainability. This requires a rigorous pursuit of productivity gains, while at the same time cost reductions should not automatically used for budget cuts or lower fare prices, instead quality improvements that attract more customers deserve preference.

A very important prerequisite for liberalisation of public transport is the introduction of pricing policies for the use of road infrastructure. Public transport companies, though often still monopolies within there own markets, are in a weak position compared to private cars and trucks. For goods transport it would also be fair to apply a pricing policy to inland waterways in a similar fashion as for rail and road.

The use of IT can enhance the functioning of market forces in transport through better transparency and responsiveness. IT could be especially very serviceable for customers, both travellers and shippers, to scan the market for the best offers at low transaction costs. The use of IT for dynamic traffic management should be stimulated and its potentials in relation to pricing policies and capacity planning further investigated. When higher utilisation rates can be achieved through IT technology, there are also interesting gains in indirect energy consumption in relation to the embodied energy of infrastructure.

Last but not least the energy technology R&D programmes should be sufficiently supported by market take up programmes aiming at transport companies. This can be partly arranged through quality requirements in concession auctions supported by monitoring and benchmarking. Additionally R&D take up will continue to need specific budgets also in liberalised markets.

8 - ENDNOTES

[1] . Perkins (1998) mentions 18 different kind of measures for greenhouse gas emission reduction only. These measures (9 economic, 7 regulatory and 3 RD&D) are installed in OECD countries. Some measures only in 1 country, mostly in 5 to 10 countries.

[2] . One of the objections put forward here is that a liberalised services on networks will tend to strive for partial and localised optima (e.g. by integrated railway companies, see also)

[3] . Instead of voluntary *negotiated* would be a more appropriate term

[4] . In October 1998 a second study has been commissioned by DGVII.

[5] . BR - British Rail (privatised into an array of regional railway companies and auxiliary companies)
FS - Italian Railways
NS - Dutch Railways, holding with separate track and train operating companies, not yet privatised and practically spoken no liberalisation
RENFE - Spanish Railways
SJ - Swedish Railways Liberalised system, track company separated from train operator, privatised operator partly using regional service contracts
SNCF - French Railways, State company, but some regional lines operated through conditional subsidy tied to regional service contract.

[6] . Rover = Reizigersorganisatie Openbaar VERvoer (Travellers organisation in Public Transport) an independent interest group)

[7] . A success seems to be a new generation of electric drive systems for rail transport, which is more energy efficient, but it has other positive aspects as well and just affect the infrastructure.

[8] . Austria, Ireland and Luxembourg had incomplete data

[9] TUE is the international unit for a standard sea-container (which can also be loaded on barge, truck or train).

[10] . Assuming an increase of the share of mini buses from near zero up to 20% and a mini bus fuel use of 50% of a standard bus, the efficiency improvement of standard size buses and doubledeckers should have increased by 25% in that case.

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