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SUGGESTED APPROACHES TO THE PROBLEMS OF HIGHWAY TAXATION

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SYNOPSIS

Concepts of equity in highway taxation demand that just proportions of the burden be assigned among the three major classes of beneficiaries: the property directly served; the general public; and motor-vehicle users, respectively. Among the theories proposed to bring about an equitable solution of this problem the greatest promise is found in the theory of relative use, which would allocate highway tax responsibility in accordance with the extent to which different classes of highways render the following kinds of service: (1) direct access to land; (2) access to localities or neighborhoods; and (3) service to through traffic. Objective measures of these three kinds of service, in terms of the origins and destinations of traffic, are proposed; and it is recommended that the proposal be tested on a pilot-study scale before being seriously considered as a solution to the highway tax problem.

A similar problem arises with respect to the equitable assignment of motor-vehicle tax responsibility among vehicles of different dimensions and weights. The theory of differential costs, or increment theory, recognizing that vehicles of different sizes differ in the extent of their requirements for highway facilities, would allocate motor-vehicle tax responsibility in accordance with an ascending scale of cost requirements for vehicles in different weight groups, determined by study of highway engineering theory and experience. In spite of great technical difficulties encountered in the analysis, the incremental method has much to commend it, both from the standpoint of engineering theory and from that of equitable assignment of tax responsibility.

Serious weaknesses are found in the theory that motor-vehicle tax responsibility should be graduated in proportion to gross ton-miles traveled. There is no economic basis for the contention that the product of gross weight and distance is a measure of value of service; and the assertion that gross ton-miles constitute a measure of energy absorbed in transportation is contrary to the facts of motor-vehicle operation.

There is a basic validity in the concept that motor-vehicle taxes should be graduated in proportion to some measure of the value of highway service provided to the user, although this proposal fails to deal positively with the question of increased highway costs occasioned by the use of heavy vehicles. Two possible methods of measuring value of service are discussed, one based on the calculation of mileage-element and time-element savings resulting from road improvements, and one based directly on vehicular operating costs. It is indicated that the two methods would give very similar results. The use of the value-of-service concept in conjunction with the incremental cost analysis is recommended. The study of motor-vehicle operating costs, earnings, and rates is urged as essential to a highway tax investigation.

The problem of equity in highway taxation is two-fold. It is first necessary to find a means of assigning just proportions of the burden among the three major classes of beneficiaries: the property directly served; the general public; and motor-vehicle users, respectively. Once this task has been accomplished we are faced with the equally difficult

problem of allocating motor-vehicle tax responsibility among vehicles of different types, sizes, and classes of use.

THE ADDED-EXPENDITURE THEORY

In early studies of this subject, considerable support was given to the concept that motor-vehicle users as a group should be held responsible for all road and street expenditures in excess of the scale of expenditures prevailing during the period immediately prior to the advent of the motor vehicle. This theory was used by Messrs. Breed, Older, and Downs (*1*)[1] in their work as consultants of the railway interests. In modified form it was also used by the Federal Coordinator of Transportation in his report on the so-called public-aids problem (*2*).

Extreme difficult is encountered in fixing the point in history after which the influence of motor vehicles on highway expenditures became significant, years ranging from 1904 to 1920 having been used for this purpose. Critics of the added-expenditure theory have pointed out that the lusty good-roads movement which began in the 1890's would have resulted in a substantial upgrading of the highway plant even if the automobile had never been invented. The meagerness and inaccuracy of early records of road and street expenditures also cast grave doubt on the validity of such comparisons. Furthermore, the benefits derived from motor-vehicle use of the highways are benefits of today; and their present value is independent of any reference to conditions in an earlier period. These and other considerations led the Board of Investigation and Research, in its report on public aids to transportation (*3*), to reject the added-expenditure theory. Indeed, the further we recede from the pre-motor-vehicle era, the more unrealistic it becomes to look to that remote day for a basis on which to found a solution of present and future tax problems.

THE THEORY OF DIFFERENTIAL BENEFITS

The methods of calculating mileage-element and time-element savings resulting from road improvements, which were set forth in the Oregon State Highway Department Bulletin, "The Economics of Highway Planning" (*4*), were used as a basis for the allocation of highway tax responsibility in Bulletin No. 10 of the same Department (*5*). The calculated benefits or savings were distributed to the several road and street systems on a ton-mile basis. Their unit magnitudes were determined by a comparison of the improvement status of each system in the year of study, 1937, with its status at a pre-motor-vehicle stage of development. The year 1905 was used as the base year in this comparison.

As in the case of the added-expenditure theory, this procedure is open to the objection that motor vehicles derive benefits from what exists in the way of road and street improvements today, and not by virtue of a comparison with what did or did not exist in 1905. Recognition of this fact suggests a possible modification of the theory, in which motor-transport benefits would be calculated on the basis of the savings derived from annual increments of expenditure for improvement and maintenance of the several road and street systems.

There is also some reason to question the method used in the Oregon study to determine the amounts of transmitted benefits, defined as motor-transport benefits which, in their final incidence, accrue to the land or to the community, rather than to the motor-vehicle user. It was decided that the benefits derived from the use of private passenger cars should be allocated to the user alone; whereas all benefits derived from the use of trucks and busses, in excess of those balanced by user tax payments, should be allocated to the community or the land, depending on the class of use and the system on which the travel occurred.

To assume that the total benefits accruing to commercial vehicles are transmitted to the purchaser of the service, or to the community as a general beneficiary of commercial transportation, is, in effect, to assume that the commercial operator derives no benefit from his operations. In any further application of this method of analysis it would be desirable to find a means of indicating that a part of the excess benefit is retained by commercial users, rather than being transferred in total to the community and the land.

[1] Italicized figures in parentheses refer to list of references at the end of the paper.

THE THEORIES OF RELATIVE USE AND PREDOMINANT USE

A procedure which has been called the theory of relative use would allocate highway tax responsibility in accordance with the extent to which different classes of highways render different kinds of service. The service of direct access to land, although it is the predominant function of local roads and residential streets, is provided to some degree by all classes of highways except controlled-access facilities. Similarly, there is some through traffic even on unimportant roads and quiet streets. There is an intermediate service, that of providing access to neighborhoods, which is the primary function of roads and streets of intermediate traffic importance. This division of highway service into categories of land service, local or neighborhood service, and through-traffic service, immediately suggests the parallel allocation of tax responsibility to the land, the community or general tax base, and the motor-vehicle user.

This general approach was adopted by the Board of Investigation and Research in its public aids study; and was also used by the Federal Coordinator as an alternate to the added-expenditure method. Other students, including Dearing in his work on American Highway Policy (*6*), while accepting the theory, have advocated that its application be simplified by allocating tax support in accordance with the predominant use to which a given road or street system is put.

In applications of the theory of relative use, investigators have utilized data on traffic volume and composition, origins and destinations, trip lengths, numbers of farms, dwellings, and business establishments served per hundred miles, and other data of related import. No means has been developed, however, for organizing this diverse material into a systematic analysis that will lead to inevitable numerical results. For such an analysis it is necessary to have definite, objective measures of land service, community service, and through-traffic service. It is possible to define such measures in terms of the origins and destinations of traffic.

MEASURES OF HIGHWAY SERVICE

First, we define a unit road section as any segment of road or street lying between two successive intersections. Of the total traffic within such a section, the land-service component is defined as that portion which has either origin or destination, or both, within the section. The community-service or neighborhood-service component is defined as that portion of the traffic passing through both intersections which has origin or destination, or both, within a specified radius, or distance by road, from either of the two bounding intersections. The remainder is defined as through traffic.

It is necessary, of course, to give a numerical value to the radius or distance which defines a neighborhood area with respect to a given unit road section. Such a neighborhood unit should obviously be very small in closely built and congested areas of cities; and should be relatively large in sparsely settled rural sections. Data gathered in origin-destination studies provide a ready means of bringing about this variation. An access unit is defined as any trip origin or destination. A given zone or area may be characterized as generating a certain number of access units per day; and different zones may be compared in terms of the numbers of access units per square mile of area. In the same terms a neighborhood unit may be defined as an area generating 5,000, 10,000, or some other number of access units per day. In a trial made with data from the Transportation Study of the Baltimore Metropolitan Area (*7*), it was found that, if 5,000 access units per day were taken as the standard of a neighborhood area, its value would vary from 0.02 or 0.03 sq.mi. in the downtown section to more than 5 sq. mi. in outlying suburban zones. If the same standard were applied to thinly populated rural areas the size of neighborhood unit would be much larger.

Tax responsibility for the support of a given unit road section would, under this theory, be allocated as follows: to the land, the annual cost of a road facility adequate to support the existing volume of land-service traffic; to the community or general tax base, the annual cost of a facility adequate to support the existing volume of land-service plus community-service traffic, less the increment of cost assignable to the land; and to the motor-vehicle user, the annual cost of a facility adequate to support the total volume of traffic in the section, less the increments of

cost assignable to the land and the community. Application of this procedure to a representative sample of all road and street sections in a given State would lead to an evaluation of the respective total highway tax responsibilities of the land, the community, and the highway user.

It is recognized that this new proposal needs a practical test, on a pilot-study basis, before it is seriously considered as a method of attack on the highway tax problem. Furthermore, its success depends, as do all other proposed solutions, on public acceptance of its basic concepts.

THE THEORY OF DIFFERENTIAL COSTS

With respect to the kindred problem of equitable graduation of motor-vehicle taxes, one of the best-known methods of analysis is that commonly called the increment theory, or theory of differential costs. Its foundation is the undeniable fact that vehicles of different dimensions and weights differ in the extent of their requirements for highway facilities. Since existing roads and streets are, with very few exceptions, designed for a mixture of traffic of varying characteristics, the problem becomes one of determining successive requirements of cost which may be associated with an ascending scale of vehicle sizes and weights, beginning with a "basic" or passenger-car type, and ending with the heaviest weight group permitted on the roads. The analysis takes up in turn various elements of road cost, including pavement thickness, width, grade and alignment, structures, and maintenance; and attempts to determine the extent to which the cost requirements of each element vary with the size of vehicle. The technical problems involved in this procedure severely tax the resources of engineering theory and experience.

The most difficult step in the analysis is that of determining the highway cost requirements of the basic vehicle; for there is no extensive background of experience to tell us what types of facilities would meet the demands of passenger cars and light trucks if there were no heavy trucks and busses on the roads. Another critical step is that of making proper allowance for the extent and distribution of the use of roads and streets by vehicles in the heavier weight groups. Such vehicles should be held responsible for added costs only on that mileage of roads on which their frequency of occurrence is, or is likely to be, appreciable. Failure to take this factor into account may result in an excessive assignment of tax responsibility to these vehicle groups.

The Federal Coordinator's report employed the incremental procedure in an analysis which goes deeply into the technical aspects of the problem. Consultants of the railway interests have used a similar approach in numerous reports and briefs. The increment theory also formed the basis of findings regarding road-user taxes by successive legislative interim committees in the State of Oregon (*8*). The Board of Investigation and Research, on the other hand, decided against the incremental procedure, on the ground that the great technical difficulties encountered in the analysis leave it vulnerable to attack.

The fact remains that roads and bridges are being designed day by day for specific wheel loads and gross-load combinations. The incremental method has much to commend it, both from the standpoint of engineering theory and from that of equitable assignment of tax responsibility. In any thorough-going tax study the feasibility of its use should be investigated. Because of the technical hazards attendant upon the incremental cost analysis, it would be well for the investigator not to place complete reliance on this method alone.

THE GROSS TON-MILE THEORY

The theory that motor-vehicle tax responsibility should be graduated in proportion to gross ton-miles traveled has been adopted in a number of tax studies in recent years, including that of the Board of Investigation and Research. Its advocates claim for it an attribute of fundamental equity. They assert that the product, weight times distance, is a measure of value of use, or value of service rendered to the user by the highway facility. But value, in this work-a-day world, is measured in fiscal, not in physical terms; and there is no economic basis for the assertion that the product of gross weight and distance is a measure of monetary value.

A basis in physical science is also claimed for the gross ton-mile theory. One writer (*9*) states:

"The direct measure of transportation is obviously the gross ton-mile or other equivalent unit defining energy absorbed by transportation (weight multiplied by distance)."

It is evident that this writer, and numerous others who take the same tack, have confused the ton-mile with the foot-pound. The latter is a unit of work or energy; the former is not.

The ton-mile measures neither energy input nor the output of mechanical energy. Engine efficiency, internal friction, wind resistance, and tractive resistance are the determining factors in these relationships. Gasoline consumption itself is a measure of energy input; and, as we all know, gasoline consumption per ton-mile varies inversely with the size of vehicle. It would take at least twice as much gasoline to propel ten 3,500-lb. passenger cars one mile as it would to move one 35,000-lb. truck the same distance. Instead of imposing a tax proportional to the energy absorbed in transportation, the gross ton-mile theory attempts to compensate in part for the savings in energy absorption derived from the use of heavy vehicles—in short, to penalize efficiency in transportation.

The foregoing discussion indicates the serious shortcomings of the theory that road-user tax responsibility should be graduated in proportion to gross ton-miles traveled. These objections should not be interpreted as condemning the use of mileage, ton-mile, and passenger-mile taxes as a part of the mechanism of taxation. When used in combination with registration fees and the gasoline tax, such imposts may provide a means of adjusting the tax burden to an accepted standard of equity. The use of gross ton-miles alone as a measure of road-user tax responsibility is not recommended.

SUGGESTED MEASURES OF VALUE OF SERVICE

In attempting to make gross ton-miles do double duty as a physical unit and as a measure of value, the advocates of the gross ton-mile theory have at least hit upon the valid concept that highway tax responsibility should be allocated in proportion to some measure of the value of services rendered to motor-vehicle users by the highway facilities provided. It is clear that such a measure should be monetary rather than physical in its character. It would also seem that this measure of value should have some relation to the amounts of money put into the operations which it is proposed to tax.

A possible solution may be found in the Oregon theory of differential benefits, in that the mileage-element and time-element benefits, or savings, derived from road improvements, may be regarded as a measure of the value of the service provided by such improvements. There is also the alternate suggestion —as yet untried in any practical study—that motor-vehicle operating costs, which rise steadily with size of vehicle, may be taken as a measure of the value of service provided, and therefore as a basis for assignment of road-user tax responsibility. Justification of this proposal lies in the basic economic relationship between cost and price, or exchange value. Although there are numerous other influences, the major determinant of exchange value is the total cost of producing a commodity or service and making it available to the consumer. As one economist (*10*) has phrased it, "Market price consistently tends to approach the normal price, which is defined as the cost of producing a unit of the commodity in question." This line of reasoning leads to the conclusion that the amount of money put into the operation of a motor vehicle is a measure of the value of the operation.

It is a rather interesting fact that these two alternative proposals, which at first glance seem opposite in intent, have much in common; for, let us consider the simple case of a road improvement resulting solely in a reduction of distance. The principal mileage-element savings resulting from such an improvement would be in gasoline consumption; and, for vehicles of different sizes, this savings would obviously be proportional to the rate of consumption in gallons per mile. Other mileage-element savings would be similarly proportional to the corresponding costs; and the time-savings would be proportional to the total time-element costs. For other types of road improvement the relationships would be more complex; but there is no doubt that the calculated savings from all types of road improvement would tend to vary directly with the operating costs of vehicles of different sizes. It seems likely, therefore, that much the same results would be obtained, whether operating costs, or savings in operating costs, were used as the measure of value of highway service.

The proposal to allocate motor-vehicle tax responsibility in accordance with a measure of value of service fails to deal positively with the question of increased highway costs occasioned by the use of heavy vehicles. The supposition is that the steady rise in value of service with increase in size of vehicle will fully account for the rise in costs of providing the service; but this supposition can hardly be accepted without substantive proof. For this reason it is desirable that an analysis of tax responsibility from the standpoint of value of service be accompanied by an analysis on the incremental-cost basis. If, over a considerable range of motor-vehicle sizes, it should be found that value received by the user runs parallel with highway costs occasioned by the use, there would be no difficulty in devising a tax schedule that would produce substantial equity in both respects.

If, on the other hand, it were found that, at some point in the size-and-weight scale, required highway costs begin to depart materially from proportionality with value of the service to the user, then a danger point would be recognized; and the question would arise whether to tax at an increasing rate with respect to value, or to impose size and weight limitations at the point where the operation was judged to be uneconomical in terms of combined vehicular and highway costs.

Prohibitive tax rates, designed to discourage the use of heavy vehicles, offer no solution to the highway tax problem. What we seek is not revenge, but revenue; and tax revenue from commercial vehicles can only be obtained from the money they earn. It follows, therefore, that the study of motor-vehicle transportation costs, earnings, and rates is essential to a highway tax investigation. Only by learning what goes on in the business of motor transport can we devise tax schedules that will be just in their incidence on the taxpayers and successful in the production of revenue.

If we impose taxes on a theoretical basis that has no reference to the money involved in the operations, and particularly if we are ignorant about such facts, the taxes we select will be imposed blindly, without real thought of their effect on the tax yield, on the taxpayer himself, or upon the public which purchases commercial transportation.

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9. Ibid., 1945 report, p. 5.
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