INFRASTRUCTURE PRICING AND THE E.E.C. COMMON TRANSPORT POLICY

The Case of Roads and Commercial Vehicles

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Charging for the use of infrastructure has long been considered one of the key problems of the E.E.C's common transport policy. Having emphasised the importance of the problem in its memorandum on the direction that the Common transport policy should follow (Doc.VII/COM(61) and in its programme of action (Doc.VII/COM(62), the Commission proposed as far back as 1963 to reorganise the systems of taxation and levies in the transport sector to achieve an equitable and efficient distribution of the costs of infrastructure. The primary justification for this reorganisation is to harmonise the conditions of competition in the transport sector (COM(71),268).

A programme of studies on infrastructure charging, initiated in the mid-sixties by the Council [5], provided important data for technical and economic assessment. For the railways, integrated control permits the direct inclusion of infrastructure costs in transport charges. Some progress has already been made by the United Kingdom in implementing E.E.C. proposals for normalisation of railway accounts. The Railways Act 1974 is "An Act to amend the law relating to the British Railways Board; to make provision for the performance by the Secretary of State of functions in relation to the Board under certain regulations of the Council of the European Communities relating to transport". More specifically, the Act refers to Council Regulation (E.E.C.) 1191/69, on public service obligations in transport, and Council Regulations (E.E.C.) 1192/69, on common rules with respect to the financial status of railway undertakings.

For roads and inland waterways the control of infrastructure is separate from that of transport services, and users must therefore pay separate charges for the use of infrastructures. In the case of inland waterways technical operating conditions permit reliance on tolls, which may be varied widely according to the characteristics of the various waterways and vessels.

A counterpart to the normalisation proposals for rail is the defiscalisation proposals for road. One of the basic principles of the final draft of document COM(71)268 [22] is to transform the existing structure of vehicle taxation into a charge that will reflect the utilisation of the infrastructure. In line with the defiscalisation objective, the Council of the European Communities in 1968 issued a draft directive [21] setting out a framework for the harmonisation of commercial vehicle taxation, so that the structure of taxation would reflect the marginal road "wear and tear"

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costs caused by different categories of commercial vehicles. The draft Directive was considered by the Economic and Social Committee of the European Communities in February 1969, and by the European Parliament in May 1969. There were some minor amendments of text and presentation, but no changes of real substance. In January 1970 the Council of Ministers of Transport agreed to study arrangements for putting into operation a system of taxation based on the Commission's Directive, and it was then expected that the Directive would be finally adopted at the end of 1970. Discussions are still taking place, and there is no indication that substantive changes have so far been made to the proposed new tax set out in the Commission's 1968 Directive.

This article sets out briefly the various systems of charging for the use of infrastructure considered by the E.E.C., and the E.E.C. proposals for revising commercial vehicle taxation. An attempt is then made to devise a new tax structure for commercial vehicles in the U.K. on the basis recommended in the E.E.C. draft Directive.

SYSTEMS OF CHARGING FOR INFRASTRUCTURE

The main criteria adopted by the Commission for selecting between the various charging systems are set out in COM(71)268 [22]:

(a) Firstly, the system chosen should optimise the use of infrastructure facilities. The prices should be fixed so that the best possible utilisation of infrastructure is assured from the point of view of society. This objective is achieved if the prices dissuade only those users who value the use of infrastructure less than the costs that its use imposes on society.

(b) Secondly, it must fulfil a function of providing finance. The pricing must raise the necessary resources to cover the running costs of the infrastructure and the expansion of the networks.

In the light of these objectives the Commission examined four possible charging systems[1]:

1. Marginal social cost pricing

The marginal social cost is defined as the cost to society of the last additional unit of traffic to use the particular infrastructure facility. When it has been decided to provide a certain volume of output, and capital has been invested, the only resources affected by a decision to produce an extra unit of output, for example a vehicle kilometre, are those which vary directly with the level of output. If charges include costs of resources committed in such a way that the resources cannot be released quickly for other uses, then users may be led to choose a service or product which is more expensive in the use of current resources, and optimal resource allocation will not be achieved.

Marginal social cost is regarded as having three main constituent elements:

(i) marginal "wear and tear" arising from use of the infrastructure;

[1] Alternative charging systems are examined in detail in Allais [1], Malcor [12], and COM(71) 268 [22].

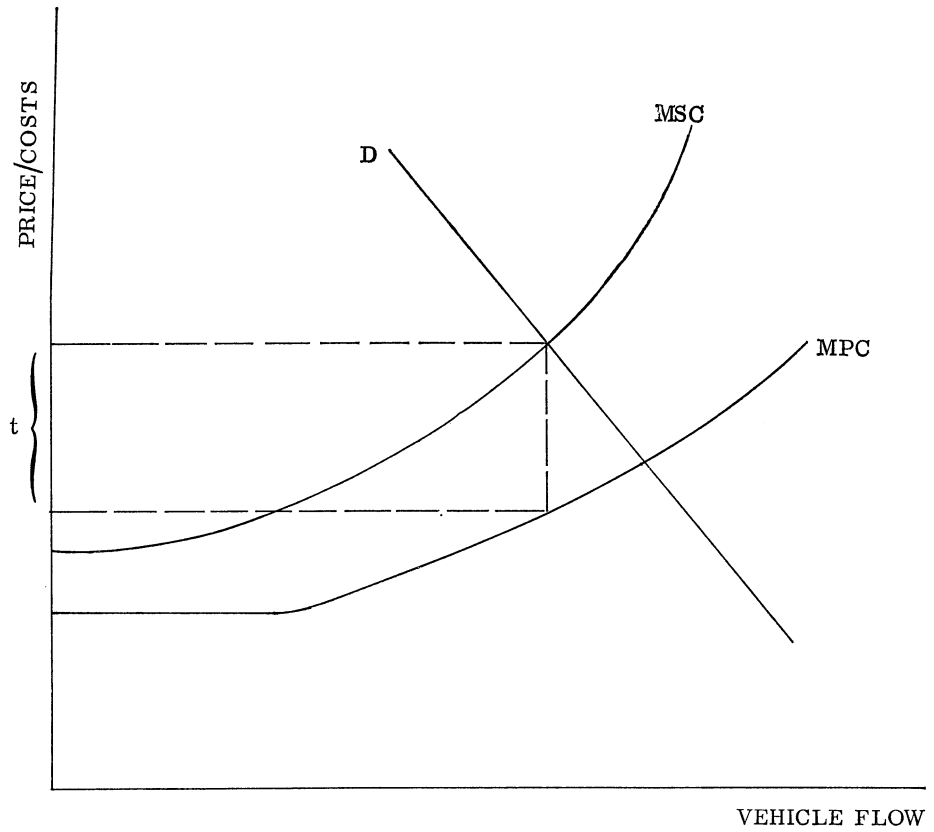

FIGURE 1

Taxation, Marginal Social Cost and Marginal Private Cost

(ii) marginal social cost of congestion, which is the increase in costs imposed on the rest of the traffic by the extra traffic;
(iii) marginal cost of externalities, which is the increase in all the other costs (particularly costs of accidents and disamenity costs of pollution) caused to society by the extra traffic.

Figure 1 postulates a hypothetical relationship between marginal private cost and marginal social cost for vehicle flow at different levels. As vehicle flow increases operating costs rise, so the marginal private cost curve is upward-sloping. The marginal social cost curve is derived from the marginal private cost schedule by adding to it increased marginal "wear and tear" cost, marginal social cost of congestion, and the marginal cost of other externalities. The standard argument is that the optimal level of user taxation is given by t in Figure 1, where the willingness-to-pay for the marginal vehicle kilometre travelled equals the marginal social cost imposed (Walters [17]).

2. Pricing according to economic rents

Pricing according to economic rents is distinguished from marginal social cost pricing by an additional constraint on the level of utilisation of the infrastructure, which limits utilisation to a level below the physical capacity. The economic rents include marginal "wear and tear" costs arising from use, and the pure economic rent, which is such as to ensure that demand equals the capacity. When demand is below the previously determined capacity the pure economic rent is zero. When demand is liable to go above this capacity, the pure economic rent is fixed at such a level that demand is brought back to the level of capacity.

3. Pricing for financial balance

Pricing for financial balance is based on the system of marginal social cost, but with the additional constraint of budgetary equilibrium. The optimal resource allocation price equates the amount of capacity supplied and demanded. It minimises the inefficiency caused by road wear and tear, excess capacity, congestion and undesirable externalities. The efficient price is determined by the intersection of demand and marginal social cost. Since marginal social cost is generally unequal to long-run marginal cost (LMC), and since LMC in turn is generally unequal to long-run average cost (LAC), efficient pricing may give rise to either surpluses or deficits. The Allais Report [1] argues that it may be considered inequitable to put all or any of the burden of infrastructure upon taxpayers as a whole. Moreover, incorrect investments in infrastructure may be made as a result of political pressures where public expenditure is involved. Subsidies intended to finance the deficit of infrastructure may also be used to cover inefficient operation, and may enable inefficiency to continue. Finally, competition may be distorted if some modes of transport are relieved of the financial burdens connected with their infrastructures, while other modes have to carry them. To avoid the problems associated with a deficit, the Commission advocates the raising if necessary of marginal social cost by a rent designed to procure the necessary supplementary revenues to balance the budget. The Commission recognises that the additional constraint of budgetary equilibrium is an ambiguous concept, and that it is necessary to determine the period for recovery and the pattern of cost recovery over the period. Access to loanable funds would be a major factor determining ability to spread the costs of investment over time. A further problem would be to determine the extent of the regional or modal sub-network over which the constraint of financial balance should operate, and to agree on a system of allocating costs between modes, and within modes: for example, the cost responsibility of commercial vehicles vis-a-vis cars (Gwilliam and others [9]).

4. Pricing at full economic costs

Commercial, rather than marginalist, principles constitute the basis of the full economic costs charging system. Its objective is to cover the costs incurred in the provision and utilisation of the existing infrastructures. The full economic cost is composed of maintenance and running costs of the facility plus the costs of capital, consisting of the amortisation costs and the interest on invested capital. In allocating these costs among users a distinction is drawn between marginal wear and tear costs

and the costs of the provision of capacity independent of the level of use. The full cost system is essentially only a method of calculating the costs, and not a solution to the problem of pricing the use of infrastructures.

The Commission concluded that "pricing for financial balance" conforms most closely to the two principal objectives: optimal utilisation of existing infrastructures, and finance for running costs and expansion of the network.

E.E.C. PROPOSALS FOR COMMERCIAL VEHICLE TAXATION

According to the existing E.E.C. proposals for commercial vehicle taxation [21], member states are to be left free to determine the general level of taxation, and as a first stage adjustment should be limited to the harmonisation of the structures of taxation systems, i.e. the method of application, the bases of calculation, and the ratios between the rates applicable to the various taxation classes. A special tax is to be introduced for the use of road infrastructure, replacing current taxes and dues on the possession or use of commercial vehicles, as specified in Article 2:

Belgium: taxe de circulaiont sur les vehicles automobiles (vehicle tax);
France: (a) taxe special pour l'usage des infrastructures routières (axle tax) and (b) taxe differentielle (differential tax);
Germany: Kraftfahrzeugsteuer (commercial vehicle tax);
Italy: (a) tassa de circulazione sugli autoveicoli (vehicle tax) and (b) tassa addizionale de 5% sulle tasse di circulazione (additional 5% on vehicle tax);
Luxembourg: taxe de circulation sur les vehicles automoteurs (vehicle tax);
Netherlands: motorrijtuigenbelastung (vehicle tax);
Denmark: vaegtafgift of motorkørtøger m.v.;
U.K.: annual licence duty;
Eire: annual licence duty.

The framework for determining the tax rates of different commercial vehicle categories is set out in Article 9, paragraph 1:

> "Account is taken of the following elements, established on the basis of average national conditions of use of vehicles in the various taxation classes, per vehicle and per annum:
>
> (a) marginal 'wear and tear' costs;
> (b) fuel taxes;
> (c) difference between (a) and (b)."

Marginal "wear and tear" cost is further defined as "the increase in maintenance, renewal, operation and management costs of road infrastructures caused by one additional vehicle movement" (Article 9, para 2(a)).

Further guidance on the method for determining the tax rates appears in the Preamble to the Directive, which states in somewhat ambiguous terms: "Whereas the levels of this tax must be established so that they reflect the respective responsibilities of the various vehicles with respect to the costs occasioned by their movement; whereas to this end, it is important that differences in absolute value between the rates applicable to the various taxation classes should equal these between the total average annual marginal 'wear and tear' costs occasioned by vehicles belonging to these same classes, bearing in mind the taxes on fuel which also bear on their circulation . . ."

Different scales would be drawn up for the implementation of the new tax, within which scales would be allocated to commercial vehicles as a function of their types and of their total permitted laden weight. A "type" is defined by the number of axles of the vehicle and their arrangement, as well as, where necessary, by the constructional characteristics of the vehicle (Article 7). As soon as the vehicle was put into use the new tax would be payable, and payment would be made for periods laid down by each member state, but not less than 3 months (Article 15).

U.K. COMMERCIAL VEHICLE TAXATION AND THE E.E.C. PROPOSALS

The major implication of the E.E.C. proposals for U.K. commercial vehicle taxation is that the existing annual Excise Licence Duty would be replaced by a new Road Wear and Tear Tax. In Tables 1 and 2 an attempt is made to estimate such a tax based on current E.E.C. proposals.

In Table 1 the calculation of the Road Wear and Tear cost is based on the following formula:

Road Wear and Tear Cost arising from vehicles in category i

$$= R \left[\frac{A_{Li}K_{Li}V_i + A_{ui}K_{ui}V_i}{\sum_{i=1}^{56} A_{Li}K_{Li}V_{Li} + A_{ui}K_{ui}V_i} \right]$$

Road Wear and Tear Cost per vehicle in category i

$$= R \left[\frac{A_{Li}K_{Li} + A_{ui}K_{ui}}{\sum_{=1}^{56} A_{Li}K_{Li}V_L + A_{ui}K_{ui}V_i} \right]$$

where: R = aggregate road maintenance expenditure attributable to commercial vehicles
A_{Li} = estimated standard axle laden
A_{ui} = estimated standard axle unladen
K_{Li} = annual average kms laden
K_{ui} = annual average kms unladen
V_i = number of vehicles in each of the 56 gross vehicle weight categories distinguished.

Evidence on road maintenance costs attributable to different categories of commercial vehicles is scanty. Some tentative estimates of road maintenance costs allocatable to commercial vehicles are presented in the Ministry of Transport Memorandum to the Geddes Committee on licensing [7]. Maintenance consists of a wide range of activities, which are not all related in the same way to use of the roads by particular types of vehicles. Following the Geddes submission, four categories may be distinguished:

(i) Repair
(ii) Preventive maintenance
(iii) Miscellaneous work on drainage, kerb renewal, etc.
(iv) Provision of signs, signals and road markings.

One of the Ministry's estimates (the least favourable to commercial vehicles) on a percentage basis suggests that 35·4% of total road maintenance expenditure should be allocated to vehicles over 1 ton unladen weight. The total 1972/73 maintenance expenditure on roads in Great Britain was £231 million, and 35·4% of that is £81·8

million. In Table 1 this road maintenance expenditure is reallocated between different categories of commercial vehicles on the basis of their estimated road "wear and tear" effect.

The road "wear and tear" factor is derived from the estimated numbers of vehicles in each gross vehicle weight category; kilometres travelled, laden and unladen; and number of standard axles. The number of standard axles is estimated by assuming that a single pass over a section of road by an 18,000 lb. axle has a road damage factor of 1·0, and all other axle weights are related to it on the basis of the "fourth power law" [15]. The fourth power law is derived from a series of tests undertaken by the American Association of State Highway Officials (A.A.S.H.O.), and postulates that relative road wear is a function of the fourth power of the ratio of axle loadings. Although subject to criticisms (International Road Transport Union, [11]), in the absence of any other authoritative empirical work the "fourth power law" is generally accepted in assessing road wear and tear.

TABLE 1

Estimated Road "Wear and Tear" Costs of Commercial Vehicles:

Vehicle Category Gross Vehicle Weight (Tons)	*Estimated Standard Axle Laden* (a) $(A)_{Li}$	*Estimated Standard Axle Unladen* (a) (A_{ui})	*No. of Vehicles* (b) (V_i)	*Annual Average kms Laden* (b) (k_{Li})	*Annual Average kms* (b) *Unladen* (k_{us})	*Estimated Road Wear and Tear Cost per vehicle £ p.a.*
Two Axle Rigid						
5	0·0162	0·0012	34000	12277·8	4822·2	1·00
6	0·0651	0·0026	31300	13211·2	5188·8	3·00
7	0·1279	0·0040	26400	13785·6	5414·4	6·00
8	0·2212	0·0058	33600	13763·4	6536·6	10·50
9	0·3898	0·0090	31800	14509·2	6890·8	20·00
10	9·5645	0·0133	31600	15526·2	7373·8	30·50
11	0·8500	0·0178	30150	16611·0	7889·0	49·50
12	1·0638	0·0237	22800	17695·8	8404·2	66·00
13	1·4532	0·0275	27600	18196·2	8983·8	92·00
14	1·8104	0·0325	9600	19820·8	10579·2	125·00
15	2·2371	0·0385	8100	22037·6	11762·4	172·00
16	2·7050	0·0442	91000	27840·4	14859·6	262·50
Three Axle Rigid						
15	0·4995	0·0102	1000	17734·4	9465·6	31·00
16	0·6544	0·0120	450	19951·2	10648·8	45·50
17	0·7702	0·0155	1400	20994·4	11205·6	56·50
18	1·0044	0·0201	1000	22559·2	12040·8	79·00
19	1·2131	0·0239	350	24645·6	13154·4	104·50
20	1·5423	0·0283	14400	26014·8	13885·2	140·00
21	1·9465	0·0336	400	31491·6	16808·4	213·50
22	2·4375	0·0398	10800	32404·4	17295·6	275·50
23	2·8101	0·0463	100	33269·0	18231·0	326·00
24	3·4527	0·0517	2100	34431·8	18868·2	414·00

Vehicle Category Gross Vehicle Weight (Tons)	*Estimated Standard Axle Laden* (a) (A_{Li})	*Estimated Standard Axle Unladen* (a) (A_{ui})	*No. of Vehicles* (b) (V_i)	*Annual Average kms Laden* (b) (k_{Li})	*Annual Average kms* (b) *Unladen* (k_{us})	*Estimated Road Wear and Tear Cost per vehicle £ p.a.*
Four Axle Rigid						
24	1·7112	0·0220	12200	32106·2	17593·8	191·00
25	2·1578	0·0244	1000	33269·0	18231·0	249·50
26	2·4188	0·0273	2500	36886·6	20213·4	310·00
27	2·7078	0·0302	100	38501·6	21098·4	362·50
28	3·0260	0·0335	400	40052·0	21948·0	421·50
29	3·3770	0·0372	200	42119·2	23080·8	494·50
30	3·7630	0·0410	500	44703·2	24496·8	584·50
Three Axle Articulated						
10	0·0911	0·0087	5000	6520·0	3480·0	2·00
11	0·1356	0·0106	650	7302·4	3897·6	3·50
12	0·1995	0·0128	900	8932·4	4767·6	6·50
13	0·2795	0·0150	500	11018·8	5881·2	11·00
14	0·3814	0·0175	500	13628·8	7273·2	18·50
15	0·5095	0·0205	500	16300·0	8700·0	29·50
16	0·6674	0·0241	4700	20994·4	11205·6	49·50
17	0·8774	0·0271	600	23080·8	12319·2	71·00
18	1·1358	0·0312	3600	25167·2	13432·8	100·00
19	1·4495	0·0359	2600	25688·8	13711·2	130·50
20	1·8255	0·0411	4900	26210·4	13989·6	167·50
21	2·2719	0·0470	100	26210·4	13989·6	208·00
22	2·7971	0·0540	1700	26732.0	14268·0	261·00
23	3·4108	0·0612	500	27318·8	14581·2	325·00
24	4·1213	0·0689	9100	27384·0	14616·0	393·50
Four Axle Articulated						
22	1·0826	0·0452	1300	22868·4	12531·6	87·50
23	1·3493	0·0458	100	23385·2	12814·8	111·00
24	1·6692	0·0555	2900	24935·6	13664·4	146·50
25	1·9229	0·0669	1400	27067·4	14832·6	183·00
26	2·3414	0·0673	2400	32235·4	17664·6	265·00
27	2·7978	0·0682	500	33269·0	18231·0	326·00
28	3·3446	0·0687	4300	34819·4	19080·6	407·00
30	3·9370	0·0703	6200	37984·8	20815·2	521·50
31	4·2871	0·0713	100	40052·0	21948·0	598·50
32	4·7268	0·0722	34000	41602·4	22797·6	685·00
Five Axle Articulated						
32[1]	2·2417	0·0337	3600	40568·8	22231·2	317·00
32	2·2220	0·0697	800	40568·8	22231·2	314·50

[1] Tri-Axle Trailer.

Sources: (a) A survey of vehicle specifications.
(b) *The Continuing Road Goods Survey.* H.M.S.O.

In Table 2 estimates are made of fuel tax paid by each category of vehicles. The difference is taken between the fuel tax estimates and road wear charges, providing the basis for a structure of taxation reflecting road wear and tear costs along the lines set out in Article 9, paragraph I. The structure of taxation would be such that, for example, taking the 32 ton G.V.W. five-axle articulated vehicles as a base, the 24 ton and 10 ton G.V.W. three-axle articulated vehicles might pay £680.50 and £837.50 more respectively; the 24 ton and 15 ton G.V.W. three-axle vehicle might pay £525.50 and £659.50 more respectively; and the 16 ton and 5 ton G.V.W. two-axle rigid vehicles £659.00 and £799.50 more respectively.

In calculating the road wear and tear factor in Table 1 the average standard axles are based on "nominal loads" derived from a survey of vehicle specifications.

TABLE 2

The Structure of the Road Wear and Tear Tax
(£ per vehicle per annum)

Vehicle Category Gross Vehicle Weight (tons)	*Road Wear and Tear Cost (1)*	*Existing Fuel Tax (2)*	*Difference between (2) and (1) (3)*
Two Axle Rigid			
5	1·00	140·50	−139·50
6	3·00	160·50	−157·50
7	6·00	179·00	−173·00
8	10·50	202·50	−192·00
9	20·00	217·50	−197·50
10	30·50	237·00	−206·50
11	49·50	258·50	−208·00
12	66·00	280·50	−214·50
13	92·00	306·00	−214·00
14	125·00	340·00	−215·00
15	172·00	385·50	−213·50
16	262·50	542·50	−280·00
Three Axle Rigid			
15	31·00	310·50	−279·50
16	45·50	388·50	−343·00
17	56·50	383·00	−326·50
18	79·00	420·50	−341·50
19	104·50	469·50	−365·00
20	140·00	557·50	−417·50
21	213·50	675·00	−461·50
22	275·50	694·50	−419·00
23	326·00	757·50	−431·50
24	414·00	827·50	−413·50
Four Axle Rigid			
24	191·00	771·50	−580·50
25	249·50	738·00	−488·50
26	310·00	840·00	−530·00
27	362·50	900·50	−538·00
28	421·50	1083·00	−661·50
29	494·50	1139·00	−644·50
30	584·50	1208·50	−624·00

Vehicle Category *Gross Vehicle Weight (tons)*	*Road Wear and Tear Cost* (1)	*Existing Fuel Tax* (2)	*Difference between (2) and (1)* (3)
Three Axle Articulated			
10	2·00	103·50	−101·50
11	3·50	120·50	−117·00
12	6·50	159·50	−153·00
13	11·00	201·00	−190·00
14	18·50	254·00	−235·50
15	29·50	310·50	−281·00
16	49·50	409·00	−359·50
17	71·00	460·00	−389·00
18	100·00	513·50	−413·50
19	130·50	537·00	−406·50
20	167·50	561·50	−394·00
21	208·00	561·50	−353·50
22	261·00	573·00	−312·00
23	325·00	616·50	−291·50
24	393·50	652·00	−258·50
Four Axle Articulated			
22	87·50	494·50	−407·00
23	111·00	532·50	−421·50
24	146·50	599·50	−453·00
25	183·00	669·00	−486·00
26	265·00	820·50	−555·50
27	326·00	872·00	−546·00
28	407·00	941·50	−534·50
30	521·50	1095·50	−574·00
31	598·50	1195·00	−596·50
32	685·00	1285·50	−600·50
Five Axle Articulated			
32[1]	317·00	1253·50	−936·50
32	314·50	1253·50	−939·00

[1] Tri-Axle Trailer.

Sources: Table 1 and fuel consumption estimates derived from road tests in *Motor Transport* and *Commercial Motor.*

Given that the objective of the new tax structure is to charge a price reflecting the actual road wear and tear imposed by a vehicle category, the measured "on the road" or "effective load" basis for estimating standard axles has obvious advantages. Unfortunately data available on "effective loads" is very limited. In Table 3 a comparison is made between average standard axles based on nominal loads (as in Table 1) and "effective loads", derived from a limited sample of axle loads as measured for different vehicles on the road at test sites on the M1, A40 and A30 (Croney and Watkins [53].)

The "effective load" basis for estimating standard axles would result in a much more skewed distribution of the road wear and tear costs. A far bigger survey covering different types of roads would be required before a system of charges could be based on the effective load approach. Also the sample, since it was based on actual loads, includes overloaded vehicles breaking the law. The effective load of legally operated vehicles is more likely to be closer to the ratio of the nominal loads.

TABLE 3

Comparison of "Nominal Load" and "Effective Load" Bases for Measuring Standard Axles

Vehicle Category	*Estimated Average Standard Axles*		*Ratio of Average Standard Axles*	
	Using Nominal Loads	*Using Effective Loads*	*Using Nominal Loads*	*Using Effective Loads*
2 Axle Rigid	1·12	0·39	1·00	1·00
3 Axle Rigid	1·90	0·86	1·71	2·21
4 Axle Rigid	1·98	1·90	1·78	4·87
3 Axle Artic	1·64	0·98	1·47	2·51
4 Axle Artic	4·12	2·73	3·69	7·00
5 Axle Artic	2·28	2·89	2·04	7·41

HARMONISATION OF COMMERCIAL VEHICLE TAXATION

How successfully do the proposals for harmonisation of commercial vehicle taxation meet the primary objectives stipulated by the Commission for an infrastructure charging system?

(a) *The charging system must optimise the use of infrastructure facilities*

The draft Directive on harmonisation of commercial vehicle taxation [21] adopts marginal social cost as a basis for the charging system. Marginal social cost is defined as marginal road "wear and tear" costs. Since it is only infrequently that central or local government has to consider whether rising traffic on any particular road is going to necessitate long-run capital expenditure rather than the relatively small short-run cost of maintaining a road, and since for most roads there is a very large gap between total and marginal costs, a short-run marginal cost pricing system may have its advantages. The existing structure of U.K. commercial vehicle taxation evolved haphazardly over time. It is sometimes suggested that annual licence duty may reflect road wear and tear costs. Figures 2 and 3 show clearly that it does not.

However, the E.E.C. proposal to equalise the total tax on each vehicle category, and then to reflect only the absolute value differences of its road wear and tear effect, is a very narrow basis for a marginal social cost charging system. Implementation of the tax relationship set out in Article 9 would greatly improve the competitiveness of heavier vehicles, particularly on a tonne-km basis. As a result the other constituents of marginal social cost identified by the Commission but excluded from the draft Directive charging system (namely, congestion and other environmental effects) could increase significantly. Moreover, an additional constituent of marginal social cost, omitted from the draft Directive and the general studies of the Commission on infrastructure pricing, is the energy shadow price element of vehicle taxation, which is now so important. The draft Directive would result in at least one hidden cost being reflected by the tax structure. However, unlike fuel tax, the proposed tax is a lump sum tax levied annually and not directly related to the cost of a particular additional journey. Unfortunately as yet no measures of dispersion are available for

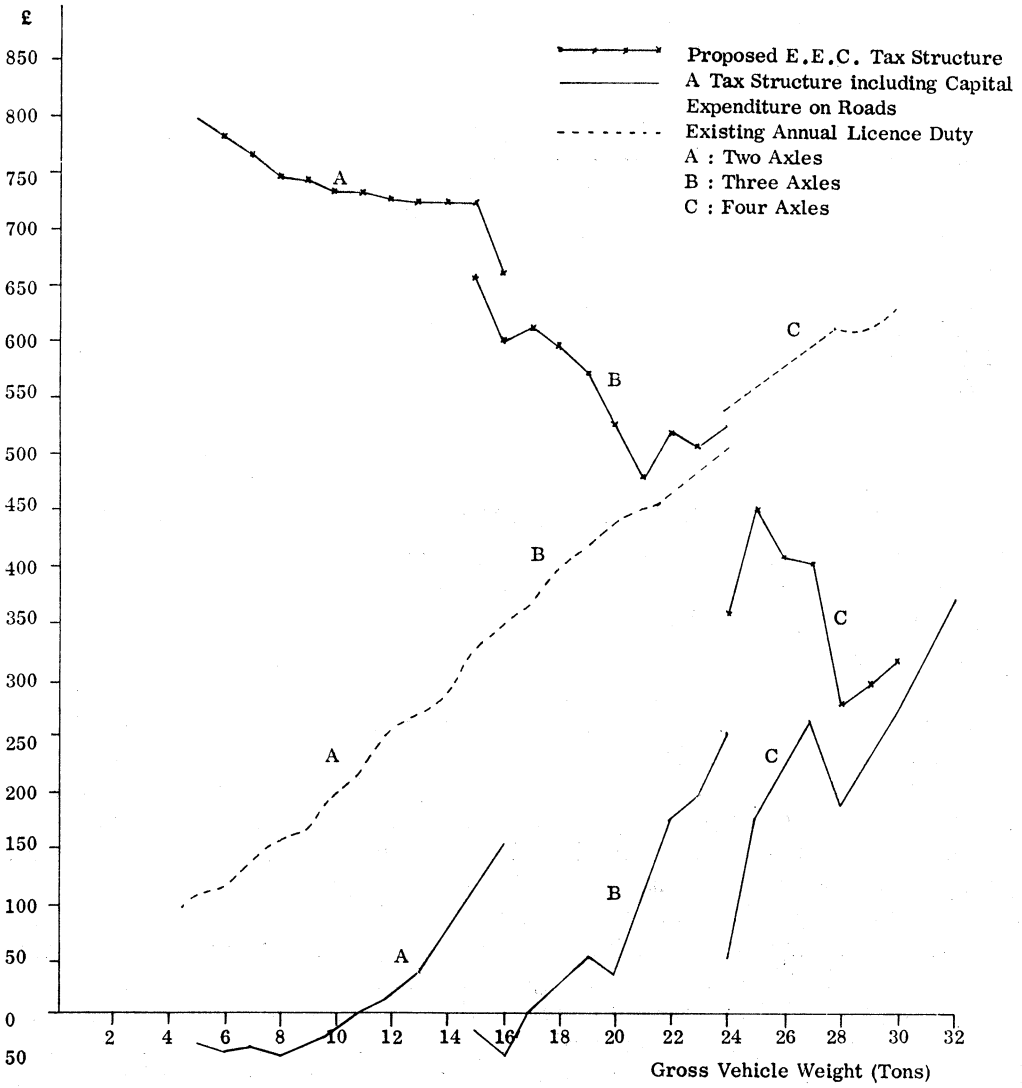

FIGURE 2

A Comparison of Existing U.K. Annual Licence Duty, the Proposed E.E.C. Tax Structure, and a Tax Structure Including Capital Expenditure on Roads: (*£ per vehicle per annum*)

Rigid Vehicles

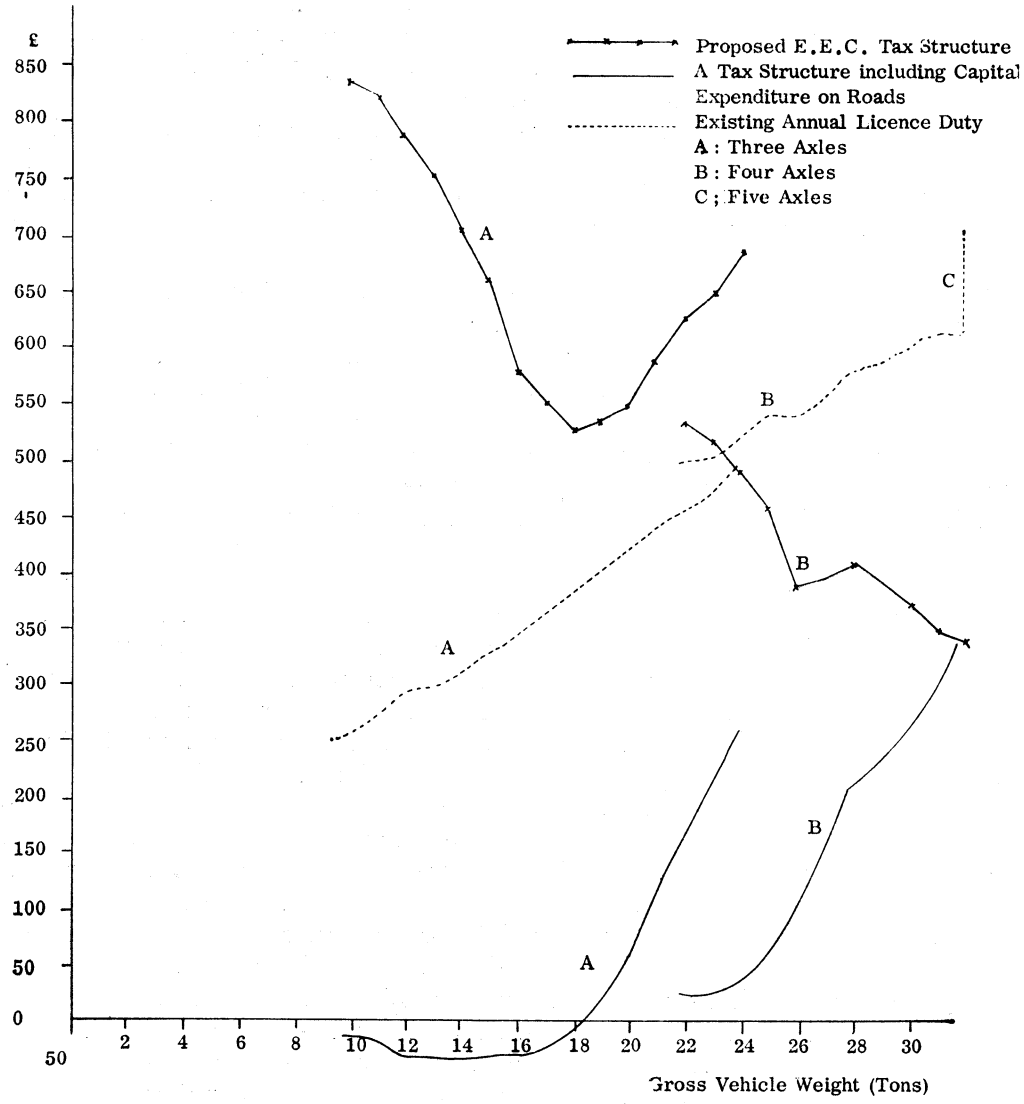

FIGURE 3

A Comparison of Existing U.K. Annual Licence Duty, the Proposed E.E.C. Tax Structure, and a Tax Structure Including Capital Expenditure on Roads: (*£ per vehicle per annum*)

Articulated Vehicles

the data derived from the Continuing Road Goods Survey used in Table 1. Inefficiency could result if there were a significant degree of dispersion for distance travelled by individual vehicles within each weight category. It is disappointing to note this gap in Ministry statistics, and the importance of having estimates of variance for kilometres per vehicle to evaluate this form of tax was emphasised ten years ago by Harrison [10]. Also there is a wide range of variation in the public costs of providing roads of different types, and it could be argued that a charging system should encourage users to travel where marginal wear and tear costs are low, and discourage them elsewhere.

A related problem is the flexibility of a Road Wear and Tear Tax over time as conditions change. Article II of the Directive states: "The rates of the tax for road infrastructures are compulsorily revised when the elements mentioned in Article 9 paragraph I are subject to changes likely to substantially affect the differences in absolute value between the rates corresponding to the various taxation classes".

As Walters [16] has observed: "The necessity for political approval for any change in the taxation system means that the price is quite rigid for long periods. While the taxation and road pricing system is controlled directly by the legislature this long lag seems to be part of the nature of the political process. A concensus of opinion requires a long time to organise and secure."

An evaluation of the efficiency of the proposed tax revisions should be based on accurate knowledge of elasticities and substitution. From the efficiency point of view, if there is zero elasticity of substitution it does not matter what charges are made. If elasticities are high it matters correspondingly more that relative prices should be "right". Between goods carried in heavy and in light commercial vehicles elasticities are likely to be high. In contrast, empirical evidence indicates that price elasticities of demand for road haulage services are low. A U.K. study of consignments shipped in the manufacturing sector revealed that price was not an important factor influencing the distribution of traffic between modes (Bayliss and Edwards [3]). Price substitution elasticities were −0·21 for own account versus professional operations, and a similar result was found for professional road haulier versus rail, but this was not significant at the 5% level. A Dutch modal split study based on a consignment analysis found price substitution elasticities between road and inland waterways of −0·04 for semi-manufactured goods, and −1·1 for sand and gravel [13]. Results of investigations into shippers' knowledge of transport prices also imply price inelasticity. The U.K. study of transport demand in the manufacturing sector found that only in relation to about 25% of consignments dispatched was the shipper able to give *any* indication of the charge by an alternative mode. A similar study in Germany [6] found that 50% of industrial companies and 75% of trading companies made no systematic charges comparisons. Given such low elasticities, it could be argued that any desired changes in modal split are likely to be more successfully achieved by regulations. The whole problem is complicated by a lack of empirical data on how taxation in its various forms affects operating costs and substitutions in road haulage. Further confusion arises from the admission that, for purely fiscal reasons unconnected with any arguments about the allocation of marginal social cost, each member Government has the authority to increase or decrease the general level of taxation on a class of vehicle road users.

Given marginal cost pricing and adoption of the appropriate investment policies for maximisation of social surplus, competition would achieve an efficient allocation of resources within the transport sector. If marginal cost pricing were to exist throughout the economy and if there were no non-market externalities, this would result in a Pareto-optimal allocation of resources, so that no further change in the allocation of resources could make someone better off without making someone else worse off. Marginal cost pricing is however not consistently applied, either across the economy as a whole or in other transport sectors. Analysis of second-best effects throughout the economy is very complicated [14]. Empirical investigations are few, and none have taken place in transport.

The practical question to be determined is whether or not there is prima facie evidence that one factor can be substituted for, or found complementary to, another in such a way that net welfare losses elsewhere will more than offset the welfare gain from implementing marginal cost pricing. Since inland waterways are relatively unimportant in the U.K., the pertinent relationship is that between price and marginal cost on rail. We have already noted that the marginal rate of substitution between road and rail appears to be low. On most roads and for most classes of traffic a change in road prices is unlikely to lead to appreciably greater use of railways. This factor has led Foster [8] in his reassessment of the transport problem to shift his priorities:

"As the amount of road traffic declines for which the railways are an effective competitor, so the probability declines that introducing marginal social cost pricing on roads, without similarly introducing marginal social cost pricing on rail, will result in an overall welfare loss. With hindsight, even then (1963), I suspect I was giving the traditional policy of co-ordination of criteria in transport more weight than its effect on the efficient allocation of resources deserved."

(b) *The charging system should fulfil a function of providing finance.*

The draft Directive makes no provision for an additional financing constraint in the proposed charging system. The characteristic of joint costs complicates any attempt to attribute costs of track to individual user categories. Adopting a similar method to the "cost responsibility" approach used in the Track Cost Report, capital costs per vehicle may be attributed on the following lines:

$$Cg\left[\frac{W_{Li}K_{Li} + W_{ui}K_{ui}}{\sum_{i=1}^{56} W_{Li}K_{Li}V_i + W_{ui}K_{ui}V_i}\right] + C_R\left[\frac{P_{Li} + P_{ui}}{\sum_{i=1}^{56} P_{Li}V_i + P_{ui}V_i}\right]$$

where C_g = 17·5% of total capital expenditure on roads directly attributable to commercial vehicles.

C_R = Residual of capital expenditure attributed to commercial vehicles on the basis of P.C.U. vehicle kilometres.

W_{Li} = Gross vehicle weight of category i.

K_{Li} = Annual average kilometres laden.

K_{ui} = Annual average kilometres unladen.

P_{Li} = P.C.U. kilometres laden.

P_{ui} = P.C.U. kilometres unladen.

V_i = Number of vehicles in each of the 56 gross vehicle weight categories distinguished.

The British Railways Board in its evidence to the Geddes Committee argued that over 70% of the cost of building a high capacity road would be saved if it did not need to be designed for heavy vehicles. This estimate received no support, and further work by the Ministry of Transport suggested that 17½% was a more realistic potential saving. This proportion of capital expenditure on construction and major improvements may then be allocated between individual commercial vehicle categories on the basis of gross-tonne-kilometres, as in Table 4. The residual capital cost is then allocated between cars, commercial vehicles and passenger service vehicles on the basis of P.C.U. kilometres, which are generally accepted as a measure of the space occupied by, and the effect on traffic flow of, different types of vehicles. Figures 2 and 3 show total capital and maintenance costs, and the tax structure including estimated capital expenditure attributable to commercial vehicles, assuming the 32 ton G.V.W. five-axle articulated vehicle as the base. Given the higher capital costs imposed by the heavier commercial vehicles, if capital costs were included in the E.E.C. proposed tax structure the competitiveness of lighter commercial vehicles would be relatively improved.

To adopt the E.E.C. Commission's proposal that under this system of raising finance "the whole of the revenue raised by the pricing system should be used for the running and improvement of the infrastructures" [22] would be a significant breach in the principle of non-hypothecation held by the U.K. Treasury. Earmarking has been criticised by many economists as a poor budgetary procedure, since it introduces rigidities and does not permit a proper allocation of general revenue between competing uses [4]. However. in this particular instance it may be argued

TABLE 4

Allocation of Capital and Maintenance Expenditure Attributable to Commercial Vehicles

Vehicle Category (GVW Tons)	*Maintenance Cost (1)*	*Capital Cost*		*Total Cost (4)*	*Fuel Tax Revenue (5)*	*Difference between (4) abd (5) (6)*
		Gross Tonne kms (2)	*PCU Vehicle kms (3)*			
Two Axle Rigid						
5	1	26	87	114	141	−7
6	3	32	94	129	161	−32
7	6	45	98	149	179	−30
8	11	53	104	168	203	−35
9	20	62	101	191	218	−27
10	31	74	117	222	237	−15
11	50	87	125	262	259	+3
12	66	101	133	300	281	+19
13	92	112	142	346	306	+40
14	125	133	155	413	340	+73
15	172	159	172	503	386	+117
16	263	214	218	695	543	+152

Vehicle Category (GVW Tons)	*Maintenance Cost (1)*	*Capital Cost*		*Total Cost (4)*	*Fuel Tax Revenue (5)*	*Difference between (4) and (5) (6)*
		Gross Tonne kms (2)	*PCU Vehicle kms (3)*			
Three Axle Rigid						
15	31	128	139	298	311	−13
16	45	153	156	355	389	−34
17	57	171	164	392	383	+9
18	79	194	176	449	421	+28
19	105	224	193	522	470	+52
20	140	248	204	592	558	+34
21	214	315	246	775	675	+100
22	276	339	254	869	695	+174
23	326	365	263	954	758	+196
24	414	393	272	1079	828	+251
Four Axle Rigid						
24	191	370	253	814	772	+42
25	250	398	263	911	738	+173
26	310	458	291	1059	840	+219
27	363	496	304	1163	901	+262
28	422	534	316	1272	1083	+189
29	495	580	333	1408	1139	+269
30	585	637	353	1575	1209	+366
Three Axles Articulated						
10	2	33	51	86	104	−18
11	4	40	57	101	121	−20
12	6	53	69	128	160	−32
13	11	70	86	167	201	−34
14	18	93	106	217	254	−37
15	29	118	128	275	311	−36
16	49	162	164	375	409	−34
17	71	188	181	440	460	−20
18	100	217	197	514	514	0
19	130	233	201	564	537	+27
20	167	249	205	621	562	+59
21	208	261	205	674	562	+112
22	261	279	209	749	573	+176
23	325	297	214	836	617	+219
24	393	310	214	917	652	+265
Four Axle Articulated						
22	88	242	181	511	495	+16
23	111	258	185	554	533	+21
24	146	286	197	629	600	+29
25	183	323	214	720	669	+51
26	265	398	255	918	821	+97
27	326	426	262	1014	872	+142
28	407	461	275	1143	942	+201
30	522	535	300	1357	1096	+261
31	599	582	316	1497	1195	+302
32	685	623	328	1636	1286	+350
Five Axle Articulated						
32	317	616	320	1253	1254	−1
Tri-Axle						
32	315	610	320	1245	1254	−9

that the tax is linked to particular expenditures because the tax payments approximate to charges imposed on the consumer. This linkage may be efficient to the extent that the tax reflects variable costs, and equitable to the extent that it distributes costs in line with benefits received. Furthermore, the link may induce preference revelation and thereby contribute to improved decisions on expenditure. In view of the narrow definition of marginal social cost implicit in the E.E.C. Proposals, there are unlikely to be significant efficiency gains from earmarking.

CONCLUSIONS

1. Vehicle taxation has grown up haphazardly over time and there is little economic rationale underlying its existing structure. The defiscalisation objective, proposed as part of the E.E.C.'s common transport policy, could in principle lead to a more efficient use of infrastructure in the transport sector.

2. Marginal social cost pricing, which has significant advantages as a charging system for roads, forms the basis of the E.E.C. proposals for harmonisation between members of commercial vehicle taxation. If fuel tax were adjusted to reflect marginal social cost, since it is paid with each kilometre travelled, it would have a clear advantage. However, as yet administrative difficulties prevent its use to transmit the contribution to marginal social cost of different vehicle categories. *Faute de mieux*, a review of the annual vehicle licence duty is proposed in order that, making allowance for fuel tax, it will reflect marginal social cost.

3. Marginal social cost is defined very narrowly, by the draft Directive on harmonisation of commercial vehicle taxation, to include only road wear and tear. The framework for determining the structure of the proposed tax stipulates that the fuel tax on each vehicle category should be taken into account, and that the total tax burden should then be equalised to reflect only the absolute value differences of its road wear and tear effect. Implementation of this rule would improve the competitiveness of heavier vehicles. Since no account is taken of other constituents of marginal social cost (such as congestion, environmental effects, and an energy shadow price element), it seems unlikely that one of the main criteria set out by the Commission in selecting an infrastructure charging system, namely optimal use of infrastructure facilities from the point of view of society, will be complied with. There may however be substantive reasons why these other externalities are excluded, including the lump sum nature of the revised vehicle excise duty and the low elasticities of substitution. Regulations and other pricing measures may be more suitable instruments.

4. A second criterion adopted by the Commission in evaluating alternative infrastructure charging policies is the need to fulfil a function of providing finance. How serious the effects of a deficit may be largely depends upon institutional, social and political factors, rather than on economic factors. The draft Directive makes no provision for an additional financing constraint in the proposed charging system. The E.E.C. Commission proposes that the whole of the revenue raised by the pricing system should be used for the running and improvement of the infrastructures. This would involve a significant departure from the principle of non-hypothecation held by the U.K. Treasury, and is unlikely to result in an increase in efficiency.

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