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# ON THE OPTIMAL OUTPUT OF TRANSPORTATION IN AN IMPERFECT ENVIRONMENT

Gust Blauwens

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Universitaire Faculteiten St.-Ignatius
Prinsstraat 13 - 2000 Antwerpen

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In terms of welfare economics optimal outputs can be defined as those which maximize a social objective function $W(x_1,\ldots,x_n)$ subject to a transformation function $\Phi(x_1,\ldots,x_n)=o$, in which $x_i$ indicates the output of good i(1).

Of course this statement is merely definitional. It does not allow an explicit calculation op the optimal outputs, as long as the quantitative information and the value judgements for an explicit formulation of $\Phi$ and W are not given.

On the other hand, relying on the market mechanism to provide a mechanical solution to the problem would only be justified under a very restrictive set of assumptions (2) which do not fit economic reality.

In practice we cannot rely on the market mechanism to provide an optimal allocation. Nor do we have the data to calculate explicitly the maximum of W subject to $\Phi$. In this paper we shall try to find an in-between way. Our specific purpose is the formulation of welfare economic judgements on the optimal output of transportation in an economy which does not satisfy the conditions for perfect free market allocation and for which W and $\Phi$ exist, but are not explicitly known.

Of course, some assumptions must be made. If nothing is known or assumed about society's welfare function and market behaviour, then just any output may be optimal. Our procedure will be, to maintain only some items from the list of assumptions for perfect market allocation. In this way an imperfect environment is supposed, which still satisfies some remaining assumptions, but which represents reality more closely than the utopian perfect environment.

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(1) W is a Bergson-Welfare function (cfr. A. Bergson, A reformulation of certain aspects of welfare economics, Quaterly Journal of Economics, 52, 1938, pp.316-334.

(2) Cfr. S.K. Nath, A Reappraisal of Welfare Economics, London, 1969, pp.8-12.

## §1. THE REMAINING ASSUMPTIONS

First of all we need a concept of welfare. Let us assume

1.A. Society defines welfare as depending merely on the welfare of its individuals (1). $W=F(W_1,W_2,\ldots,W_p)$ for a group of p individuals. Furthermore $W_1,\ldots,W_p$, indicating individual welfare, are identical to individual preferences. This means that society's definition of individual welfare does noet criticize individual utility apprecia-tions. (If the individual is not given this authority to appreciate own welfare, assumption 1.D. becomes necessarily unreal).

1.B. Individual welfare depends on both economic and non-economic variables. It can be written as $W_i=f_i(x_{1i},x_{2i},\ldots x_{ni},z_{1i},z_{2i},\ldots z_{mi})$ in which $x_{1i},\ldots x_{ni}$ are the quantities of those goods which are made available to individual i against payment of a price, and $z_{i1}\ldots z_{mi}$ are all other factors affecting the welfare of individual i. Individual utility functions are defined as individual welfare functions in which the z-variables are, under a ceteris-paribus clause, replaced by their given constant values; thus $U_i=f_i(x_{1i},x_{2i},\ldots x_{ni},z^\circ_{1i},z^\circ_{2i}\ldots z^\circ_{mi})$ in which ° indicates constants. By definition the utility function and the individual's budget constraint contain the same variables: those which are subject to monetary compensation.

1.C. The distribution of income is assumed to be optimal, in the sense that the "marginal social significance" (1) $\frac{\partial W}{\partial U_i}=\frac{\partial W}{\partial W_i}$ attached by society's welfare function to individual i, equals $\frac{a}{\frac{\partial Ui}{\partial Yi}}$ such that $\frac{\partial W}{\partial U_1}\cdot\frac{\partial U_1}{\partial Y_1}=\frac{\partial W}{\partial U_2}\cdot\frac{\partial U_2}{\partial Y_2}=\ldots\ldots\ldots=\frac{\partial W}{\partial U_p}\cdot\frac{\partial U_p}{\partial Y_p}=a$, in which $Y_i$ is income of individual i, and a an arbitrary constant.

So far it is clear that our concept of welfare rests upon two value judgements, namely the complete reliance upon individual preferences (assumption 1.A) and the acceptance of the actual distribution of

(1) Cfr. O. LANGE, "The foundations of Welfare Economies", Econometrica, 10, 1942, p.215.

income as conform to the judgements of society on distributional equity (assumption 1.C). Point 1.B is not truly hypothetical. It is merely definitional, and will serve later on.

Let us now introduce an assumption about individual behaviour.

1.D. Consumers are price takers and maximize their utility functions, subject to the budget constraint $\sum_j p_j x_{ji} = Y_i$. $(j = 1,\ldots,n)$

($p_j$ = price of good j).

By virtue of this assumption, requiring $pj = \frac{\partial Ui}{\partial x_{ji}} / \frac{\partial Ui}{\partial Y_i}$, and of assumption 1.C stating $\frac{1}{\frac{\partial Ui}{\partial Yi}} = \frac{\partial W}{\frac{\partial Ui}{a}}$, if the unit of W is defined such that a=1, we have $pj = \frac{\partial W}{\partial U_i} \cdot \frac{\partial Ui}{\partial x_{ji}}$ meaning that the price paid by any consumer represents the marginal contribution of the good to W through its impact on the individual utility-function. It is merely in order to obtain this very important result that assumptions 1.C and 1.D have been introduced. However, we are <u>not</u> going to introduce the traditional but very unrealistic assumption that economic activity can provide x-variables without affecting the z-variables. Neither are we going to suppose that pj represents the full effect $\frac{\partial W}{\partial x_{ji}}$. On the contrary we define

$$\frac{\partial W}{\partial x_{ji}} = \frac{\partial W}{\partial W_i} \cdot \frac{\partial U_i}{\partial x_{ji}} + \sum_k \sum_l \frac{\partial W}{\partial Wk} \cdot \frac{\partial W_k}{\partial z_{lk}} \cdot \frac{\partial z_{lk}}{\partial x_{ji}} \qquad \begin{array}{l} k = 1\ldots p\text{(individuals} \\ l = 1\ldots m\text{(z-factors)} \end{array}$$

Thus $\frac{\partial W}{\partial x_{ji}}$, which we shall call the marginal direct value of good j; equals the price $p_j$ of good j plus a summation over k and l, indicating the marginal welfare effect through the impact upon z-factors. If we represent this summation, which is not accounted for by monetary compensation, with the symbol $Z_j$, we have $\frac{\partial W}{\partial x_{ji}} = p_j + Z_j$.

Next, let us assume

1.E. Producers maximize their profits. They buy primary factors or intermediate goods and transform these into other intermediate or final goods. These transactions are <u>not</u> supposed to take place on perfectly competitive markets. Thus, instead of maximizing profits at the point $p_j \cdot \frac{\partial xj}{\partial u_{ij}} = p_i$ ($u_{ij}$ beging an input and $p_i$ its price), producers will maximize their profits when (1)

$p_j(1+\frac{1}{e_j}) \cdot \frac{\partial x_j}{\partial u_{ij}} = p_i(1+\frac{1}{e_i})$ in which $e_j$ is the elasticity of demand for the output and $e_i$ the elasticity of supply of the input. We allow these elasticities to be finite.

We do not suppose either that every input or output is subject to monetary compensation. On the contrary the occurrence of unpaid factors or the creation of atmosphere in the sense of Meade (2) may be brought into our analysis, if the productions prevented or stimulated in this way are considered as an element of $Z_j$. (There should not necessarily exist a theoretical distinction between direct uncompensated effects upon the consumer's $z_{ji}$ and indirect uncompensated effects via other productions $x_{ji}$).

1.F. The supply of factors (labour and other) is fixed. Unless their price is zero their given quantity is fully employed. (This hypothesis prevents macro-economic arguments concerning the level of employment from intervening in our discussion, which focuses on mere efficiency within a situation of full employment.)

Points 1.A. to 1.F. define our imperfect environment. As compared to the utopian set of assumptions for perfect free market allocation a gain of reality is obtained by allowing for imperfections in competition and for external effects (upon z-variables or in the sense of Meade).

## §2. OPTIMAL OUTPUT OF TRANSPORTATION IN THE IMPERFECT ENVIRONMENT

Obviously, a market mechanism, characterized by our set of "imperfect"conditions, cannot achieve the absolute welfare maximum. What matters for the problem at hand is a second best optimum (3). We will investigate what output of transportation maximizes welfare, given a non-optimal behaviour in other industries. Such a second best

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(1) Cfr. E. MALINVAUD, Leçons de théorie microéconomique, Paris 1969, pp.64-69.
(2) J.E. MEADE, External Economies and Diseconomies in a competitive situation, The Economic Journal 62 (1952), pp.54-67.
(3) Cfr. LIPSEY and LANCASTER, The General Theory of Second Best, Review of Economic Studies, Vol.XXIV(1), nr.63, pp.11-32.

optimum is a sound criterion for a transportation policy which has to regulate its own industry and to consider the behaviour of other industries as given.

The second best optimum requires that the effect upon welfare of the marginal unit, produced in the imperfect environment, is zero. Now, this marginal welfare effect would equal the marginal direct value of transportation as defined under 1.D, only if transportation could be produced without affecting outputs of other goods. In this case it should be produced until $\frac{\partial W}{\partial x_t}=p_t+Z_t$ equals zero (the subscript t representing transportation).

It is clear, however, that producing $x_t$ will always involve changes in other outputs. These other productions are affected in two different ways:

1) The supply of an additional unit of transportation requires complementary production and substitutions which are launched either by the ultimate consumer or at intermediate levels. The effect exerted upon W in this way will be called the marginal <u>side</u> value of transportation, $S_t$. It consists of substitutions and complementary productions in other industries, diverting productive factors from an old occupation to a new one. If in this new occupation the diverted factors contribute more to consumer satisfaction, $S_t$ is positive and equals this additional contribution. If, however, the diverted factors contribute less to consumer satisfaction $S_t$ is negative. (Under perfect competition, factors produce the same consumer satisfaction in any application, such that marginal reallocations leave consumer satisfaction unchanged and $S_t$=o. This proves that the emergence of side values is typically related to an imperfect environment.)

An example of a positive side value $S_t$ may be given for transportation of a product that is manufactured by a monopolistic industry which has high profit margins but attracts factors from other industries with low profit margins. The monopolistic industry diverts factors from an allocation in which their product is valued at a low price to an occupation in which it is valued much higher. The productivity gain thus realized is a positive component of $S_t$.

2) Producing transportation will not only affect other outputs through the substitutions and complementary productions, launched by intermediate and final users, but also, and very substantially, by

engaging productive factors, thus by preventing alternative productions. The sacrificed welfare contribution of these alternative productions is to be regarded as the "opportunity cost of transportation". If the alternative production is represented by $x_a$ (a synthetic variable, representing the bundle of sacrificed products), the opportunity cost of one unit of transportation is $\frac{dx_a}{dx_t}(p_a+Z_a+S_a)$ in which

$\frac{dx_a}{dx_t}$ number of units $x_a$ secrificed for one unit $x_t$

$pa + Z_a$ marginal direct value of one unit $x_a$
$S_a$ marginal side value of one unit $x_a$.

There is no loss in generality when the unit of $x_a$ is defined such that $\frac{dx_a}{dx_t}=1$. Then we may write the complete marginal welfare effect of transportation as

$$p_t + z_t + S_t - p_a - Z_a - S_a \qquad (2.1)$$

with $p_t + Z_t$ = marginal direct value (cfr.1.D.)
$S_t$ = marginal side value
$p_a + Z_a + S_a$ = opportunity cost (defined analogously to own direct and side value).

In the optimum the expression (2.1) must equal zero. The symbols $p_t$ or $p_a$ represent prices paid by final consumers and consist first of a price $P_t$ or $P_a$, received by the transportation enterprise or the alternative producer and, second, of margins $M_t$ or $M_a$, added at further stages of production. (Only if the product is supplied directly to the consumer or if the consecutive intermediate producers face perfect competition, M equals zero.)

Thus $p_t$ and $p_a$ can be rewritten as $P_t+M_t$ and $P_a+M_a$, such that the optimality condition now reads:

$$P_t + M_t + Z_t + S_t - P_a - M_a - Z_a - S_a = o \qquad (2.2)$$

If we could quantify these eight terms, the optimal output of transportation could be determined. In the absence, however, of explicitly given W and Φ such a quantification is a hopeless matter, if we do not at least refer to the market information contained in the behaviour of producers who are presumed to maximize profits. For this reason we want to compare the optimal output $x_t^o$ satisfying (2.2) with the output $x_t^{\pm}$ automatically determined by free market behaviour of profit maximizers.

## §3. COMPARISON OF SOCIALLY DESIRABLE AND PROFIT MAXIMIZING OUTPUTS

As explained under 1.C the absence of perfect competition will cause the emergence of a positive margin between the factor price and the price at which the product of that factor is sold. If c is the market price of the (synthetic) factor required for the additional production of one unit $x_t$ or $x_a$, the use of this factor for transportation will convey a margin $(P_t-c)$, while its allocation to the alternative production whould convey the margin $(P_a-c)$. If profits are maximized these margins depend on elasticities of demand and factor supply.

From the identities
$$P_t \equiv c + (P_t - c)$$
$$c \equiv P_a - (P_a - c)$$

we have the trivial but important equality concerning $x_t^{\pm}$:

$$P_t \equiv P_a + (P_t-c) - (P_a-c) \qquad (3.1)$$

which states that the difference between the price, charged by the transportation firm and the price of the alternative production is exactly the difference between profit margins.

Equality (3.1) relates to the output $x_t^{\pm}$ automatically determined by profit maximizers. It clearly differs from equation (2.2) which defines the social optimum $x_t^o$:

$$P_t + M_t + Z_t + S_t - P_a - M_a - Z_a - S_a = o.$$

Nevertheless, under the traditional assumptions of a perfect environment, equalities (3.1) and (2.2) are identical. Under the first assumption, that economic activity does not affect z-factors (nor x-factors without monetary compensation) $Z_a$ and $Z_t$ equal zero. Under the second assumption of perfect competition (infinite elasticities of supply and demand, and marginal reallocations without influence upon consumer satisfaction) the margins $(P_t-c)$ and $(P_a-c)$, Mt and Ma and the side values $S_t$ and $S_a$ also equal zero. Expressions (3.1) and (2.2) are both reduced to $P_t=P_a$ and are thus identical.

However, in our imperfect environment with monopolistic profit margins (imperfect elasticities of supply and demand) and effects upon z-variables (3.1) and (2.2) may be essentially different. The outputs $x_t^o$ and $x_t^{\pm}$ will only be equal if

$$(M_a-M_t)+(Z_a-Z_t)+(S_a-S_t) = (P_t-c)-(P_a-c) \qquad (3.2)$$

The sufficient (but not necessary) conditions for 3.2 to hold are:

3.2.a) $(P_t-c)=(P_a-c)$: transport is confronted with the same elasticities of supply and demand as the alternative production.

3.2.b) $M_t=M_a$ : margins added to the price of transportation at further stages of production equal analogous margins added to the price of the alternative product.

3.2.c) $S_t=S_a$: the marginal side value of transportation equals the marginal side value of the alternative production.

3.2.d) $Z_t=Z_a$: the effects of transport upon z-variables are equivalent to the analogous effects of the alternative production.

If the conditions 3.2.a to 3.2.d are satisfied, profit maximizing coincides with the social optimum, even though the economic environment is imperfect. The result is logical. Conditions 3.2.a to 3.2.d eliminate the effects of imperfection by supposing that they are cancelled by exactly the same effects, attached to the alternative production.

The four assumptions are neutral and seem plausible at first sight. If no information at all is available about elasticities of supply and demand, nor about side values, it is sound to assume the equivalence of transport and other productions with regard to these points. This assumption, of course, does not convey the judgement that transport and its alternative production must in fact be equivalent. It only states that differences may occur in both directions, but with zero expectation. It only lays "the onus of counter-poof on those who defend an intervention in the market mechanism" (1). Of course, if counter arguments can be successfully developed to demonstrate that, e.g. $(P_t-c)<(P_a-c)$, there is a valid reason for corrective intervention.

Paragraph 4 will develop such counter-arguments. For this purpose, the alternative production $x_a$, which it is almost impossible to specify exactly if W and $\Phi$ are not given, is assumed to be an average sample of economic activity, with "average" profit margins, "average" side effects, etc. This assumption at least allows a reasonable pro-

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(1) D. MUNBY, The economics of road haulage licensing, Oxford Economic Papers, March 1965? p.111.

bability judgement, which is better than discontinuing the analysis with the agnostic lamentation that the true alternative production cannot be specified.

## §4. TRANSPORT VERSUS THE AVERAGE ECONOMIC ACTIVITY

### 4.1. The equality $(P_t - c) = (P_a - c)$

This equality will only hold, if the elasticities of factor supply $e^s_t$ and $e^s_a$ and of demand $e^d_t$ and $e^d_a$, experienced respectively by transportation firms (subscript t) and by the average firm (subscript a) satisfy the equality

$$\frac{1 + \frac{1}{e^s_t}}{1 + \frac{1}{e^d_t}} = \frac{1 + \frac{1}{e^1_a}}{1 + \frac{1}{e^d_a}}$$

It seems plausible to assume $e^s_t = e^s_a$. There is, at least at first sight, no sufficient empirical evidence to pretend that the elasticity of factor supply is systematically greater or smaller in the case of transportation than in the average case.

On the other hand, we do have some prima facie evidence about the elasticity of demand $e^d_t$. Transportation constitutes a highly competitive market in which price differences can easily incite customers to move from one competitor to an other. The market share of an individual firm is highly sensitive to its price and price cuts are the main instruments of competition. Even in those subsectors where oligopolistic price agreements occur, the threat of outside competition remains very real and profit margins tend to be low. The situation has been called "unbridled" or "ruinous competition".

At least we may posit that the majority of transporters are confronted with an exceptionally elastic demand, $e^d_t < e^d_a$.

The result of $e^d_t < e^d_a$ and $e^s_t = e^s_a$ is clear: $(P_t - c) < (P_a - c)$. Transportation margins tend to be systematically below the average. The provisional hypothesis $(P_t - c) = (P_a - c)$ should be rejected.

## 4.2. The equality $Z_t=Z_a$

The assumption $Z_t=Z_a$ has some reliability as long as $Z_t$ can be considered as an "average" percentage of private production costs c. This clearly does not hold. It is well known that transportation entails exceptionally high environmental costs, such as air pollution and congestion. These costs constitute an important negative component in $Z_t$, such that $Z_t<Z_a$ has more credibility than the provisional hypothesis $Z_t=Z_a$.

## 4.3. The equalities $M_t=M_a$ and $S_t=S_a$

In general it is difficult to establish whether margins $M_t$, added at further stages of production, or side values $S_t$ in the case of transportation do or do not exceed the average.

Transportation is supplied, sometimes directly to the final consumer and sometimes to intermediate customers. In the first case $M_t=o$, thus $M_t<M_a$. In the second case $M_t$ may exceed $M_a$. For transportation in general it seems very difficult to state whether $M_t<M_a$ or $M_t>M_a$. At least we do not yet possess the empirical evidence for this argument.

In the same way, it is impossible to infer from obvious empirical evidence a systematic difference between $S_t$ and $S_a$. These side effects are highly complex and can hardly be measured.

In special cases, some of which are treated hereafter, it is possible to determine $M_t$ and $S_t$ more sharply. In general, however, we cannot prove $S_t$ and $S_a$ or $M_t$ and $M_a$ to be systematically different.

# §5. A PROVISIONAL CONCLUSION

The result of $P_t-c<P_a-c$ (5.1)

$$Z_t<Z_a \quad (5.2)$$

$$S_t=S_a \quad (5.3)$$

$$M_t=M_a \quad (5.4)$$

is clear. The marginal welfare effect of transportation as defined by (2.2).

$P_t + M_t + S_t + Z_t - P_a - M_a - S_a - Z_a < o$. Output should be restricted. The reasons which cause $x_t^*$ to exceed the socially desirable output $x_t^o$ are twofold:

1) The profit margin ($P_t$-c) is forced too far down by the excessive competition on transportation markets. $P_t$ does not completely reflect the alternative price $P_a$. It has already been pointed out by other authors (1) that in an economy which is not perfectly competitive the rare industry that does face perfect competition has a tendency to produce too much. The factor price c underestimates the opportunity cost and this underestimation should be corrected by a sufficient profit margin ($P_t$-c). Only if the entire economy is characterized by perfect competition, factor prices reflect the ultimate consumer valuation of their product. Only if the entire economy is perfectly competitive, the traditional rule, that price should be set equal to the factor cost c, is valid.

2) Transportation causes environmental costs which are not borne by the producer. These costs exceed largely an average percentage of c. Thus the transfer of factors from an average economic activity to the transportation industry entails an increase of environmental costs, which is not reflected by the price mechanism.

It is clear that other arguments may be hidden by the supposed equalities (5.3) and (5.4). However, it is difficult to pronounce a general judgment about these aspects, which would be valid for the transportation industry as a whole (2).

## §6. SPECIAL CASES CONCERNING $M_t$

Obviously $M_t$ will depend on the degree of monopoly on the consecutive intermediate markets through which the transport service, embodied in a commodity, is transmitted. Yet more decisive is the length of the chain between the transporter and the final consumer, because the adding of margins is a cumulative process (3).

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(1) Cfr. F. Den HARTOG, Redelijke Economie, Leiden, 1966, p.120.

(2) Assuming the "equiprobability of the unknown" as in (5.3) and (5.4) is the only way out of the agnostic results, reached by LIPSEY and LANCASTER, op.cit., pp.31-32.

(3) Cfr. L.W. McKENZIE, Ideal Output and the Interdependence of Firms, Economic Journal, December 1951, pp.785-805.

For this latter reason, one could conclude that, in general, for transport supplied directly to the final consumer or in final stages of production $M_t < M_a$, while for transport of raw materials $M_t > M_a$.

Thus the restriction, advocated in §5, would have an increased desirability in the case of transport for account of final or semi-final customers. For transport at early stages of production, the argument points to the opposite direction. One could imagine that in some cases the difference $M_t - M_a$ is large enough to compensate for $(P_a - P_t)$ and $(Z_a - Z_t)$, such that stimulating output would be more desirable than restriction.

## §7. SPECIAL CASE CONCERNING $S_t$

In one very special case $S_t$ can be defined in such a specific way that the whole image of welfare effects is changed. This is the case of a restrictive measure which, instead of affecting the output of the transportation industry as a whole, only applies to a specific kind of transportation $x_1$, which is merely substituted by another kind of transportation $x_2$. Using the subscripts 1 and 2 for the marginal welfare effects of the two outputs under consideration, we may write $M_1 = M_2$ (because both outputs are supplied to the same customers) and

$$S_1 = -((P_2 - c_2) - (P_{a2} - c_2) - (M_{a2} - M_2) - (Z_{a2} - Z_2) - S_{a2}) \qquad (7.1)$$

meaning that the side effect of substituting $x_1$ for $x_2$ consists of taking up again the alternative production, formerly sacrified for $x_2$.

Now, the marginal welfare contribution of $x_1$ as defined by (2.2) is $P_1 + M_1 + Z_1 + S_1 - P_{a1} - M_{a1} - Z_{a1} - S_{a1}$ or after introduction of c, which is common to $x_1$ and its alternative production,

$$(P_1 - c) + M_1 + Z_1 + S_1 - (P_{a1} - c) - M_{a1} - Z_{a1} - S_{a1} \qquad (7.2)$$

Substituting (7.1) in (7.2) and regrouping yield

$$((P_1 - c_1) - (P_2 - c_2)) + ((P_{a2} - c_2) - (P_{a1} - c_1)) + (M_{a2} - M_{a1}) + (Z_{a2} - Z_{a1}) + (Z_1 - Z_2) + (S_{a2} - S_{a1}) \qquad (7.3$$

In the optimum this expression must equal zero.

If we assume that $x_2$ releases exactly those factors which are engaged by $x_1$, such that exactly those alternative activities are taken up again, which had to be sacrificed for producing $x_1$, all symbols with subscript $a_2$ may identically change the subscript 2 for the subscript 1. If we further assume that $x_1$ and $x_2$ entail exactly the same external costs $Z_1=Z_2$, the condition that (7.3) equals zero is reduced to $(P_1-c_1)=(P_2-c_2)$.

This result is very logical. If output $x_1$ is simply a substitute for output $x_2$, which at the margin, uses exactly the same factors and has exactly the same external costs Z, then for an optimal choice between $x_1$ and $x_2$ the margins above c should be equal in both cases.

It is to be noted that the original expression (7.3) under less restrictive hypotheses concerning external and opportunity costs, appeals to the same logic. If these costs differ between the competing activities $x_1$ and $x_2$, their difference should be reflected in the margins $(P_1-c)$ and $(P_2-c)$.

We thus have to supplement our provisional conclusions. If an output restriction applies only to a subset of transportation firms, with the mere result of diverting demand to the other firms, the comparison of $(P_t-c)$ with a general average $(P_a-c)$ and of $Z_t$ with a general average $Z_a$ is no longer relevant. A right decision may only result from the comparison between the competing firms.

## §8. GENERAL CONCLUSION REGARDING OUTPUT RESTRICTION IN TRANSPORTATION

a) A restrictive intervention affecting the total supply on a transportation market, close to final consumption, is desirable on the grounds that the external costs of transportation $(Z_t)$ are too high and margins $(P_t-c+M_t)$ too low in comparison with an average economic activity. The argument, however, becomes weaker, the longer the distance between the intermediate transporation market under consideration and final consumption.

b) A partial restriction, applying only to a subset of the suppliers on a given transportation market (the word suppliers also meaning haulage on own account) and resulting merely in transport diversion is only justified, if expression (7.3) is negative, i.e.

$$(P_1-c_1) < (P_2-c_2)+(Pa_1-c_1)-(P_{a2}-c_2)+(M_{a1}-M_{a2})+(Z_{a1}-Z_{a2})+(Z_2-Z_1)+(S_{a1}-S_{a2}) \quad (8.1$$

the subscript 1 indicating the restricted output and 2 the substitution output.

Imagine for instance a restriction on road haulage for hire ($x_1$) with the effect of a complete substitution by road haulage on own account ($x_2$). In that case ($P_2-c_2$) equals zero, for own production takes place at factor price without a margin being charged. Furthermore, as in both cases the same mode is used (road haulage) engaging analogous factors and causing analogous Z-effects, the right hand side of (8.1) may be assumed to approximate zero. Then, however s ll the margin ($P_1-c_1$) charged by road haulage firms may be, condition (8.1) is not satisfied. On the contrary, it would be advisable to replace transport on own account with zero margin ($P_2-c_2$) by transport for hire (1).

If,however, the effect of restricting road transport for hire is not its replacement by transport on own account but a diversion to e.g. rail transportation which has $P_2-c_2>o$ and $Z_2>Z_1$ (the subscript 2 now indicating rail instead of road haulage), the probability that (8.1) is satisfied is much greater and the restriction may very well appear to be justified.

We may conclude that in general there are some solid arguments to restrict the free market expansion of transportation activity. Ideally speaking, however, a restriction should be the most effective in those cases where profit margins are the lowest, opportunity costs and external costs the highest and the distance to the final consumer the shortest.

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(1)Munby wrongly concluded that there is no case for any differentiation between haulage on own account and haulage for hire (cfr. D. MUNBY, <u>op.cit.</u> p.129). Such a differentiation is desirable to compensate for already existing distortions in the imperfect environment.

## §9. LICENSING VERSUS OTHER METHODS OF RESTRICTION

Clearly, outputs may be restricted by various means:

1. taxation
2. control of charges
3. production quotas (direct restriction)
4. licensing (restriction of output capacity).

Among these methods, licensing seems to get special attention in the political debate on transportation. However, the merits of this method are severely limited by its crudeness and its lack of right selectivity.

In general, licensing only concerns transport for hire. This partiality is apt to divert traffic to haulage on own account, which according to §8 is an undesirable effect.

Taxation applying also to transport on own account does not present this wrong selectivity. Congestion tolls may even by differentiated between various kinds of output, thus charging in each case the specific amount of external costs. Taxes (as well as rate regulation or production quotas) may also be applied for specific submarkets, while licensing in general affects supply or potential supply on different markets, for which the restriction is not equally desirable.

The main reason why licensing is defended by the advoctes of transport industry are the monopolistic profits resulting from it. If the government, judging on the optimal distribution of income, deliberately wants to create such profits, it may prefer licensing above taxation. From this point of view, however, the questions arise, whether redistribution of income in favour of those households who earn their income in the transportion industry cannot be achieved by less disturbing methods, and whether value judgements of this kind ought to be posited at the level of transportation policy.

One might conclude that prima facie welfare economic arguments relating to an imperfect environment do advocate some output restriction for the transport industry. However, licensing is not the only way to achieve this restriction and except for reasons of income distribution it is definitely inferior to taxation.