CLUB SUBSCRIPTIONS FOR PUBLIC TRANSPORT PASSENGERS

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A bias in the allocation of resources commonly exists in favour of private cars relative to public transport [12]. This bias can arise whenever a consumer chooses between a car and public transport, if public transport recovers all its costs and charges a single price per mile. The reason for the bias is that, while consumers pay only marginal costs per additional car mile, they pay average costs per public transport mile, and marginal costs lie below average costs in both cases. Misallocation among several decreasing cost public transport modes is also likely, if each is required to recover all its costs and tries to do so by charging a constant price per mile. A preferable arrangement would (a) afford an efficient combination of public transport modes and (b) compensate for the resource allocation advantages currently enjoyed by private cars.

TWO-PART PRICES

As many writers have shown [5], a single fixed price for a service, based on average cost, may not meet the necessary conditions for Pareto optimal resource allocation. This conclusion applies to public transport modes. Prices that reflect marginal costs do satisfy the necessary conditions and can therefore improve allocation. But to cover all costs the prices would clearly have to be in two parts: one for marginal costs, and another for the fixed costs which depend on time, number of persons, or any other variable except usage. According to Lewis [6] a “two-part tariff” was first proposed by Dr. John Hopkinson in 1892 in a recommendation for fixed and variable prices of electric power in England. It has already been recommended vigorously by Coase [4] for decreasing average cost situations, and it is implicit but imprecise in a proposal of Wicksell’s [14]. The two-part tariff permits consideration of marginal social cost in decisions made by the private consumer, yet still provides for fixed cost.

For inspiration, let us turn to the proposal made long ago by Wicksell [14]. He suggested that decreasing cost public enterprises charge prices equal to marginal cost and that their deficits be covered by taxes which fall only on those who benefit, in amounts that they are willing to pay. As pointed out by James Buchanan [3], Wicksell not only satisfied welfare maximizing criteria by setting price equal to marginal cost; he went further and, by applying his taxation principles, recovered fixed costs in a manner that also would satisfy present-day Paretian conditions for optimum welfare. Practical problems remain, but Wicksell’s consideration of both the short-

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run optimum and a longer-run investment criterion contrasts with the less complete treatments discussed during the marginal cost pricing controversy of the 1930s and 1940s. A suitable means of covering fixed costs, and thus supporting public transport investments, is precisely what is needed.

Allocating investment risks and fixed costs among many users is difficult, as Wicksell admitted. The car owner invests in a car and assumes risks in doing so. Investment commitments are also needed for public transport, but the units are large and, unlike the automobile, are difficult to divide among users. Nevertheless, the fixed costs of a public transport mode depend on the number of passengers it is capable of carrying at one time, not just on passenger miles actually travelled [7].

If the number of regular passengers influences capacity costs, which are fixed in the short run, it is reasonable to require equal payments per period from users who require access to the service. An equal charge is more precise than Wicksell's proposal, but his was a public finance problem in which the number of persons who benefited from a service had no major effect on its costs, even over a long period. To be sure, the influence of each additional person on public transport costs may not be constant. One fixed fee is then only an approximation to an ideal rate. But an approximately ideal fixed fee per period, combined with a price per mile travelled, offers important allocative advantages.

Such an arrangement would let members share the fixed costs of public transport over a contracted time period, say one to three years. They would also share risks over the contract period. A contracted sharing seems appropriate in the light of Weisbrod's argument that a mass transport service has value for potential users just by being there, in case they might want to use it [13]. If members who shared the fixed costs paid only marginal cost for their usage of the service, a potential member could evaluate the impact of his usage of public transport on the overall cost per mile to him. And he could thereupon choose between car and public transport on equal terms, at approximate marginal costs.

The effect that one's usage could have on one's public transport price is easily demonstrated. If total fixed costs for a given time period are represented by \( f \), variable costs by \( v \), and miles travelled during the period by person \( k \) as \( x_k \), then an average cost per mile obtained by allocating fixed costs over passenger miles is

\[ p = \frac{f}{\sum_k x_k} + v. \]

If, instead, fixed costs are distributed equally among \( m \) users, the average cost per mile to person \( k \) becomes

\[ p_k = \frac{f/m}{x_k} + v, \]

a value depending on person \( k \)'s own usage rather than the usage of all persons together. One user's share in fixed cost, \( f/m \), depends on the number of participants, but must be known in advance so that each can decide whether to participate. Its value could be estimated in advance, however, perhaps conservatively, with a rebate to reach ex post precision.

Resource allocation under a regime of such prices, which are different for each consumer according to his transport usage, can also be shown. Consider \( n \) public transport modes, \( i = 1, \ldots, n \), each of which has \( m_i \) members or fixed-cost-sharing users. Assume a constant marginal cost, \( v_i \), for the \( i \)th transport mode, and let \( f_i \) represent total fixed cost for that mode. For the \( k \)th individual, let the price per mile, \( p_{ik} \), be his average cost per mile for the \( i \)th mode:

\[ 1 \text{For an analytical basis for setting more exact fixed fees and for capacity decisions, see [2].} \]
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(1) \[ p_{ik} = \frac{f_i / m_i}{x_{ik}} + v_i \]

where \( x_{ik} \) is the miles he travels via the \( i \)th mode. Prices for the \( n \) modes can be combined into a weighted average price for the \( k \)th individual, \( p_k \), as follows:

(2) \[
\begin{align*}
\frac{1}{n} \sum_{i=1}^{n} p_{ik} x_{ik} &= \frac{1}{n} \sum_{i=1}^{n} \left( \frac{n}{\sum_{i=1}^{n} x_{ik}} \left( \frac{f_i / m_i}{x_{ik}} + v_i \right) \right) \\
&= \frac{1}{n} \sum_{i=1}^{n} \frac{f_i}{m_i} + \frac{1}{n} \sum_{i=1}^{n} v_i x_{ik}
\end{align*}
\]

If the solution indicates that public transport offers maximum utility for him, necessary conditions require that his marginal utility of income (\( \lambda_k \)) in connection with this choice be:

(3) \[
\lambda_k = \frac{U_{kl}}{p_k + \sum_{i=1}^{n} \left( \frac{\partial p_k}{\partial x_{ik}} \cdot \frac{\partial p_{ik}}{\partial x_{ik}} \right) x_{ik}} = \frac{U_{kl}}{p_k + \sum_{i=1}^{n} \left( \frac{x_{ik} \left( \frac{f_i / m_i}{x_{ik}} \right)}{\left( \frac{x_{ik}}{x_{ik}} \right)^2} \right) x_{ik}}
\]

\( U_{kl} \) is the \( k \)th consumer's marginal utility of public transport. By substituting (2) into (3) and simplifying, we have:

(4) \[
\lambda_k = \frac{U_{kl}}{\sum_{i=1}^{n} \frac{v_i x_{ik}}{\sum_{i=1}^{n} x_{ik}}}
\]

Thus, if person \( k \) chooses public transport he will decide the amount he travels on the basis of the marginal costs of public modes, weighted in proportion to his usage.

Now consider his allocation among different modes. Let consumer \( k \)'s marginal utility of travel by the \( i \)th mode be \( U_{ik} \); the choice between any two different modes that are used, \( r \) and \( s \), must then satisfy:

(5) \[
\lambda_k = \frac{U_{rk}}{p_{rk} + \frac{\partial p_{rk}}{\partial x_{rk}} \cdot x_{rk}} = \frac{U_{rk}}{p_{rk} + \frac{\partial p_{rk}}{\partial x_{rk}} \cdot x_{rk}}
\]

or \[
\lambda_k = \frac{U_{rk}}{p_{rk} - \frac{f_i / m_i}{x_{rk}}} = \frac{U_{rk}}{p_{rk} - \frac{f_i / m_i}{x_{rk}}}
\]

\( \partial p_k/\partial (\sum x_{ik}) \) is defined as the weighted average of changes in \( p_k \) as all \( x_{ik} \) change simultaneously by an equal amount: \( \sum \partial p_k/\partial x_{ik} / \sum x_{ik} \).

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By substituting (1) into (5) and simplifying, we have:

\[ \lambda_k = \frac{U_{ik}}{v_r} = \frac{U_{ik}}{v_s} \]

Since the kth person is now planning usage of public modes according to their relative marginal costs, no further changes can make him better off, and allocation among the public transport modes will thus be Pareto optimal for the set of persons paying fixed fees.

This proposal does not guarantee ideal resource allocation beyond the transport sector. In particular, it may favour transport generally, for it lets consumers choose their own transport usage at marginal cost, while prices for non-transport goods and services may often exceed marginal costs. Where these other goods and services are produced by perfectly competitive industries, of course, their marginal costs should equal their prices and no misallocation need arise. Alternative goods supplied by public utilities, such as telephone and electricity, are sometimes priced in a manner that reflects marginal cost, and so the present proposal only offsets their former advantage.

A disadvantage of the two-part price is the high charge it may impose on occasional users. This might be moderated by offering two-part prices that extend only over a very short time period, though at higher cost than a longer-run arrangement. Lower fixed fees could also be offered that would entitle persons to travel at a lower average price outside rush-hour periods.

The two-part price arrangement has advantages over marginal cost pricing, which can repair the balance between social cost and private cost but creates two problems in doing so. Both problems arise because, in decreasing cost industries such as transport, marginal costs are always less than average cost. First, marginal cost pricing for public transport will introduce a long-run allocative bias in its favour by removing its fixed cost as an influence in consumers’ private decisions. Second, it leaves unsolved the question how those fixed costs are to be met. In contrast, a two-part price proposal permits consumer planning based on marginal costs for alternative modes, and then affords a final commitment, based on consequent average costs, to either public or private transport. In this way an optimal choice can be achieved.

A PASSENGERS’ CLUB

Consider an institution which we shall call the Passengers’ Club. Membership extends over a long time, perhaps three years. In addition to a fixed membership fee (payable in convenient monthly instalments), members would pay a direct charge (for which they would be billed monthly) based on their usage of each different public transport mode. Membership commitments over shorter periods could also be available. They would probably require higher membership rates per unit of time, in much the same way, for instance, that magazine subscriptions are regularly offered, and could also apply on termination of membership before the normal date of expiry. Transport is

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3The advantages of such commitments for transport firms are genuine but beyond the scope of this paper. More general resource allocation virtues of planned consumption arrangements have been pointed out by M. W. Reder [11].
a personal service, and a member would not lend his low marginal cost travel privilege when doing so would prevent him from exercising the privilege himself. Special membership arrangements could be devised for organizations so that a business firm, while sharing fixed costs only as one person, could not extend low marginal cost travel rates to its many employees.

Each consumer would then be free to choose specialized transport modes for his different needs in such a way that his average cost per mile for each mode would decrease with greater usage. At the same time, the consumer through his membership fee would share in the fixed costs of public transport agencies, thus facilitating planning by those agencies. Two questions arise at once. Is it possible to determine fixed and variable fees? Is it feasible to collect them?

Meyer et. al. [8] have demonstrated the possibility of determining fixed and variable costs of the means of public transport. Largely as a result of their success in identifying costs, they recommended that rate structures be developed which will reflect the long-run marginal cost of each transport medium to replace “value-of-service” and other historical rate structure bases. The view that railroad rates can rest heavily on cost factors was supported by nine economists in a paper commissioned by the American Association of Railroads [1]. And, judging from recent French applications [9], costing concepts are now adequate to deal with marginal costs in practice.

The feasibility of assessing a direct fee (per mile travelled) has been enhanced by recent technological advances. The modern large-scale public transport project now under development at San Francisco may include one of several alternative devices which will record passenger access and departure points as a basis for customer charges based on exact usage [10]. Several of the proposals involve paper or plastic tickets containing tiny metal slugs which can be magnetically encoded. Access to the system is recorded by such encoding and, at a departure point, charges can then be calculated automatically. Some proposals involve recording on the ticket its remaining value, after charging for each trip. One proposal would accommodate central recording by the customer, so that credit could be extended with periodic billing. For other modes, such as taxi cabs, airlines and inter-city rail and bus travel, mileage is of course known; technology is required only for recording and invoice rendering, and those capabilities are already well developed for commerce generally. We can conclude that direct consumer usage of public transport can be assessed and invoiced, say monthly, together with a fixed membership fee.

After these fees are collected, there remains the problem of distributing them among participating transport agencies. Variable fees would simply be transmitted direct to the agency affording service. The fixed fee presents a slightly more difficult problem. Suppose, first, that fixed and variable fees could be determined for each mode. This would be easier for modes represented by a single agency, for it would only require cost identification by that agency. Where several separate agencies offer the same mode of transport service, let us say that they would agree on, or be subject to, one fixed and one variable fee. In these circumstances – for instance when more then one taxi company serves a community or several airlines connect the same two points – there are usually uniform prices already.

With fixed and variable fees uniform for each mode, the consumer might be permitted to choose which of the available modes he desired his membership to include,
thereby enforcing an element of competition between them. At the same time, an identifiable portion of his total fixed fee could be earmarked for each mode. The fixed fee could then be further distributed among agencies within a mode in proportion to the member’s usage of the respective agency services. The Passengers’ Club would thus formalize much of the revenue clearing that already occurs among the different travel services, and might provide billing and credit service on both national and local levels well.

**SUMMARY**

If public transport is characterized by decreasing costs per passenger mile, if it must cover its costs, and if it now uses single fixed prices to do so, misallocation of resources can arise not only among the public transport modes but between public and private modes as well. To compensate for these allocative biases, we propose two-part prices and a Passengers’ Club institution to implement them. The proposed institution enables each consumer to plan his transport usage, taking account of approximate marginal social costs, and on that basis to make a forward commitment either to private or to public transport. Investment in transport resources, as well as short-run usage, can then be coordinated. Public transport becomes a more effective substitute for private car travel. The proposed Passengers’ Club institution can serve one city or can be extended to a larger area where inter-city travel requires coordination.

**REFERENCES**


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