Internalising the External Costs of Road Freight Transport in the UK

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Executive summary

Two-thirds of the freight tonnage moved in the UK goes by road. Our economy and social well-being are critically dependent on the road haulage system. Most of the cost of this system is borne by lorry operators and passed on to customers. Some of the wider environmental and congestion costs, however, are imposed on the community at large. If the polluter pays principle were applied, all these external costs would be completely internalised by taxation. Environmental groups have argued for many years that lorries should be taxed at a level that achieves full internalisation. This report assesses the degree to which the external costs of road freight transport in the UK are currently being internalised by taxation.

The analysis focused on three types of cost: environmental costs (comprising climate change, air pollution, noise and accidents), congestion costs and infrastructure costs. Lorries' contribution to the cost of providing, operating and maintaining road infrastructure is not an externality as such, but has to be calculated to determine its share of road freight taxation. It is out of the remaining taxes that the environmental and congestion costs should be recovered.

Current estimates of infrastructural, environmental and congestion costs have been obtained from official government sources and disaggregated by vehicle type and gross weight class. Two scenarios have been constructed: a 'base-case' using emissions data for lorries from the government's National Atmospheric Emissions Inventory, and the other, a 'worst-case' scenario, based on the assumption that all trucks emit the maximum amount of pollutants permitted by EU regulations. Using mid-range estimates, the total infrastructural, environmental and congestion costs attributable to UK-registered heavy goods vehicles (HGVs) in 2006 were £7.1 billion for the base-case and £7.6 billion for the worst- case scenario.

The taxes paid by HGVs covered approximately two-thirds of these costs (in the base-case scenario). The proportion of the total cost internalised varied by vehicle class, with the lightest category of rigid vehicles covering only 55% of their allocated costs, but the heaviest rigid vehicles covering 79%. Overall, the analysis suggested that taxes on lorries would have to rise by around 50% to fully internalise infrastructural, environmental and congestion costs.

This finding requires several qualifications, however:

- If one excludes congestion costs, it appears that lorries more than cover their infrastructural and environmental costs, even in the worst-case scenario. At 40% of the total external costs, congestion exceeds the share of costs attributable to environmental impacts (36%) and infrastructure (23%).

- Britain is already much closer to full internalisation of the external costs of road freight transport than most other EU countries. Raising the taxes on road freight operators above current levels would put UK operators at an even greater competitive disadvantage within the open EU market for road haulage services.

- Hardly any of the externalities imposed by foreign-registered vehicles running on Britain's roads are currently internalised because their operators avoid high UK fuel duties by purchased almost all their fuel in other countries.

- Taxing road freight operators more heavily to recover a higher proportion of external costs would reduce the financial resources they have available to upgrade their fleets and introduce other 'green' measures.

Even in the absence of any fiscal changes by government, the proportion of external costs internalised by taxation is likely to change. The gradual upgrading of the lorry fleet to higher Euro-emission standards and steady improvements in fuel efficiency will reduce air pollution costs, while increases in the social cost of carbon and in the level of traffic congestion will have a counteracting effect. It is difficult to predict what the net effect of these conflicting cost pressures will be on the future degree of internalisation.

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DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EC	European Commission
ECMT	European Conference of Ministers of Transport
EEA	European Environmental Agency
FTA	Freight Transport Association
FVA	Foreign vehicle activity
gvw	gross vehicle weight
HGV	Heavy Goods Vehicle
ppl	pence per litre
ppm	parts per million
PM	Particulate matter
RHA	Road Haulage Association
SMMT	The Society of Motor Manufacturers and Traders Ltd

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http://www.greenlogistics.org

1. Introduction

Road is by far the dominant mode of freight transport in the UK accounting for 83% of tonnes-lifted and 64% of tonne-kms in 2004 (DfT, 2006). The road freight transport system plays a critical role in the development of the British economy and maintenance of social welfare. Were it to be disrupted for only a few days, the consequences for the country would be truly disastrous (McKinnon, 2006a). It is clear that road freight transport yields enormous economic and social benefits. Against these benefits, however, must be set a range of environmental and infrastructural costs, many of which are borne by the community at large rather than the companies operating freight vehicles. These costs are associated with the emission of air pollutants and greenhouse gases, traffic noise, accidents, congestion and road wear.

In its Sustainable Distribution document (DETR, 1999) and subsequent policy statements the British government has identified a series of policy measures designed to make logistical operations more sustainable in economic, social and environmental terms. It is very difficult to forecast the net impact of these measures both individually and collectively because of uncertainty about the extent to which the environmental costs of freight transport are currently internalised by taxation and the amount by which taxes might have to rise to enforce the 'polluter pays principle' in the freight sector.

The 'fair and efficient pricing' policy promoted by the European Commission (EC, 2001 and 2006) aims to ensure that all external damage caused by road traffic is fully internalised in the price of transport. It argues that pricing should be fair, meaning that 'polluters' are obliged to pay the marginal social cost of their activities, and efficient, giving them an economic incentive to reduce the negative effects of these activities (EEA, 2006). At an EU level, freight movement by all modes is responsible for a third of the total external costs of transport, with the movement of people accounting for the rest (INFRAS, 2004).

The purpose of this report is to estimate the total external costs imposed by heavy goods vehicle (HGV) traffic in the UK and to measure the degree to which these externalities are currently internalised by duties and taxes paid by lorry users. This report focuses on vehicles over 3.5 gvw and does not include any estimates of the external costs imposed by freight-carrying vans. An effort has been made to include an estimate of the total cost of externalities imposed by foreign-registered HGVs operating in Britain.

2. Internal and external costs of road freight transport

2.1. Internal (market) costs of road freight transport

Internal costs, sometimes referred to as market or private costs, are the costs borne directly by road freight transport operators. These costs consist of operating costs and capital investments in facilities and vehicles which eventually need to be replaced. Operating costs are closely related to the level of haulage activity and include fuel, labour, repair and maintenance, infrastructure charges, taxes, insurance and depreciation (Forkenbrock, 1999, Janic, 2007). In the UK, vehicle operating cost tables are compiled by the Freight Transport Association (2006), Road Haulage Association (2006) and industry publications, including *Motor Transport* and *Transport Engineer.*

2.2. External (non-market) costs of road freight transport

The adverse impacts of road freight transport impose external costs which are not borne by those who generate the road freight traffic but by society as a whole. Hence, externalities are not normally taken into account in the decisions made by transport users. Internalisation measures aim to correct this anomaly by increasing the price of transport services in proportion to all the relevant social and environmental costs generated (Beuthe et al., 2002, Baublys et al., 2005). Placing an appropriate value on external costs of road freight traffic is, therefore, fundamental to their internalisation.

External costs included in this calculation relate to the negative effects of air pollution, greenhouse gas emissions, noise, accidents and congestion. Lorries' contribution to the cost of providing, operating and maintaining road infrastructure is not an externality as such, but has to be calculated to determine its share of road freight taxation. It is out of the remaining taxes that the environmental and congestion costs should be recovered. For this reason, the calculation also includes HGV's allocated share of infrastructure costs.

Emissions: air pollution and greenhouse gas emissions

Combustion of fossil fuels leads to two types of emissions from vehicle engines: noxious gases and greenhouse gas emissions. The former cause adverse health, effects, damage to buildings and materials, effects on crops and agricultural production and impact on natural and semi-natural ecosystems (INFRAS 2004, DEFRA, 2006a). The environmental and health effects of vehicle emissions are summarised in Table 1.

Air pollutant	Health and environmental effects
Carbon monoxide	Combines with haemoglobin in the blood to form carboxyhaemoglobin, reducing the blood's oxygen carrying capacity. Exposure to high concentrations results in loss of consciousness and death. At lower concentrations, CO affects the functioning of the central nervous system, causing impairment of vision, slowing reflexes and mental functions. Can also cause headaches and drowsiness.
Nitrogen oxides	Involved in the formation of nitrous and nitric acid, contributes to eutrophication or acidification. Also involved in the formation of tropospheric ozone (O_3) and contributes to global warming. Exposure is linked to increased susceptibility to respiratory infection, increased airway resistance in asthmatics and decreased pulmonary function.
Hydrocarbons	Hydrocarbons and aldehydes can cause irritation of skin and mucous membranes and may lead to breathing difficulties. Long term exposure to hydrocarbons has been shown to lead to impairment of lung function. Hydrocarbons are also involved in the formation of tropospheric ozone (O_3) and photochemical smog, which in turn may cause respiratory problems.
Particulate matter	Can irritate mucous membranes lining the respiratory tract and may give rise to breathing difficulties. Some constituents (e.g. polyaromatic hydrocarbons) may be carcinogenic.
Sulphur dioxide	Associated with respiratory disease, chest discomfort and possible risk of mortality

Table 1. Environmental and health effects of vehicle emissions
Adapted from: Johnstone and Karousakis, 1999

European Union directives limit exhaust emissions from new vehicles. They define Euro emission standards, for carbon monoxide (CO), hydrocarbons (HC), nitrogen oxide (NO_x) and particulate matter (PM10). Since 1997, partly as a result of fuel duty concessions for ultra low sulphur diesel in UK, the level of sulphur dioxide (SO_2) emissions from road freight transport has significantly decreased. However, SO_2 emissions still pose an environmental hazard.

Climate change is currently high on political and corporate agendas. Global carbon dioxide levels now exceed 380 ppm and are rising at 1.7-2.0 parts per million (ppm) per annum (Figure 1). It has been estimated that to keep the increase in global temperature by 2100 within 1- 2^{o} C and minimise the risk of major ecological disasters it will be imperative to restrict ppm to 450. National governments and supranational organisations are introducing carbon reduction targets and policies to constrain the increase in greenhouse gas (GHG) concentrations. Globally, according to the Stern report, transport accounts for 14% of total greenhouse gas emissions, with three-quarters of these emissions from road transport (Stern, 2006). In the UK, road freight traffic is responsible for 22% of all CO_2 emissions from the transport sector and roughly 6% of total domestic CO_2 emissions (DfT, 2006). It is estimated that in 2004 the UK freight transport sector emitted 33.7 million tonnes of CO_2 with HGVs constituting 78.5 % of this total (McKinnon, 2006b).

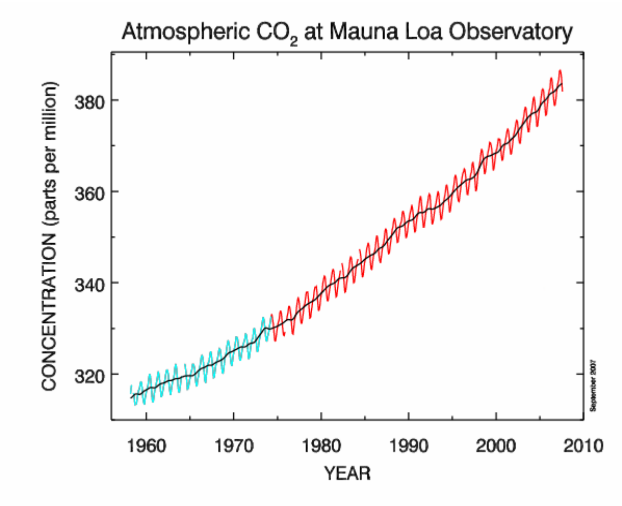

Figure 1. Monthly mean atmospheric carbon dioxide at Mauna Loa Observatory, Hawaii Source: National Oceanic and Atmospheric Administration, accessed on 2nd October 2007 at: http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_data_mlo.html

Infrastructure

Road freight operators contribute to the cost of infrastructure through the duties, taxes and, in the case of a few estuarial crossings road links, tolls. As explained earlier, the infrastructure costs attributable to HGVs need to be estimated as they form a key element in the internalisation calculation. Application of the full 'polluter pays principle' would require the taxes paid by lorries to cover their allocated infrastructure, as well as their environmental and congestion costs.

In the internalisation calculation reported in this paper, no allowance has been made for the external costs of road construction, such as damage to local ecosystems, noise, severance and landscape impacts.

Congestion

Congestion is not, in the strict sense, an environmental externality either, since its effect on transport cost is taken into account by carriers and reflected in their pricing (Beuthe et al, 2002). An extra vehicle entering the road system causes delays to the other vehicles on the network imposing an additional cost upon them, known as the marginal congestion cost (Sansom et al., 1998). Thus, road users should be required not only to absorb the direct cost of congestion which they experience themselves, but also the marginal cost they impose on other road users (Beuthe et al, 2002).

Using cost data from the Goods Vehicle Operating Costs 2006 published by the Road Haulage Association (2006), it is possible to estimate the cost to the UK road freight sector of a 15 minute delay caused by traffic congestion. This calculation includes driver costs related to the time spent running on the road on revenue-earning trips (assuming 55 hour working week and including national insurance) and vehicle-related costs (depreciation, insurance, goods in transit insurance, interest on capital and other vehicle overheads). No allowance was made for distance-related costs (i.e. fuel, tyres or repair and maintenance). Table 2 indicates the time-related cost of a 15 minute delay affecting the different types and weight classes of HGV.

Vehicle type	Time cost per vehicle per 15 mins delay (£)
Rigid	
3.5 tonne	1.86
7.5 tonne	2.07
13 tonne	2.15
18 tonne	2.20
26 tonne	2.29
32 tonne	2.33
Articulated	
32/33 tonne	2.34
38 tonne	2.41
40 tonne	2.41
41 tonne	2.41
44 tonne	2.41

Table 2. Time-based direct costs of congestion.

Traffic congestion also has an adverse effect on fuel consumption and CO_2 emissions. Figure 2 shows the impact of vehicle speed on CO_2 emissions per vehicle kilometre. Traffic flow speed lower than 20 km/h causes a significant increase in fuel consumption and CO_2 levels emitted per vehicle-km. (SMMT, 2005). It has also been estimated that, for a 40 tonne articulated lorry, making '*two stops per kilometre leads to an increase of fuel consumption by roughly a factor of 3'* (International Road Union, 1997).

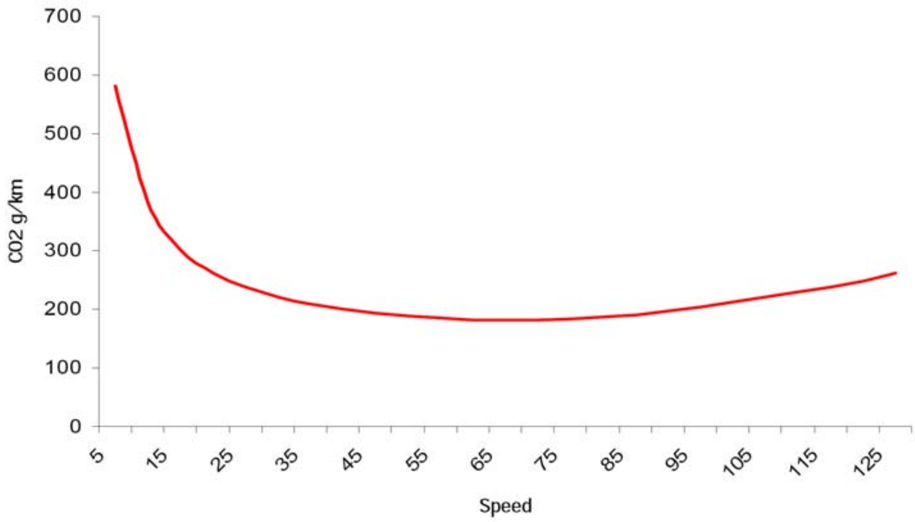

Figure 2. Vehicle flow speed and CO_2 emissions – mixed traffic flow including 10% HGVs
Source: SMMT 2005 adapted from: Highways Agency, 2003

Noise

Excessive noise generated by lorry traffic can lead to annoyance and, in the longer term, to negative effects on health and personal wellbeing (Maddison et al.,1996) Janic, 2007). Traffic noise also has an adverse effect on residential property values and rent (Forkenbrock, 1999). Although noise limits have been getting tighter for all types of vehicles (Figure 3), noise is still an important externality associated with road freight transport.

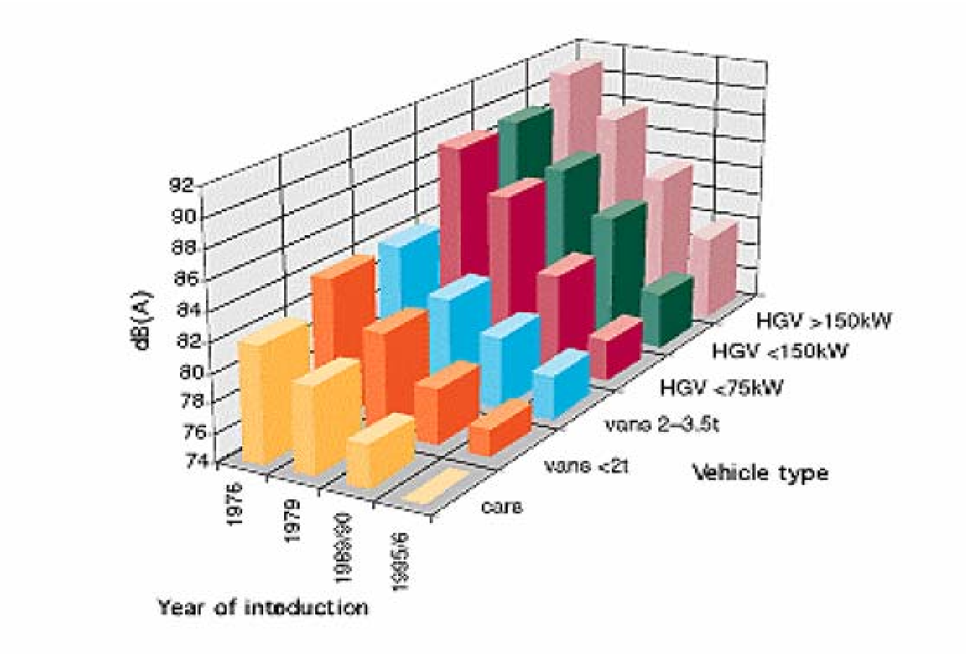

Figure 3. Tightening of European vehicle noise limits
Source: DETR, 1998

Accidents

The external costs of accidents include the cost of personal injury and death, medical services, police, other emergency services and related administration, as well as damage to vehicles and property (Button, 1990, NERA, 2000). These costs vary with the nature, frequency and severity of accidents (Gibbons et al., 2002). HGVs have a lower frequency of involvement in traffic accidents overall, but a significantly higher involvement in serious and fatal accidents, reflecting their greater momentum.

3. Internalisation of the external costs imposed by British-registered vehicles

3.1. Taxes and charges borne by vehicle operators

In the UK ultra-low sulphur diesel is liable for duty of 50.35 pence per litre (ppl) and for Value Added Tax (VAT) at a rate of 17.5% of the full retail price. Additionally, vehicle ownership incurs Vehicle Excise Duty. Apart from one motorway link and a few tolled bridges and tunnels, there are no direct infrastructure charges in Britain.

The following calculations were based on the average bulk and retail diesel fuel prices at 1st July 2006 – 79.15 pence per litre (ppl) and 83.66 ppl, respectively. An assumption that 80% of fuel used will be purchased in bulk was made based on FTA annual distribution costs guidelines. This gives an average diesel fuel price of 80.05ppl (FTA, 2006). A duty rate of 47.10 ppl at 2006 level has been used to ensure the same base year for all calculations.

Although most HGV operators are VAT-registered and can recover this tax through VAT transactions, VAT passes along the supply chains and it is finally borne by one of the direct or indirect transport users. Hence, VAT is included in the estimate of the income generated by duties and taxes from road freight transport.

In 2006, nearly £4.7 billion was collected from diesel fuel duty, VED and VAT. 73% of this was from fuel duty and only 6% from VED (Table 3).

2006 (£ million)	Rigid				Articulated		All vehicles
	Over 3.5 tonnes – not over 7.5 tonnes	Over 7.5 tonnes – not over 17 tonnes	Over 17 tonnes – not over 25 tonnes	Over 25 tonnes	Over 3.5 tonnes – not over 33 tonnes	Over 33 tonnes	
Fuel duty (47.1 ppl)	423.3	240.7	354.8	604.8	175.4	1613.2	**3412.3**
VAT (17.5%)	125.9	71.6	105.5	179.9	52.2	479.8	**1014.9**
VED	25.4	11.2	29.3	55.0	13.9	136.3	**271.0**
Total	**574.7**	**323.5**	**489.6**	**839.6**	**241.6**	**2229.3**	**4698.2**

Table 3. Duties and taxes paid by HGV operators in 2006.

3.2. External cost of road freight transport in the UK

A spreadsheet has been constructed based on freight and traffic data from the government's Continuing Survey of Road Goods Transport (CSRGT) (DfT, 2006) and National Road Traffic Survey (NRTS) (DfT,2007a). It models the relationship between HGV activity in the UK and a series of freight transport-related externalities, including climate change, air pollution, noise and congestion.

The estimates of congestion, noise and infrastructure costs are based on valuations provided by the DfT and used in a recently published report on the external costs of food distribution in the UK (DEFRA, 2007) (Table 4). The infrastructure, noise and congestion cost values were originally expressed in 2002 prices and have been inflated to 2006 values using the Retail Price Index (RPI). The cost of accidents was given in 2005 prices and RPI was again used to re-base it to the 2006 level.

External costs (pence per km)	Motorway	Rural	Urban
INFRASTRUCTURE			
Rigid over 3.5 tonnes – not over 7.5 tonnes	0.47	2.18	2.44
Rigid over 7.5 tonnes – not over 17 tonnes	1.01	4.71	5.27
Rigid over 17 tonnes – not over 25 tonnes	1.45	6.73	7.53
Rigid over 25 tonnes	2.52	11.70	13.08
Artic over 3.5 tonnes – not over 33 tonnes	2.76	8.42	9.46
Artic over 33 tonnes	4.93	15.06	16.92
NOISE			
Rigid	0.43	0.21	1.25
Artic	0.81	0.35	2.38
CONGESTION			
Rigid	5.41	4.24	43.58
Artic	6.59	5.15	72.89
ACCIDENTS			
Rigid	6.80	6.80	6.80
Artic	5.47	5.47	5.47

Table 4. Infrastructure, noise, congestion and accident costs.

The estimates of emissions of carbon dioxide (CO_2), hydrocarbons (HC), nitrogen oxide (NO_x) and particulate matter (PM10) were derived from the National Atmospheric Emissions Inventory (NAEI)[1]. In the NAEI spreadsheet "emission factors for CO_2 refer to 'ultimate CO_2', referring to all the carbon in the fuel emitted at the tailpipe as CO_2, CO, unburned hydrocarbons and particulate matter which ultimately have the potential in forming CO_2". Carbon monoxide (CO) emissions were not, therefore, modelled separately. The cost of carbon emissions was calculated using the values quoted by Clarkson et al. (2002). This cost was updated to the 2006 level in accordance with the Green Book (HM Treasury, 2003). The 'Air Quality Damage Cost Guidance' report (DEFRA, 2006b) was used to calculate the cost of PM10, NO_x and SO2 emissions while the 'Damage Cost for Air Pollution' report (DEFRA 2006a) was the source of cost data on volatile organic compound (VOC) emissions (Table 5).

Air pollution costs (£ per tonne)	LOW	MEDIUM	HIGH
C	45.85	85.27	164.10
PM motorway	11118	13627	16136
PM rural	11118	13627	16136
PM urban	74749	91618	108487
VOCs	0	1	2
NO_x	1407	1728	2050
SO_2	2290	2780	3269

Table 5. Air pollution costs (2006 prices).

The full external costs by vehicle category are shown in Table 6. These include environmental, infrastructural and congestion costs. The total costs have been estimated at £6.7 billion, £7.1 billion and £7.7 billion using, respectively low, medium and high emission cost values. The heaviest articulated vehicles (with gross weights of over 33 tonnes) carry 72% of all road tonne-kms (DfT, 2007a) but are responsible for only around 47% of all the external costs of road freight transport. Conversely, rigid vehicles account for 48% of the total external costs while carrying only 24% of

[1] Available online at: http://www.naei.org.uk/datachunk.php?f_datachunk_id=8

total tonne-kilometres. These differing proportions show how larger / heavier trucks have lower external costs per tonne-km, assuming loading factor and empty running figures at current levels.

Total external cost of HGV activity in the UK (£ million)	Rigid				Articulated		All vehicles
	Over 3.5 tonnes – not over 7.5 tonnes	Over 7.5 tonnes – not over 17 tonnes	Over 17 tonnes – not over 25 tonnes	Over 25 tonnes	Over 3.5 tonnes – not over 33 tonnes	Over 33 tonnes	
Low estimate	1009	457	784	1028	316	3094	**6688**
Medium estimate	1036	473	812	1068	338	3324	**7050**
High estimate	1080	498	862	1136	376	3733	**7684**

Table 6. Total external costs of road freight transport

Overall, 40% of the total external costs is attributable to congestion, 23% to infrastructure, 19% to traffic accidents, 15% to air pollution and greenhouse gas emissions and only 2% to noise (Figure 4). As some gases, such as methane and carbon monoxide, contribute both to global warming and air pollution, it has not been possible to split the external costs associated with these emissions between climate change and reductions in air quality. An indication of the climate change component can be given by focusing on CO_2 emissions from lorry exhausts as these have no effect on air quality. On this basis, climate change costs would represent around 8% of the total external costs of road freight transport in the UK.

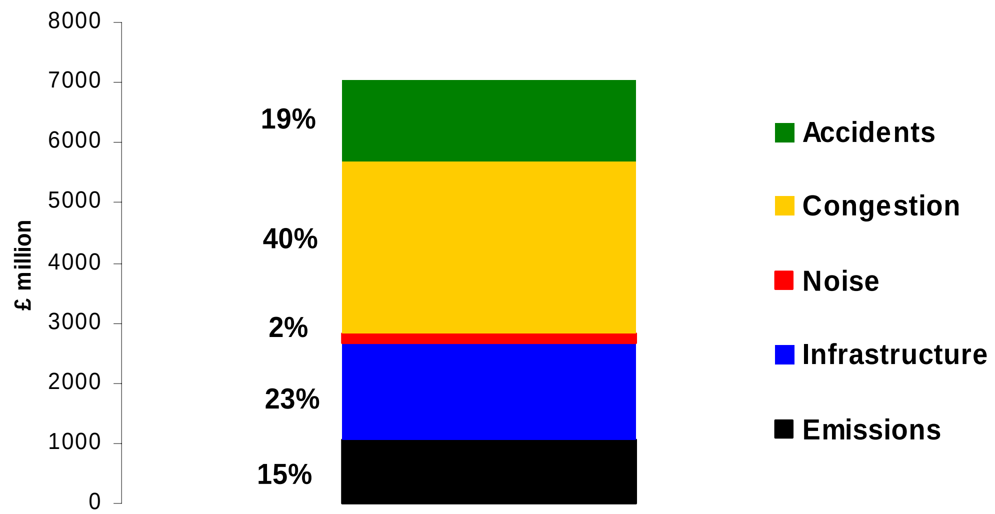

Figure 4. Total external costs of HGV activity in UK

3.3. Modelling the Worst-case Emissions Scenario

The calculation outlined above uses data from the NAEI which is likely to reflect an average level of exhaust emissions from trucks. A worst-case emissions scenario was constructed by assuming that all emissions of controlled pollutants (carbon monoxide (CO), hydrocarbons (HC), nitrogen oxide (NO_x) and particulate matter (PM10)) were set at the maximum level permitted by EU regulations for vehicles of differing ages (DfT, 2005). As these limits are defined in grams per kWh, the calorific value of diesel fuel recommended by Carbon Trust[2] was used to convert them to grams per litre of fuel consumed. Carbon dioxide emissions were estimated by applying conversion factors provided by DEFRA (2005). The procedure to assess sulphur dioxide (SO_2) emissions was the same as in the earlier calculation. On this basis, the upper limit of external costs related to air pollution was calculated. Costs of congestion, noise, infrastructure and accidents remained at the same level as in the first scenario.

Table 7 compares the external costs calculated for the two scenarios (base-case versus worst-case air pollution estimates). The 'worst-case' estimates are 7%, 8% and 8% higher than in 'base-case' scenario for low, medium and high cost estimates, respectively.

Total external cost of HGV activity in the UK (£ million)	Low estimate	Medium estimate	High estimate
'Base-case' scenario	6688	7050	7684
'Worst-case' scenario	7189	7623	8269
Difference	7%	8%	8%

Table 7. Total external costs of road freight transport- comparison of base- and worst- cases

[2] http://www.carbontrust.co.uk/resource/measuring_co2/Measuring_CO2_Methodologies.htm

3.4. Degree of Internalisation of External Costs

The assessment of the degree to which the total external costs imposed by lorry traffic in Britain are currently internalised by duties and taxes paid by transport users was based on the 'base-case' scenario and medium cost values.

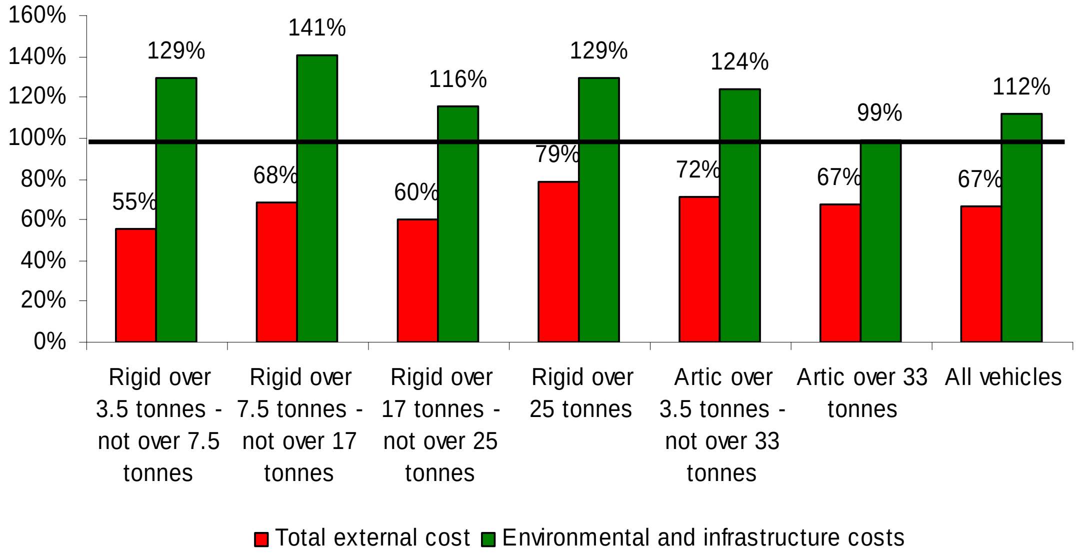

Figure 5. Internalisation of external costs by HGV category

The duties and taxes paid by transport operators cover on average 67 per cent of the total external costs (i.e. environmental, noise, accidents, congestion and infrastructure costs) imposed by British-registered HGVs in the UK. In the case of rigid vehicles between 55% to 79% of the costs are recovered by taxation depending on the weight class of the vehicle. The taxes paid by articulated vehicles with gross weights in excess of 33 tonnes internalise roughly two-thirds of the externalities (Figure 5).

Congestion costs constitute approximately 40% of the full external costs of lorry traffic in Britain. If these congestion costs are excluded, it appears that taxes currently exceed the value of the remaining externalities for all but one of the HGV weight classes, and even this weight class (>33 tonne artic) covers 99% of its allocated external costs, excluding congestion. In 2006, the average truck in the UK paid 12% more in duties and taxes than its allocated infrastructural and environmental costs (excluding congestion costs).

The overall level of internalisation declines to 62% when the ‘worst-case’ situation is considered. The greatest differences occur within the rigid vehicle categories, with a 12% discrepancy for rigid trucks over 25 tonnes gvw. For articulated trucks only marginal differences of 1%-2% occur (Figure 6).

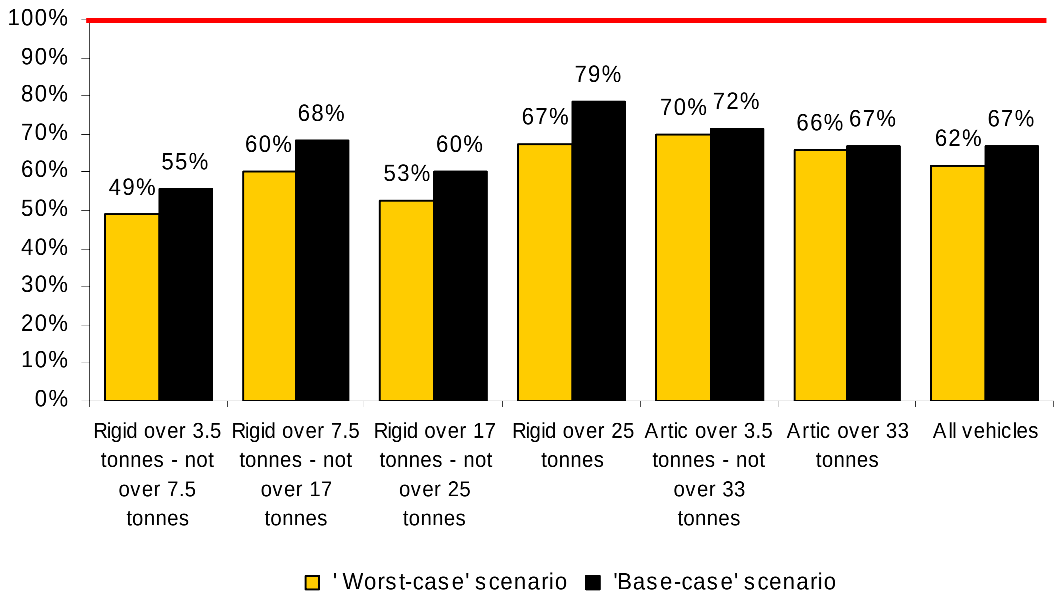

Figure 6. Comparison of ‘base-case’ and ‘worst-case’ scenarios.

In the light of recent re-assessments of the impact of climate change, these estimates of the degree of internalisation may turn out to be too optimistic. New research on the economics of climate change suggests that this element of external costs may have a significantly higher value than previously assumed. If so, the tax-to-cost ratio would be lower than calculated, reinforcing the case for sustainability measures to reduce the environmental damage done by HGVs. The Stern report suggests that the cost of carbon should be around £265 per tonne in 2006 prices – roughly three times higher than the medium value of the social cost of carbon factored into the above calculations. The adoption of this value would reduce the overall degree of external cost internalisation for road freight operations in the UK to 49%.

4. External costs imposed and by foreign registered vehicles

The estimates of the external costs and their internalisation reported in Section 3 are based solely on the activities of UK-registered lorries. A significant proportion of road freight movement in the UK is undertaken by foreign-registered vehicles and this share has risen sharply over the past decade. According to recent estimates compiled by the DfT, the number of foreign-registered goods vehicles travelling each year between Britain and mainland Europe grew from 268,200 in 1985 to over 1.5 million in 2006 (Figure 7) (DfT, 2007b). This foreign HGV activity imposes an additional burden on the UK environment and transport infrastructure. This negative impact needs to be evaluated and included in the estimates of the external costs associated with road freight transport. As foreign trucks pay no vehicle excise duty in the UK and very little fuel duty, the degree to which their external costs are internalised is likely to be very much lower than that of UK-registered lorries.

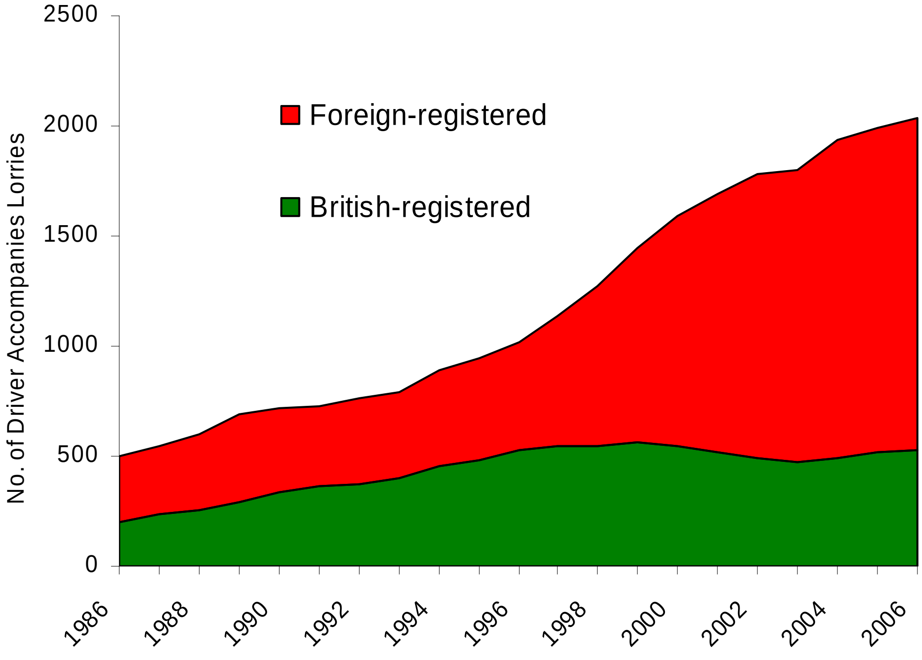

Figure 7. Foreign- and UK-registered trucks travelling to mainland Europe
Source: Department for Transport, 2007b

In a report on the external costs associated with non-domestic HGV activity, NERA (2005) estimated the total environmental and track costs imposed by foreign-registered trucks in 2003 at £236.4 million (in 2004 prices). Burns (2005) calculated the annual track costs attributable to foreign goods vehicles to be £195 million, environmental costs £35 million and accident cost £33 million in 2005. His total of £263 million excluded congestion and noise costs.

This section updates these earlier evaluations of the external costs imposed by foreign-registered goods vehicles travelling on British roads, including movements to and from the country, journeys within the UK (cabotage[3]) and transit traffic.

The last official estimates of distances travelled by foreign-registered HGVs on UK roads were made in 2003 by the Survey of Foreign Vehicle Activity in Great Britain (FVA survey) (DfT, 2003). According to this survey, overseas-registered trucks travelled 924 million kilometres on Britain's roads in 2003. The average distance travelled per visit to the UK was 640 kilometres (DfT, 2003). Burns (2005), in his Freight Taxes Inquiry, estimated foreign truck activity to be 1072 million vehicle kilometres in 2005. If, however, one scales up the 2003 estimate of foreign-HGV kilometres in proportion to the growth in the number of foreign trucks travelling between the UK and mainland Europe the annual distance travelled by these vehicles would have been 1058 million vehicle kilometres in 2006. This assumes that the average distance travelled per visit to the UK remained constant between 2003 and 2006.

The methodology and cost estimates were the same as those used for the earlier analysis of British-registered HGVs. For consistency, the vehicle categories used in FVA survey needed to be aligned with the weight-classes used in this earlier analysis (Table 8).

HGV categories used in FVA	HGV categories used in this report
Rigid less than 36 tonnes	Rigid over 25 tonnes
Rigid between 36 and 38 tonnes	Articulated over 33 tonnes
Rigid over 38 tonnes	Articulated over 33 tonnes
Articulated less than 36 tonnes	Articulated over 33 tonnes
Articulated between 36 and 38 tonnes	Articulated over 33 tonnes
Articulated over 38 tonnes	Articulated over 33 tonnes

Table 8. Alignment of HGV categories

[3] Cabotage is domestic haulage work undertaken by foreign-registered carriers.

In line with the FVA survey, 85% of the total kilometres travelled and 89% of goods moved were by vehicles over 38 tonnes gvw (DfT, 2003). As the vast majority of foreign-registered trucks operating in Britain belong to the largest and heaviest vehicle categories, it was assumed that all rigid vehicles with gross weights of less than 36 tonnes belonged to the 'rigid over 25 tonnes' class. As the maximum permissible weight for rigid vehicles on four axles is 32 tonnes gvw, it was assumed that all rigid vehicles over 36 tonnes are drawbar trailer combinations. For this reason, the external cost values for articulated lorries over 33 tonnes were applied to these vehicles.

As in the case of the external cost analysis of UK-registered HGVs, emissions from foreign-registered vehicles were calculated in two ways. Again, 'base-case' and 'worst-case' scenarios were constructed and modelled. The estimates of the total external costs of foreign vehicle activity in Britain are presented in Table 9.

Total external cost imposed by foreign-registered HGV in the UK (£ million)	Low estimate	Medium estimate	High estimate
'Base-case' scenario	275.1	297.7	338.9
'Worst-case' scenario	290.5	310.9	342.2
Difference	6%	4%	1%

Table 9. Total external costs of foreign-registered goods vehicle activity in Britain

As found in the earlier analysis of UK-registered vehicles, the % difference between the base- and worst-case scenarios was greater for rigid vehicles, but still relatively small.

Based on medium cost valuations and the base-case scenario for foreign-registered vehicles, congestion constitutes 30% of their external costs, followed by infrastructure wear (29%), air pollution (20%), accidents (20%) and noise (1%) (Figure8).

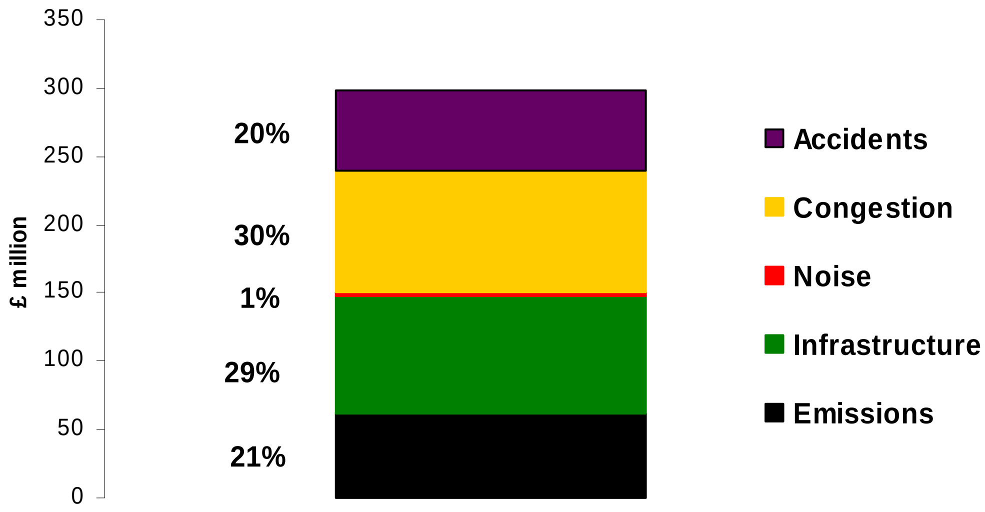

Figure 8. Total external costs imposed by foreign-registered trucks in the UK

83% of foreign lorries spend less than two days in the UK per visit and 93% of visits last three or fewer days (DfT, 2003). Given the average distance travelled per visit (640 km), foreign-registered lorries can undertake almost all their haulage work in the UK using fuel purchased outside the country. As the average price of diesel fuel in France, Belgium and the Netherlands was 28% lower in 2006 than in the UK (McKinnon, 2007), foreign carriers have a strong financial incentive to fill their tanks before entering the UK. As a consequence, hardly any of the external costs imposed by foreign trucks in the UK are currently internalised. It is not known what proportion of the fuel consumed by foreign trucks in the UK is actually purchased here. As this is likely to be very low, however, it can be safely assumed that the level of internalisation is minimal. If the estimated 1058 million vehicle kilometres run by foreign-registered lorries in 2006 had been run using diesel fuel purchased in the UK at an average level of fuel efficiency, an extra £177 million in duty would have been raised for the UK Exchequer (£201 million at the duty rate in October 2007). Full internalisation of the external costs of foreign-HGV activity in the UK would have raised around £300 million (assuming base-case estimates).

5. Internalisation of the external costs of road freight transport across Europe

At a European level, according to the European Environmental Agency (EEA) (2006), distance-related charges (fuel taxes and infrastructure charges) levied on lorry transport are still below the minimum estimates of marginal external cost in all EU states (Figure 9). In 2002 the average value of the full external cost of road freight traffic was estimated to be 0.26 Euro per truck kilometre. More than 80% of these external costs in Europe were related to accidents, climate change and air pollution. Noise and congestion were also included in the calculation and were a substantial proportion of external costs in urban areas (EEA, 2006).

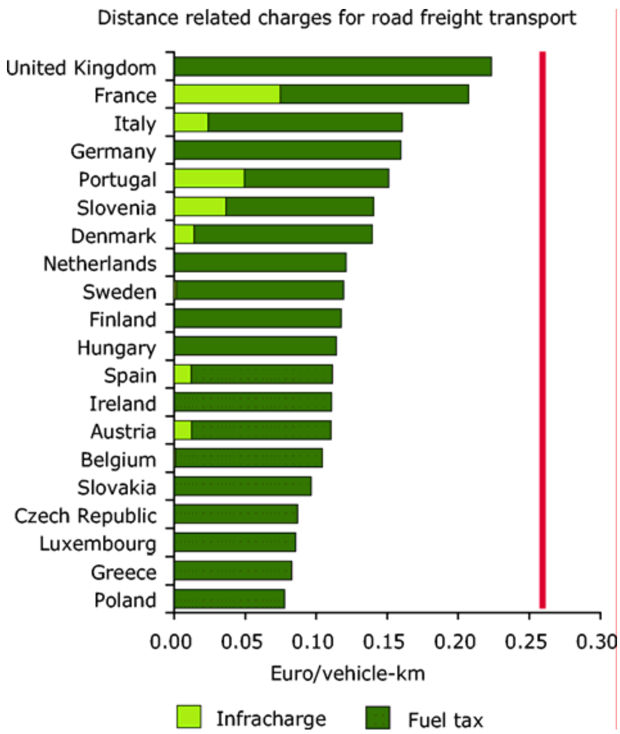

Figure 9. Distance-related charges and external costs of road freight transport (2002)
Source: EEA, 2006.

According to the EEA estimates for 2002, taxes levied on HGVs in Britain internalised around 88% of the external costs of road freight transport, a higher proportion than in any other EU country. At the other extreme, countries such as Poland, Greece and Luxembourg only internalised around 30% of the external costs arising from road freight transport.

The internalisation estimates published by EEA cannot be directly compared with the valuations presented in this report. Although the EEA does not explain the methodology used, it is clear that its internalisation calculations involve comparing national taxes on HGVs with an EU-wide average figure for external costs per truck-km. Moreover, since 2002 there have been significant changes in the valuation of external costs and in tax levels.

The duty levied on diesel fuel in Britain remains the highest in Europe (Figure 10). In August 2007, the duty on diesel fuel in the UK was 77% higher than the European average and 154% higher than in Cyprus, the EU member state that taxes fuel the least. Given these wide fuel duty differentials, it is likely that in 2007 British-registered operators are still much closer to fully internalising their external costs than most of their counterparts elsewhere in the EU. Since 2002, however, Germany and Austria have introduced road tolling systems for trucks which have significantly increased their tax burden and helped to narrow the gap between external costs and taxes. A comparison of the net taxes that would be paid by a 40 tonne gvw domestically-registered truck making a 400km journey within 16 EU countries suggested that taxation in Germany was slightly higher than the UK in 2006 (0.284 Euro per km as opposed to 0.245 Euro per km) (ECMT, 2007). The UK figure was still well above the average for the 16 EU countries surveyed (0.177 Euros per km). Without knowing the corresponding external costs for each country it is not possible to compare international variations in the degree of internalisation in 2006.

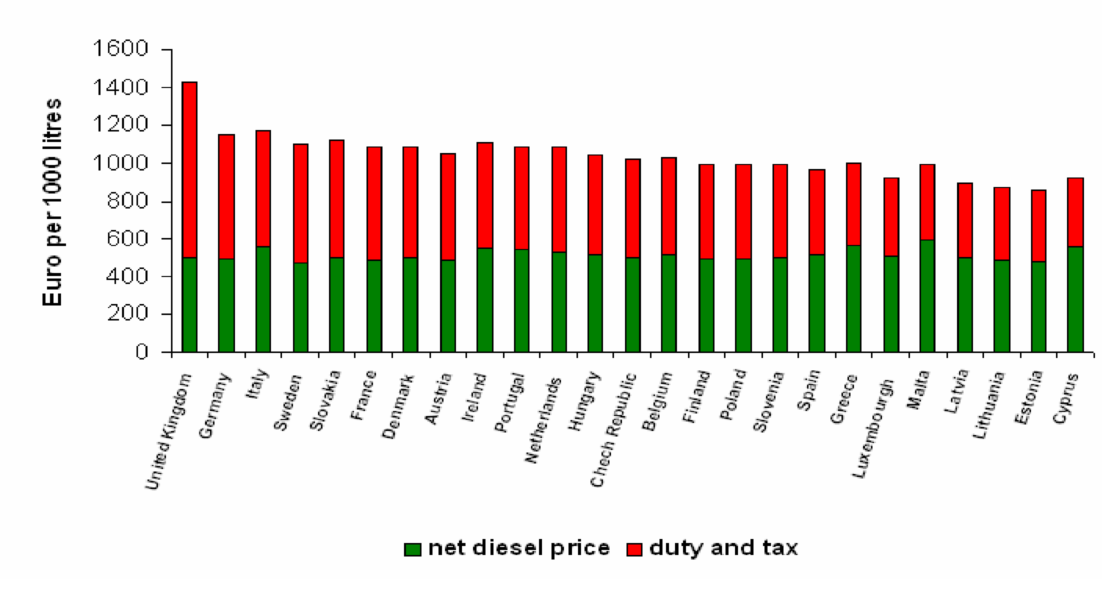

Figure 10. International variations in diesel fuel prices and duty / tax – August 2007
Source: European Commission, 2007

6. Conclusions

This report provides updated estimates of the total external costs of road freight transport in the UK. In 2006, domestic- and foreign-registered HGV activity imposed external costs of around £7.3 billion based on mid-range valuations. In the case of British-registered trucks 67% of these costs were internalised by duties and taxes paid by road freight operators. Hardly any of the externalities imposed by foreign-registered vehicles are currently internalised, because almost all the fuel they consume is purchased before entering the country and they incur virtually no direct infrastructure charges in the UK. Combining British- and foreign-registered truck activity and assuming that none of the external costs imposed by overseas operators are currently internalised, the overall level of internalisation of externalities associated with road freight transport in the UK drops to 64%. Although, the monetary estimates of external costs vary widely at an international level (Walter et al, 2000), it seems likely that in 2007 the UK is still much closer to fully internalising the total external costs of its domestic road freight sector than most other EU countries.

The relatively high level of internalisation in the UK can be considered desirable in environmental terms. It requires several qualifications, however:

- The 'polluter pays' principle is not applied uniformly across the UK economy. If it is being more rigorously applied in the road freight sector than elsewhere, this will cause market distortions and unfairness in the implementation of environmental policy.

- The imposition of higher taxes on British road freight operations places them at a competitive disadvantage within an open EU market for road haulage services. Ironically, the high fuel duty policy has promoted increased penetration of the UK road haulage market by foreign operators who internalise very little of the external cost they impose on the UK environment and infrastructure. There is an apparent conflict between the European Commission's efforts to apply the 'polluter pays principle' to road freight transport and its rules on cross-border competition which make it difficult for the UK government to 'level the fiscal playing field' between British and foreign hauliers and achieve 'internalisation' parity between the two groups.

- Trade bodies representing the road haulage industry argue that the high taxes required to internalise the external costs of road freight transport reduce the financial resources that operators have available to upgrade their fleets and to introduce many of the green measures promoted by the government's Freight Best Practice programme (www.freightbestpractice.org.uk).

Even though duties and taxes on road freight traffic in the UK are very high by international standards, they would still need to be increased by 50% to fully internalise all the externalities. It would clearly be very difficult and very unfair on road freight operators for the British government unilaterally to increase taxes by this margin. Moreover, British-registered lorries currently pay significantly more tax than required to cover their environmental costs and share of road infrastructure costs. It is only when congestion costs are factored into the calculation that a tax shortfall results. If the government were to provide additional road space and / or use other traffic management measures to relieve traffic congestion, congestion costs would be reduced and the degree of internalisation increased. Given the importance of road freight transport to the national economy, this would probably prove a more effective transport strategy than taxing HGVs more heavily.

The gradual upgrading of the UK HGV fleet to higher Euro emission standards and steady improvements in fuel efficiency will reduce the total value of emission-related externalities. Increases in official estimates of the social cost of carbon and in the level of traffic congestion, however, will tend to counteract this downward pressure on external costs. It is difficult to predict what the net effect of these conflicting cost pressures will be on the future degree of internalisation. The issue would be further complicated by the inclusion of road freight operations in the European Emissions Trading Scheme as has been recently discussed by Raux and Alligier (2007).

Awareness of the full costs of freight transport services should help businesses to plan and manage their logistics in a way that achieves longer term sustainability. This may involve greater use of alternative modes, more localised sourcing, improved vehicle utilisation and even some relaxation of current just-in-time scheduling. If the higher freight costs associated with greater internalisation are passed down the supply chain, the purchasing behaviour of final consumers should also become more sensitive to the environmental impact of the distribution operations that keep them supplied with goods and services.

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