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PUBLIC UTILITY PRICING AS AN OPTIMAL TAX

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Economists have again begun to find more merit in the proceedings of courts and administrative agencies that have stood the test of time than they did during the Great Depression and World War II and the post-war reconstruction decade. An outstanding example of this is Ronald Coase's analysis of Social Cost[1] where he found a considerable amount of cogent logic in court decisions that compared most favorably with the analysis even of such giants of economic analysis of welfare as Pigou.

The present analysis is another example of the comparison of the results that follow directly from the theory of social cost with those that emenate from the complicated legalistic rules and procedures that have grown up in connection with the pricing of services of natural monopolies, notably electric power. From an economic point of view the salient features of the pricing of such services flow from the fact that a natural monopoly has a continuously decreasing long run average cost curve. Thus marginal cost is less than average cost at all outputs, and any single price charged to all users necessarily will yield a total revenue which is less that the total expenses. Yet, to charge different prices to different users can be shown to be discriminatory, and to

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[1]Coase, Ronald, "The Problem of Social Cost", Journal of Law and Economics, Oct. 1961, 3, 1-44.

produce less than the welfare maximum.

This fact is recognized, perhaps not explicitly, in the rules and procedures that have grown up in the regulation of public utility prices and services offered. In general, a rate structure that does cover all of the costs of the utility is constructed. But at the same time there is an elaborate structure of rates tailored to the various classes of users and also to the quantities that the individual users consume. These "discriminatory" rates are often contrasted unfavorably by economists to an alternative procedure whereby the rates would be set equal to the marginal costs of production for all users, and any deficit covered from the general revenue of the government. This, solution to the problem can be viewed as an abandonment of the effort to find a method of financing which, is consistent with an optimal result as defined by welfare economists. One is encouraged to take this easy way out if he believes that transfers via the public purse can improve income distribution.

The contentions of this paper are: (1) that the set of discriminatory rates can properly be regarded as a set of tax rates both in theory and in practice, and (2) that such rates are, or can be made to be more consistent with the general principles of welfare economics than can any system whereby the deficit is made up out of the general revenues of government.

The reasoning runs as follows: The revenues that accrue to the firm from the higher prices charged for some of infra-marginal purchases can be regarded as tax revenues. While they are suggested by the utility,

they are in effect imposed by a public body which pays some regard to the benefits received by the rates they set, but which, nevertheless amount to a compulsory payment, the fairness of which is adjudicable by the courts. Hence they may be considered taxes, or quasi-taxes added to the price, rather than discriminatory prices.

There are many difficult problems to be solved when there are many users some in competition with each other, some who are not, some who can be supplied cheaply (in additional capital costs to the utility) and some who can not, and some who can contract to be consistent users of the service and some who can not. The present paper does not address itself to these difficulties. Instead it addresses itself to the determination of an optimal discriminatory price-tax structure in the simplest case, where there is but one buyer.

A regulated public utility which charges discriminating rates will, if it follows principles that can be derived from modern welfare economies, come to the same result that a publicly owned public utility would which is also managed according to the same principles. The relevant principles that come out of modern welfare economics are two: (1) That price equal marginal cost for each user, so as to achieve the optimal allocation of resources, and (2) That the taxes paid to overcome the operating deficit be such that no taxpayer be benefited at the expense of another.

The key observation in connection with #2 is that the "tax" (the amount raised by the prices which are higher than the marginal cost)

makes an increase of output possible at the lower marginal cost so that each buyer is better off than he would be if he had escaped the "tax" but had to pay a higher price, equal to average cost of the utility when the demand curve is equal to long run average cost. This suffices to show that the optimal set of discriminatory prices is equivalent to a system of taxes that is consistent with welfare economics, for the taxpayer is himself the recipient of benefits of greater value to him than the cost of his taxes. This observation also suffices to show that this choice is better than the alternative system of having the deficit made up from general revenues, for in that case it is unthinkable that some of the general taxpayers would not have had to pay taxes for which they received no benefit in return, and consequently it is inconceivable that other taxpayers, and in particular those who secure the additional supply of electricity (or whatever the product of the utility might be) not benefit from the subsidy paid by those who do not benefit.

The remainder of this paper demonstrates for the simplest case the fact that the "taxpayer" benefits by more than the cost of his taxes and discusses one minor complication.

If there were in fact but one buyer it is reasonable to suppose that he would set up his own generating plant and produce at the level marginal cost equals price, covering the apparent losses by an accounting transfer from other parts of the integrated firm's activities. In such case, the rate making problem is an exercise in accounting logic into which we will not enter. The typical utilitiy's decreasing cost structure

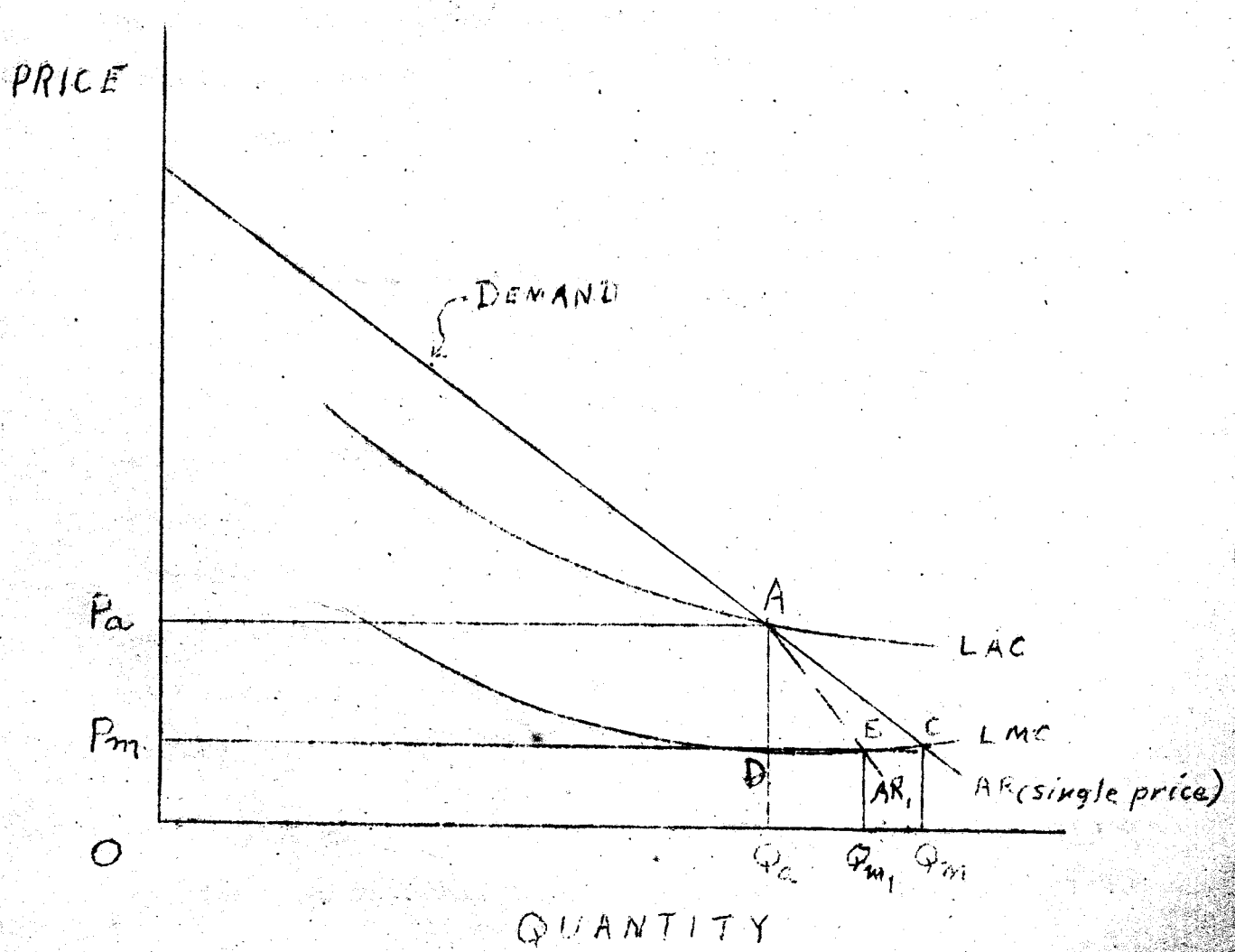
is such as to preclude this case as an important phenomenon, since there are typically many users of the utility's services in the area which it can supply.

Suppose then, for purely illustrative purposes, that a utility sells to a single buyer, and, being a private concern, must cover its total costs. Will the utility's customer be better off or worse off if the utility commission imposes a single price or a structure of prices upon the buyer? The situation can be illustrated by Figure 1.

If a single price is charged, the lowest possible consistent with the utility's continued existence is at P_a, where price = long run average cost. A lower price, say P_m = marginal cost, fails to cover all of the utility's costs, and is, therefore, inconsistent with the long run survival of the utility. Suppose, therefore that the utility is permitted to charge that price, P_a and the consumer does not act (as he would if he were a single buyer) to build his own electricity plant.

The marginal cost of supplying additional units is much below this price. Additional sales that cover the additional cost of the utility and which are priced below the value of the service to the customer are, therefore possible, and it is scarcely conceivable that the two firms would not make some mutually advantageous arrangement to improve their positions.

FIGURE 1


PRICE
DEMAND
A
P_a
LAC
P_m
E
C
LMC
D
AR_1
AR (single price)
O
Q_a
Q_{m_1}
Q_m
QUANTITY

It should be observed, however, that the position of the demand curve is affected by the price charged for the initial quantity, Q a The higher than marginal cost price absorbs some of the funds that could have been used elsewhere in the business. Thus the demand curve below point A is rotated leftward from the demand curve that denotes the relationship between the quantity taken and alternative single prices.

If the utility sells at its marginal cost, it will continue to exactly cover its total costs, and the buyer will buy his marginal units at the level where marginal cost equals price. Thus the buyer pays the amount illustrated by the two rectangles OPaAQa + QaDEQm$_1$. But he enjoys the additional benefit shown by the area DAE. Hence the buyer is better off with a two-price system that covers the cost of the utility.

It should be observed that he would be still better off if someone else paid the utility a subsidy equal to PmPaAD and the whole supply were made available at marginal cost C. In that case the buyer would have purchase Quantity Qm. However, in that case the demand curves of those who paid the subsidy would have shifted to the left somewhat, reducing their consumer surpluses and it is not possible to say whether their losses would have been greater or less than the loss of ACE sustained by the buyer since this is basically an income transfer which involves interpersonal comparisons of utility.

What can be said is that when the buyer of the product has the opportunity to buy additional units at the lower price he benefits from

doing so, while in contrast, there is no certain benefit to the others who might have been made to pay the supra-marginal costs, PaADPm, a payment which if made by these others yields a benefit to the purchasers of electricity equal to those super-marginal costs plus the value indicated by AED. Thus it appears to be so highly probably as to amount to a certainty that the two-price system is closer to a welfare maximum than is a marginal cost price system made viable by a transfer from people including those who are not consumers of the service.[2]

The Two-Price System As A Tax

From a functional point of view, the analysis presented above can be viewed as an alternative system of taxes to overcome an external economy. Such an externality requires a subsidy of some sort to the "lumpy" capital input. The problem is, who should pay the subsidy. The standard answer has been that the subsidy should come from general revenues of the government, presumably because they are collected with due regard to ability to pay, and various other social objectives properly weighted by the responsible officials.

This is represented in the preceding analysis by the alternative of having the necessary subsidy paid by "others". If the funds come

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[2]A minor complication arises when the marginal cost curve is not flat in the region between Qa and Qm. If it is falling, as is likely, the marginal cost price applied across that interval will not produce enough revenue to cover the full costs. This is true because since total cost = total revenue at Qa, the additional costs are shown by the area under the marginal cost curve while the additional revenues are the lesser amount under the "marginal price" line PmE. This can be remedied either by charging two or more prices less than Pa, as is commonly done by utilities, or by making the "base price", Pa, slightly higher. Likewise, if the marginal cost curve is rising in this interval the base price can be lowered slightly to eliminate excess profits.

from general taxation, we may be sure that consumers of electricity will be among them, and that their demand curves for all goods, including electricity, will be shifted somewhat to the left because of the additional taxes paid. If this is considered to be negligible for purposes of illustration in Figure 1, the purchasers of electricity will, as stated above, be benefited by the reduction of the price (from Pa to a bit more than Pm) on the quantity otherwise taken, plus the difference between their demand curves and the marginal cost price, (QmC) for the additional amount purchased. On the other hand the general taxpayer who is not a consumer of electricity (or who uses it in small amounts, but happens to have to pay rather heavy taxes) will not be benefited at all, but rather will be injured. Thus some gain and others are injured so the welfare criteria are violated.

An alternative tax system will attempt to assess the taxes against those who benefit from the expenditure that the increased taxes make possible. In the present case, this can be accomplished by taxing the buyer an amount equal to PaADPm and selling the service at price Pm. If the tax is assessed as a sales tax on the initial units sold, Qa, the exact amount necessary to finance the utility's loss from selling at the marginal cost is covered. In this case, the tax is levied fully against the beneficiaries of the tax, and the benefits that they gain as a result of the subsidy made possible by the tax is greater than their costs as taxpayer by the amount AED.

The tax, although a compulsory payment, one that would not be made voluntarily except in unrealistic cases such as the one buyer-one

seller situation used here for illustrative convenience, is nevertheless, entirely consistent with welfare economics, and does not represent an arbitrarily imposed burden based upon some vague notion to the effect that the government necessarily represents the "public interest".

It is evident from the above that the type of rate structure commonly used by the public service commission is similar to the benefit tax system outlined in the previous paragraph. The rules that have grown up over the years are designed to yield returns just sufficient to cover all the costs of the regulated firms. This has been accomplished by complicated rate structures that have the effect of recognizing, on one hand, the fact that the marginal cost of supplying different consumers differ and, on the other hand, that a flat rate at the marginal cost will not suffice to cover the total costs of the utility. This deficit is made up by higher charges for a portion of the purchases made by the buyers. The excess of this over the marginal cost is in fact closely analogous to a tax from an economic point of view.

It is also analogous administratively because it is imposed by public authority and usually subject to review via administrative procedures and through the courts. Properly administered, it amounts to a way whereby the power of government is brought to bear to rectify the misallocation of the resources that would exist in the presence of an external economy in the absence of some device to lower the cost of inputs sufficiently to permit marginal cost pricing. It is analogous to a tax finally, because in the last analysis in the many-buyer case

(not analyzed here) the distribution of the burden among the various buyers is inevitably somewhat arbitrary, since the more of the tax imposed on one buyer the less need be collected from another. Here interpersonal comparisons are unavoidable and the power of government to impose a compulsory payment is necessary if marginal cost pricing is to be possible.

This analysis does limit the range of necessary compulsion for it shows that the whole cost of the necessary subsidy is better borne by the purchasers of the utility's product rather than by the general taxpayer if a welfare optimum is to be attained however the tax burden is divided among the various purchasers. No doubt further analysis can provide additional guidelines for the allocation of the tax burden among users. We only reiterate the key principal here: no buyer should be made worse off because of the multiple price-tax system when compared to his situation where charged a single price equal to the average cost of service at the output attainable with that single price. It follows, in general, that the maximum rate (excluding individual costs of establishing service) should never be above that rate for any unit of purchase.

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