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PELTZMAN'S THEORY OF OWNERSHIP FORM: A REFORMULATION

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Until the appearance of Peltzman's seminal work on ownership form [13], economists had only an imprecise notion of the behavioral differences of publicly and privately owned enterprises. Peltzman's study lays the groundwork for the development of an empirically verifiable theory of the effect of ownership form on the behavior of firms. More specifically, his theory examines the effect of public ownership on pricing strategy, and from his model he obtains seven empirically verifiable propositions. The first two of these contend that, in comparison to privately owned firms, public enterprises tend to (1) have lower prices and (2) have prices which are more positively correlated since they are less cost-determined. These two hypotheses, which together will be referred to here as the "Peltzman effect," are strongly supported by Peltzman's empirical results and are logical implications of his model. The remaining five propositions contend that, in comparison to privately owned firms, public firms tend to (3) have prices which are more positively correlated since they are less demand-determined, (4) have more uniform prices, (5) offer a smaller variety of services, (6) employ less price discrimination, and (7) have smaller output levels. In contrast to the first two contentions, none of these receives clear support from his empirical results, and --more importantly--none of these is actually implied by his theoretical model.[1]

The purpose of this paper is to reformulate Peltzman's model to clarify its implications. Because the following results contradict Propositions (3) through (7), we shall replace these five hypotheses with empirically verifiable alternates. Because Peltzman's theory can be made far less vulnerable to statistical Type II errors, and because it has already inspired eight empirical studies[2] (and no doubt will engender more), its implications now merit reconsideration.

Peltzman Effect

Peltzman derives his theoretical results with a comparative-static model in which equilibrium is cleverly identified by the tangency of iso-vote and iso-profit curves. Two of his goals are to show that, in comparison with private firms, public firms tend to establish prices which are lower and less affected by the costs of serving particular groups. This "Peltzman effect" is examined below using a framework much different from that employed by Peltzman. Without doubt, the most beautiful aspect of his model is its ability to capture the very complicated relationship among vote, cost and revenue functions by using only two curves. For our purposes, however, it is necessary to focus on the critical role played by changes in consumer surplus, since this lies at the heart of Peltzman's vote-buying hypothesis. Trying to identify changes in consumer surplus without using revenue curves is like trying to describe a spiral staircase without using hands. Hence, our model employs linear revenue and cost functions instead of the more comprehensive functions adopted by Peltzman.

We begin by accepting all of Peltzman's assumptions [13, pp. 113-15]: the public utility provides a service (which cannot be resold) to only two consumer classes, groups 1 and 2. If these groups contained no voters, they would be charged monopoly-level prices and the ensuing profits would be used to "buy" votes through tax reduction. However, each consumer is a voter--and vice versa--and vote maximization

requires that consumers be charged prices below the profit-maximizing level, in which case the groups are said to be "benefitted." If the two prices are reduced only slightly below the monopoly levels, the profit contribution to government's general revenue will also fall slightly and taxes will have to be raised very little. Of course, vote maximization could require that prices be cut below AC or even to zero, but the tax increase needed for this reverse subsidy could dispel more votes than would be gained through price reduction.[3] In any event, Peltzman assumes that the magnitude of the profit reduction is determined exogenously, so for our purposes it is unimportant that the resulting profit level is positive or negative (just as long as it is not maximized when voter support is maximized).[4] Unlike Peltzman, we adopt the simplifying assumptions that average revenue functions are linear and that average cost functions are constant with respect to output. Because these two added conditions are consistent with the shapes of the curves in his graph [13, p. 116], they will not alter the logical implications of his model.

Peltzman makes the further assumption that ". . . the lower the initial price to one group the fewer votes gained by a given price decrease to that group" [13, p. 115]. The importance of this assumption cannot be overstressed since it ensures the concavity of the iso-vote curves in his model. (It will be later shown, however, that an alternative assumption also produces the Peltzman effect even though it makes his iso-vote curves convex.) This assumption would be valid, Peltzman says [13, p. 115n], if the likelihood of voter support for the firm rises in proportion to the proportional change in consumer surplus caused by the price reduction.[5] From this we can infer that government allocates the profit reduction in such a way that the last dollar forfeited to group 1 will yield the same proportionate increase in consumer surplus as that produced by the last dollar "lost" to group 2. More formally, for a given level of profit reduction, vote maximization requires that

$$\frac{\partial(\Delta CS_1/CS_1)}{\partial \pi_1} = \frac{\partial(\Delta CS_2/CS_2)}{\partial \pi_2} \qquad (1)$$

where π and CS denote profit and consumer surplus, respectively, and $\Delta CS = (\partial CS/\partial P)\Delta P$ when $\Delta P = 1$. Employing this and the other assumptions, we shall now construct a geometric framework (which is consistent with Peltzman's model in every respect) to clarify his seven empirical propositions.

Proposition 1: "There Will Be a Downward Bias in Government Enterprise Prices" [13, p. 113]

Figure 1 shows a situation in which both consumer classes have identical demand curves ($AR_1 = AR_2$) and the same cost curve (equal to AC_1). Under these conditions, the private firm maximizes profit by charging both groups price P_1. The public firm charges both groups price P_1', assuming that vote maximization requires a profit reduction (determined exogenously) equal to twice area F. Because $P_1 > P_1'$, we arrive at Peltzman's conclusion that, in comparison to monopoly-level prices, there is a downward bias in government prices.

Proposition 2: Compared to Private Prices, Government Prices Will Tend to Be More Positively Correlated Because They Are Less Cost-Determined [13, pp. 117-18]

Now suppose there is a cost increase for group 2 only, raising its average cost from AC_1 to AC_2 and increasing its monopoly-level price from P_1 to P_2. How will the new "public" prices compare to the new "private" prices P_1 and P_2? A precise answer would require specification of the amount of profit reduction that is optimal under the new circumstances. However, this amount is determined exogenously here as in Peltzman's model, so it may as well remain at twice area F since this will later prove convenient. Will government react to the cost increase like a private firm? If so, government would leave group 1's price at P_1' and raise group 2's price to P_2', in which event $P_1 - P_1' = P_2 - P_2'$. Since $AR_1 = AR_2$ and both AC curves are horizontal, equal price reductions would cause equal output increases and identical profit decreases. Accordingly, profit-reduction areas A

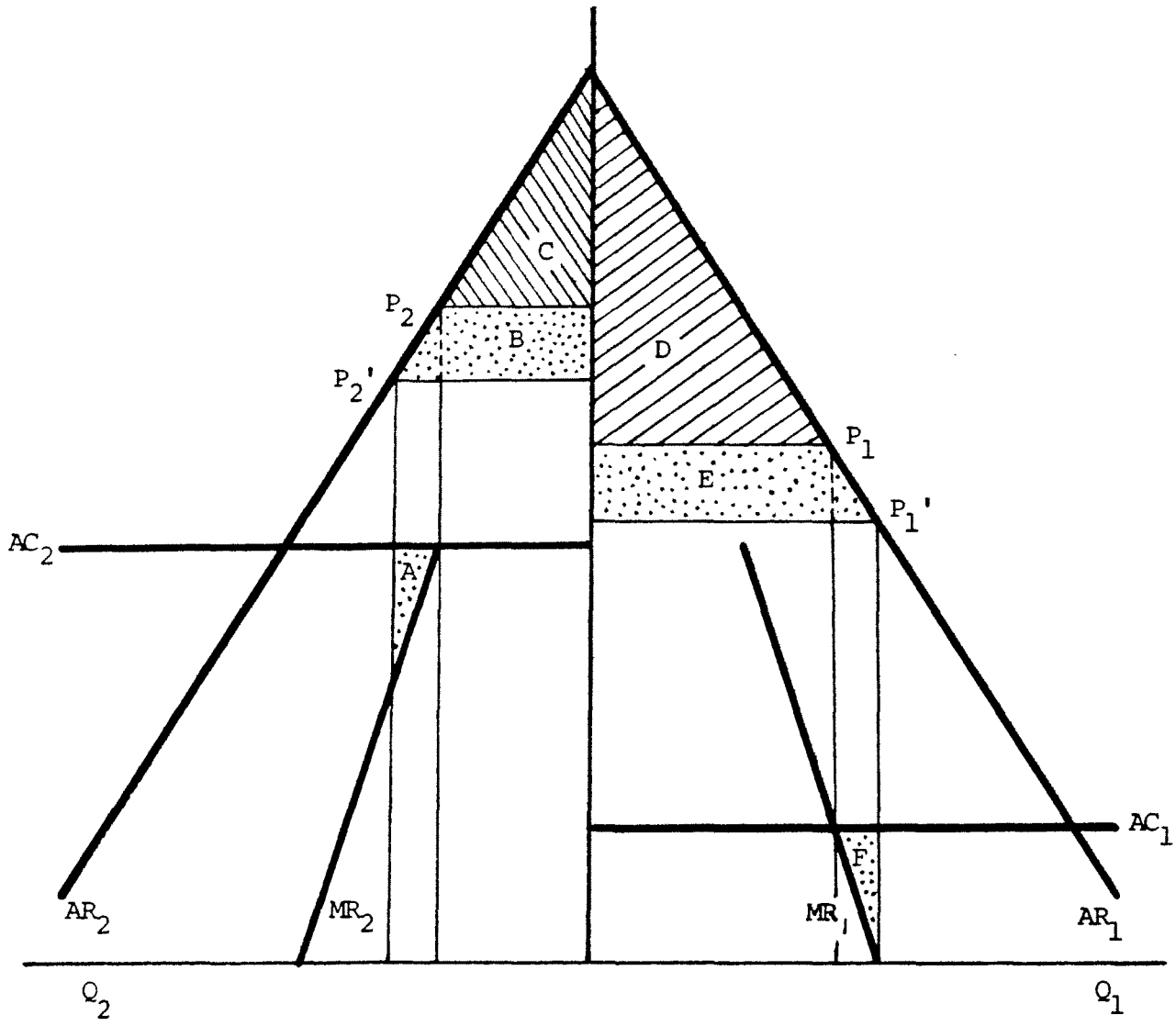

FIGURE 1

and F would be equal, so the profit loss area would still be held at twice area A. Because marginal profit loss would be the same for both groups (since $MC_1 - MR_1 = MC_2 - MR_2$), and because area B/C exceeds area E/D, equation (1) would be clearly violated. Since the same marginal price reduction would create the same marginal profit loss for both consumer classes, and since the proportionate change in consumer surplus would be smaller for group 1, government will choose instead to give group 1 a smaller price reduction than that given group 2. If the total profit reduction equals area A + F, then, P_1 is lowered to a level above P_1' and P_2 is reduced to a level below P_2'. Accordingly, government is shown to respond to group 2's cost increase by raising price above its initial level at P_1' for <u>both</u> groups.[6] This implies--as Peltzman correctly infers--that public prices will tend to be more positively correlated than private prices since the former are less affected by particular cost differences. That is, public prices are less "cost-determined."[7]

Five Propositions Reconsidered

Proposition 3: Compared to Private Prices, Government Prices Will Tend to Be More Positively Correlated Because They Are Less Demand-Determined [13, p. 117n]

The error in this hypothesis is easily identified by constructing a second scenario, which assumes cost to be identical for both groups so the effect of a demand shift is apparent. Peltzman suggests that a change in one group's demand--like a change in its cost--causes prices for both groups to change in the same direction, displaying positive correlation. This case is examined in Figure 2, which verifies the demand-induced correlation but shows it to be negative--not positive as Peltzman suggests. Assuming initially that both classes have identical demand curves equal to AR_1, that $AC_1 = AC_2$, and that the optimal profit loss is double area def, government charges both groups price P_1', which lies below private price P_1.

Now suppose that the second group's demand curve shifts toward the point of

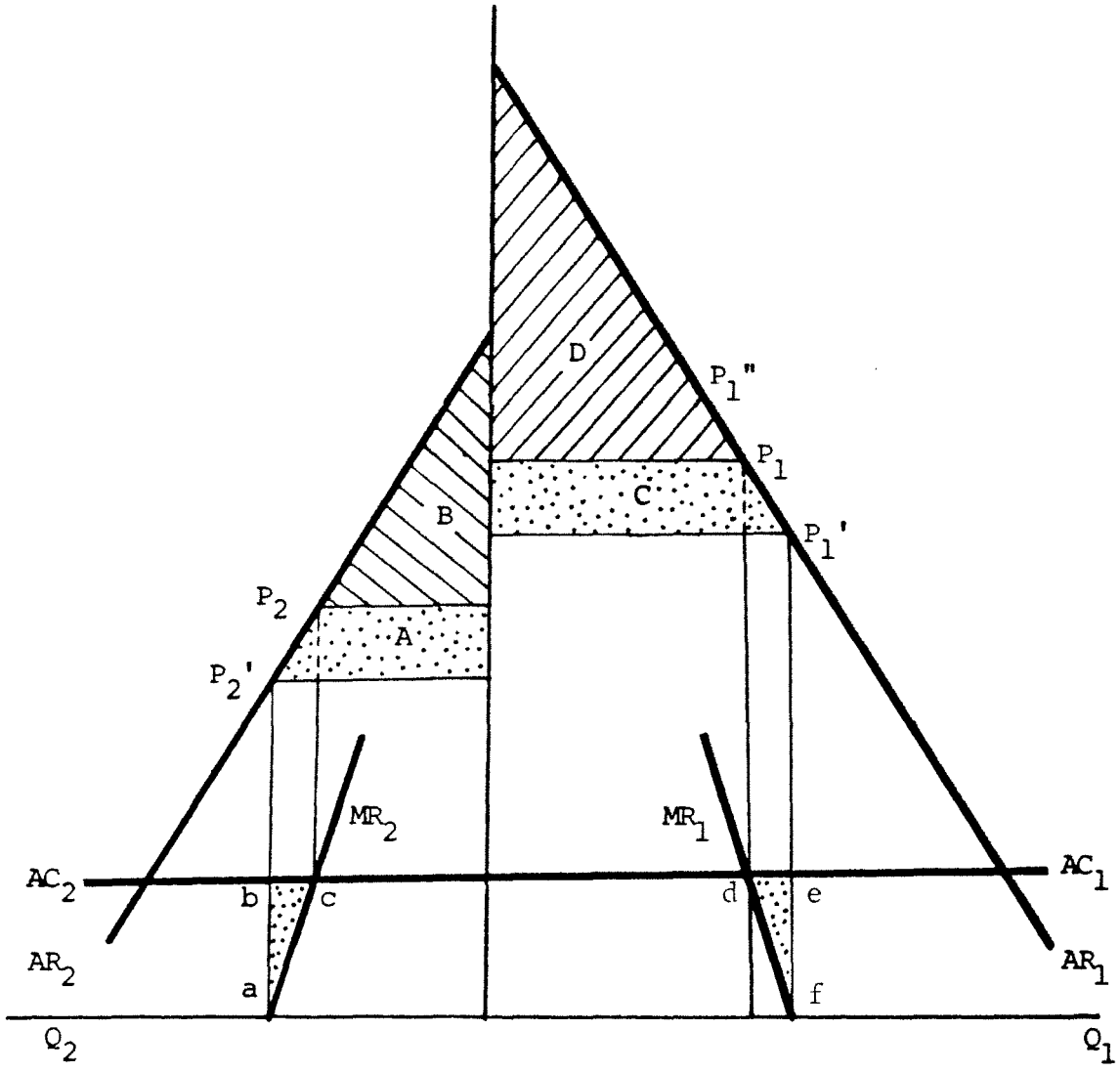

FIGURE 2

origin while maintaining a slope equal to that of AR_1. The new curve AR_2 is shown on the left side of Figure 2. The private firm responds by employing third-degree price discrimination to charge P_1 and P_2. Assuming that the optimal profit loss is unchanged,[8] an analogous response by government would be to hold group 1's price at P_1' and lower group 2's price to P_2'. Were this done, the profit losses caused by a given marginal price reduction would be the same for both groups, since ab = ef. However, equal incremental price reductions (where $P_1 - P_1' = P_2 - P_2'$) cause the proportionate change in consumer surplus to be greater for group 2 than group 1, since A/B > C/D. Hence, equal marginal price reductions--though their effect on profit is identical--will add more voter support grom group 2 than group 1. Under these conditions, the right side of equation (1) exceeds the left. This implies that government will respond to the decline in group 2's demand by lowering their initial price P_1' to a level below P_2' and by raising group 1's price P_1' to a level between P_1 and P_1'. To generalize, we can say that--as long as vote maximization precludes profit maximization, the AR curves are linear, and the two horizontal AC curves are equal--any relative changes in the two AR curves will cause government prices to be more negatively correlated than monopoly prices, because the former are more "demand-determined" than the latter. That is, government places more importance than private firms on the particular demand of a customer group in determining the price for that group.

Proposition 4: "Government Firms Will Tend to Treat Different Customer Groups More Uniformly Than Private Firms" [13, p. 146]

Because government prices tend to be positively correlated in response to cost changes and negatively correlated in response to demand changes, there is no a priori basis for asserting that these prices will even move in the same direction--much less that they will be more "uniform," a term which Peltzman does not define. Even if

public prices were generally more positively correlated than private prices, it would still not be evident that the former are also more uniform than the latter, unless by "uniform" Peltzman means that the absolute price difference for the private firm exceeds that for the government. This is why $P_1 - P_2 > P_1' - P_2'$ in Figure 1.

On the other hand, if the term is more usefully interpreted to mean that the ratio of private prices (P_2/P_1) exceeds the ratio of government prices (P_2'/P_1'), the result is unclear. This can be demonstrated in Figure 1, where average cost for the two groups is still assumed to be AC_1 and AC_2. With a small profit loss equal to area A + F, government reduces the higher price P_2 by a greater amount than the lower price P_1. Moreover, as the profit loss grows and the two prices fall, the lower price reaches zero before the higher price can drop to its level. To verify this, consider whether equation (1) is satisfied when $P_1' = P_2' = 0$. Since $AR_1 = AR_2$, groups 1 and 2 enjoy the same consumer surplus when their prices are equal. Consequently, a given marginal increase in their zero prices will produce the same proportionate decrease in consumer surplus for both classes. However, since $MC_1 < MC_2$ while $MR_1 = MR_2$, the marginal profit for group 1 is less than that for group 2 (that is, $MR_1 - MC_1 < MR_2 - MC_2$). At the margin, then, a given increase in the zero price causes group 1 to reduce voter support by the same extent as the second group but to increase profit contribution by a lesser extent. Since the left side of equation (1) exceeds the right side, a gradual withdrawal of the 100 percent subsidy will lead government to raise P_2' somewhat while $P_1' = 0$. Conversely, as the subsidy is increased to offset a growing profit loss, P_1' must reach zero while P_2' is still positive. Thus, even though P_2' falls more rapidly than P_1' as the subsidy rises, the gap between the two prices narrows at a diminishing rate. Given proportionate demand curves, P_1' always reaches zero before P_2' unless the constant AC curves are set at the same level. That $P_2/P_1 < P_2'/P_1'$ is especially evident (where $P_1 \neq 0$) when P_1' approaches zero and the lagging P_2' is many times larger. The fact that

P_1' reaches zero while P_{2L}' is still positive indicates that P_1' and P_2' are falling faster than the rate at which their difference is diminishing. Hence, $P_2/P_1 < P_2'/P_1'$ whether government's profit loss is large or small.[9] In situations such as this, government pricing is less uniform than private pricing even if the former were more positively correlated.[10]

In addition, we should consider the effect of "neglected" groups, which contain only non-voting consumers. Peltzman's analysis predicts that they will be charged prices equal to those of private firms while the benefitted groups will be charged prices which are on average lower than those of private firms [13, p. 114]. Since the price range (between neglected and benefitted groups) is hereby predicted to be greater for public firms than what would be set by monopolists, any tendency toward price uniformity among the benefitted groups could well be offset by large price differences between the benefitted and neglected public classes. This suggests that uniformity is more probable as neglected groups are more likely to (a) have low costs, (b) have high demand elasticity, and (c) be smaller in number where (a) and (b) are not sufficient to produce low monopoly-level prices.[11]

The foregoing arguments notwithstanding, it would not be surprising if public prices were found to be more uniform than private prices--though for a reason not suggested by Peltzman. Since public electricity rates are generally lower than private electricity rates, and since the small size of public electric utilities prevents their long-run marginal costs from falling below those of the large private utilities, the highest price charged any group by a public utility should be nearer MC than is true for a private firm. Therefore, a public firm--as with any firm whose top price is relatively low--would naturally have a narrower price range unless it were willing to charge prices below MC.[12] Using Peltzman's data on electric utilities, for example, the lowest/highest price ratio is only .51 for private residential consumers and only .45 for government residential. Since the highest industrial price is much

closer to MC than is the top residential price, it is not surprising that the lowest/highest price ratio is .69 for private industrial and .75 for government industrial [13, p. 124]. Because the price range is narrower for lower-priced classes, we should expect that it is also narrower for lower-priced firms, regardless of ownership form.

Even so, Peltzman's examination of electric utilities does not reveal public prices to be more uniform. In his first table, for example, government prices are all below the corresponding private prices, but none of the three customer classes receives distinctly better treatment by government than any other class [13, p. 124]. Accordingly, Peltzman concludes that these "generally negative results" are too ambiguous to support his vote-buying hypothesis [13, p. 126]. The lack of support is especially evident in a comparison of the lowest average prices for each of the three classes, which yields a public/private ratio of .86 for residential (R), .84 for commercial (C), and .86 for industrial (I). A comparison of the lowest and highest average prices within each class shows the low/high price ratio to be .45 for public R and .51 for private R; .52 for public C and .42 for private C; and .75 for public I and .69 for private I. For the C and I classes, then, public firms appear to have less price uniformity than private firms when various consumption levels are compared.

Although these results are inconsistent with Proposition 4, they are entirely consistent with the implications derived here, since government is predicted to exhibit negative price correlation (and thus less price uniformity) whenever the effect of demand differences among customer groups outweighs that of cost differences. Further, we have just seen that even positive price correlation is compatible with nonuniform public prices.[13]

Proposition 5: "Product Variety Will Be Smaller . . . in Government Firms than in Private Firms" [13, p. 118]

Since Peltzman's model cannot predict public prices to be more uniform than private prices, it may be the private firm--not government--that avoids the expenses of nonuniform treatment by grouping its customers into broader classes. In Peltzman's empirical study of the electric utility industry, government firms are shown to have a significantly smaller number of service classifications (which he takes to indicate product variety) than the private utilities [13, pp. 136-37]. Unfortunately, no pairing is done to ensure that the public and private firms are of similar sizes. Just as 7-11 stocks a smaller variety than does Safeway, small firms might well be expected to offer less product variety than large firms, regardless of ownership form. Since public electric utilities have much smaller output levels than private utilities, it would be interesting to know if Peltzman's "variety" differences are still significant when firm size is taken into account.

This questions seems to have been answered by De Alessi's study [5], which--after pairing to account for firm size--buttresses Peltzman's finding that regulated firms have more price schedules than government. However, De Alessi infers from this result that private firms employ more price discrimination--not that they offer greater product variety. If his interpretation is correct (as seems likely), these results support not Proposition 5 but 6, to which we now turn.

Proposition 6: "For Any Given Average Price Charged to a Group of Customers, the Privately Owned Firm . . . Will Engage in More Price Discrimination Within the Group [than Will the Government]" [13, p. 137]

Even if private prices were less uniform than public prices, this would not imply private firms engage in more price discrimination. Instead, it would have to be shown that the discrimination index, $(P_1/MC_1)/(P_2/MC_2)$, is farther from unity for private firms than for public firms.[14] Returning to the cost-shift scenario envisioned by Peltzman, recall that price discrimination did not exist in Figure 1

before group 2's costs increased. Instead, both groups were charged P_1 by the private firm and P_1' by government. Following the cost increase, however, the private firm raised group 2's price to P_2, a discriminatory level since $P_1/MC_1 > P_2/MC_2$. When government responded to the cost change by raising both group prices above level P_1', was its behavior less discriminatory than that of the private firm --or more? The answer is straightforward: Because Figure 1 was drawn such that $P_1 - P_1' = P_2 - P_2'$, it was easily shown that the difference between the new public and new private prices was less than $P_1 - P_1'$ for group 1 and greater than $P_2 - P_2'$ for group 2. That is, if Group 1's differential (between the new public and private prices) is called α and group 2's differential is called β, we showed $\alpha < \beta$. Thus, instead of charging prices P_1' and P_2' (a response to the cost increase which would have been analogous to that of the private firm), government was shown to charge the first group $P_1 - \alpha$ and the second group $P_2 - \beta$. Because $\alpha < \beta$, the public index $(P_1 - \alpha/MC_1)/(P_2 - \beta/MC_2)$ exceeded the private index $(P_1/MC_1)/(P_2/MC_2)$, which in turn exceeded unity. This shows that the discrimination index for the public firm was farther from unity than that for the private firm.

Since public prices tend to be more discriminatory than private prices due to cost differences (which cause prices to move in <u>like</u> directions), they will surely exhibit the same tendency in response to demand differences (which cause prices to move in <u>opposite</u> directions). This situation was shown earlier in Figure 2, where a difference between group demand curves caused the discrimination index of government to be farther from unity than that of the private firm. That is, by calling the post-demand-shift public prices $P_1 - \alpha$ and $P_2 - \beta$ where $\alpha < P_1 - P_1' = P_2 - P_2' < \beta$, it is clear that the public index $(P_1 - \alpha/MC_1)/(P_2 - \beta/MC_2)$ exceeded the private index $(P_1/MC_1)/(P_2/MC_2)$, which in turn exceeded unity. Note that in both the cost-shift and demand-shift scenarios, group 1 (having the higher P/MC ratio) was discriminated against under either form of ownership. Government discrimination against against this class was more severe than price discrimination because group 1 had

more consumer surplus in both scenarios than group 2 and, hence, had less price-elastic voter response. Since this was true for both cost and demand differences, the reformulated model (using Peltzman's premises) suggests that public firms tend to be more avid price discriminators than private firms. Whereas the private monopolist favors groups whose consumption is price elastic, the public monopolist favors groups whose voter support is price elastic.

This result contradicts Peltzman's view that public firms ". . . will tend to group customers into broader categories for price setting purposes . . ." and will engage in less "price discrimination" within the group [13, pp. 136-37], which apparently stems from his belief that they will ". . . forgo opportunities for profitable price discrimination . . ." [13, p. 118; emphasis added]. Actually, he is correct to infer that private firms (as profit seekers) will use more profit-seeking price discrimination than will public firms (as vote seekers). But this statement is quite beside the point, since government will not use profit-seeking price discrimination among the benefitted classes to a lesser degree--it will not use it to any degree. Instead, government will employ vote-seeking price discrimination and, given Peltzman's vote-buying rule, will tend to use more price discrimination per se.[15]

Of course, this conclusion impugns the validity of Proposition 6, not its accuracy. In fact, it has been supported by the results of two empirical studies.[16] Just because it cannot be derived from Peltzman's premises does not mean it cannot be explained: Averch and Jothson [1] predict that a profit maximizer subject to an effective regulatory constraint will employ below-MC pricing to expand output and, thereby, the capital rate base. Because regulated private firms cannot subsidize output expansion with tax revenues (as can government), they must cross-subsidize price-elastic customers at the expense of price-inelastic customers. Thus, private prices may be more discriminatory than public prices because "neglected" private groups provide the entire subsidy, whereas "neglected" public groups share the subsidy burden with taxpayers. Public prices are less discriminatory not because

government is averse to discrimination but, instead, because government's goal of vote-maximization is not constrained by a rate-of-return ceiling. It is this constraint which causes private firms to consider use of below-MC pricing, a practice which would otherwise be shunned. This explanation cannot be provided by Peltzman's model since, by assumption, his private firm is unconstrained [13, p. 110].

Proposition 7: "For Any Given Average Price Charged to a Group of Customers, the Privately Owned Firm Will Sell More Units of Output than the Government Owned Firm . . ." [13, p. 137]

As we have just shown, it is the Averch-Johnson effect--not the Peltzman effect--which predicts that regulated monopolists will have more discriminatory prices and, hence, larger levels of output than government enterprises. Because Peltzman's study of electric utilities compares the output levels of government firms with those of regulated private firms, it may be the Averch-Johnson effect--but surely is not the Peltzman effect--which explains one of Peltzman's most striking observations: compared to the output of government firms, that of regulated firms is about 33 percent greater for residential, 50 percent greater for commercial, and 100 percent greater for industrial customers.[17] These results are predicted by both the Averch-Johnson model and its extension by Needy [11], who shows that profit constraints may induce regulated firms to use sufficient price discrimination to push output far beyond the efficient rate. Consequently, there is reason to question yet another Peltzman hypothesis--which will not be pursued here since it relies upon the validity of Proposition 7--that ". . . the output of privately owned utilities is substantially closer to the most efficient output rate than it is for government utilities" [13, p. 140].

In contrast to the private firms in Peltzman's empirical study, those in his theoretical study are not regulated. Because there can be no regulation-induced output distortion where there is no regulation, Proposition 7 is not valid unless price discrimination based upon elasticity of consumption causes a greater quantity

to be demanded than is caused by price discrimination based upon elasticity of voter support. But none of Peltzman's premises ensures this to be true. On the contrary, both of his scenarios indicate that public firms tend to give a larger price reduction (from the monopoly-level price) to the group which is more price elastic at its monopoly-level price.

In the cost-shift scenario, for example, group 2's new public price is set farther below monopoly level P_2 than group 1's new public price is below monopoly level P_1. Because AR_2 is more elastic at P_2 than is AR_1 at P_1, output must be greater for government than the private firm, even if the amount of profit willingly forfeited by government is very small. In the demand-shift scenario, AR_2 is again more elastic at monopoly price P_2 than is AR_1 at P_1, since P_2 is nearer the midpoint of AR_2 than P_1 is to the midpoint of AR_1. As before, government favors the more price-elastic class (group 1) with the larger reduction in the monopoly-level price. This is true even if government's forfeiture of profit is very small. But this forfeiture need not be small since it is determined exogenously. Indeed, it could be so large that public customers are charged nothing at all. Because public customers may be subsidized even to the point of market saturation, and (more importantly) because government tends to have a greater output than private firms even when charging prices near the monopoly levels, Proposition 7 is the converse of what should be inferred from Peltzman's model.

Additional Caveats

Critical Role Played by the Vote-Buying Premise

Although Peltzman does not suggest it--and although it is, in fact, excluded from his model by the use of concave iso-vote curves--the correlation of government prices is also produced when the likelihood of voter support is proportional to an absolute change in consumer surplus.[18] Given linear demand curves, this implies

the lower the initial price charged one group the greater the number of votes gained by a given price reduction to that group--exactly opposite the situation envisioned by Peltzman. Government now allocates the profit reduction in such a way that the last dollar forfeited to group 1 yields the same absolute change in consumer surplus as that produced by the last dollar lost to group 2.[19] Public pricing strategy is based on the vote-buying rule that

$$\frac{\partial(\Delta CS_1)}{\partial \pi_1} = \frac{\partial(\Delta CS_2)}{\partial \pi_2} \qquad (2)$$

where $\Delta CS = (\partial CS/\partial P)\Delta P$ when $\Delta P = 1$. As we shall see, this second rule produces price correlation that is negative when cost curves diverge (between customer groups) and is positive when demand curves diverge--the opposite of the effects generated by Peltzman's vote-buying rule.

Returning to Figure 1 for the cost-shift scenario, assume as before that profit loss is double area F and that both groups have average costs equal to AC_1. Because the two groups are identical, both are charged the same price P_1 by the privately owned firm and the same price P_1' by the publicly owned firm. When group 2's costs rise to AC_2, the private price rises to P_2 for that group only. Government, on the other hand, will no longer extend both classes the same price cut of $P_1 - P_1'$. Were it to do so, it would gain more in voter support from group 1 than group 2 (since E > B) although profit reduction would be the same for both classes. This violates equilibrium Condition (2). Hence, application of Condition (2) dictates that government respond to the cost increase by lowering group 1's initial price P_1' and by raising group 2's initial price (also equal to P_1') to a level above P_2'. This implies that, in comparison to private prices, public prices tend to be more negatively correlated since they are less cost-determined. Because this contradicts Proposition 2, the Peltzman effect is shown to be very sensitive to changes in Peltzman's vote-buying rule.

Using Figure 2 for the demand-shift scenario, assume initially that both groups

are identical with costs and revenue given by AC_1 and AR_1, respectively. As before, the optimal profit loss is twice area def. This means that both groups are charged a monopoly price of P_1 and a public price of P_1'. When demand by group 2 falls (to a new position represented by AR_2), the profit-maximizing prices become P_1 and P_2. If public prices were now P_1' and P_2' a given addition to consumer surplus would cost less for the first class than the second, since A < C although area abc = area def. Consequently, the decline in demand by group 2 causes government to lower their price from P_1' to a level between P_2 and P_2'. At the same time, the first group's price is also reduced. This implies that, in comparison to private prices, public prices tend to be more positively correlated since they are less demand-determined. In this way, Peltzman's model is shown to produce Proposition 4 if his vote-buying rule is replaced with the alternative considered here.

Critical Role Played by Proportionate Demand Curves

In addition to being sensitive to an explicit assumption about voting behavior, the Peltzman effect is also sensitive to an implicit assumption about individual demand curves: since votes are cast by individuals--not groups--the Peltzman effect depends heavily upon the extent to which a change in group consumer surplus represents a change in consumer surplus for most of the individual members. Without considering the many aggregation problems that have been identified by the economics-of-voting literature, we can identify the nature of the difficulty quite simply: a 10 percent increase in consumer surplus for the group may imply a 400 percent increase for 2 percent of its members and no improvement for the others. Hence, a small price reduction in the monopoly-level price quickly wins 2 percent of the votes; further price reductions are useless until price falls to a level at which the remaining consumers are willing to buy. In such situations, government may win more votes by favoring a group in which the benefits are less concentrated. This simple example reveals the sensitivity of the Peltzman effect to an assumption which Peltzman does not explicitly make: the individual demand curves are approxi-

mately proportional to the group demand curve of which they are a part. In theory, government will reduce prices for any group that contains even one voter. In practice, however, our results will be dependent upon the utility's ability to group customers according to marginal cost of service, price elasticity of demand, and changes in consumer surplus.

Conclusion

Peltzman's model has been reformulated to show that, under the conditions specified by him, only two of his seven empirical propositions are actually implied by his theory. These are (1) that government prices tend to be lower than monopoly prices and (2) that government prices tend to be more positively correlated than monopoly prices because the former are less cost-determined. We have shown here, however, that the second proposition is only implied when cost differences among customer classes exceed demand differences. In addition, we have been able to generate five, new, empirically verifiable propositions from our reformulated model. These predict that, in comparison to privately owned firm, government firms will tend to (a) have prices which are more negatively correlated in response to demand changes, (b) have prices of the same uniformity, (c) offer the same variety of services, (d) employ more price discrimination, and (e) have larger levels of output. Of course, different results could have been obtained by altering the cost and revenue curves in our reformulated model. These functions can be manipulated to support any of Peltzman's propositions. However, because little can be said a priori about the shapes of these curves[20] (especially since Peltzman generalizes his theory to apply to all publicly owned firms) we have tested his propositions with the simplest model, in which there are no contrived special circumstances. As with Peltzman's first two propositions, our new hypotheses are subject to important caveats: they are sensitive to the assumptions that individual demand curves are proportional to the market demand of which they are a part, that voter support is proportional to the proportionate

change in consumer surplus, and that cross-subsidization of government customers by taxpayers is determined exogenously. Although these sensitivities are apparent in the reformulated model, they are not easily seen in Peltzman's model since its economical design hides as much as it reveals (as shown by its demonstrated vulnerability to misinterpretation). Hence, his model's ability to capture many complicated relationships by using only iso-vote and iso-profit curves (its mark of ingenuity) necessarily precludes its showing changes in cost, revenue, or consumer surplus. Carefully interpreted, however, Peltzman's model will continue to be an excellent foundation for the evolving theory of ownership form.

FOOTNOTES

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[1]Peltzman uses this graph as the centerpiece for a more recent article [14], but the five mistaken propositions are not corrected therein.

[2]Eight studies refer to Peltzman's 1971 paper and test one or more of his propositions. These studies are Crain and Zardkoohi [3], De Alessi [5], Hansman [6], Jarrell [8], Mann and Seifried [10], Peltzman [13], Vaughn [19], and Vaughn and Rives [20].

[3]The government's eagerness to subsidize electricity consumption is evident in the preferential tax treatment given public utilities. Using statistics provided by the Federal Power Commission, a recent study [18, pp. 65-66] finds that the 1975 tax payments by privately owned utilities represented 13.3 percent of their electric operating revenues; the comparable figure for publicly owned utilities (in municipalities) was only 4.1 percent. (However, it is noted that about 25 to 50 percent of the difference in tax payments is made up with in-lieu-of payments by public utilities to the general revenue of municipalities.) In addition, public utilities are able to issue tax-exempt municipal corporation bonds at a yield of 2 or 3 percentage points below what private utilities have to pay on their taxable corporation bonds. The lower interest rate is achieved at public expense, since the interest on public bonds is exempt from federal (and often state) income taxation. Even though public utilities as a group seem to subsidize electricity consumption, there may be many exceptions: Colberg [2, p. 382] reports that in 1955 there were 69 cities which appeared to be using excess utility profits as a

substitute for property taxes. Strauss and Wertz [17] use 1973 data to examine 58 of the 72 North Carolina cities that own electric utilities. After controlling for population and per capita income, per capita tax revenue in these cities is observed to be 25 to 45 percent lower than in other cities. Also using 1973 data, Nelson [12] compares 28 municipal utilities that make revenue contributions with 23 municipal utilities that do not. He finds that the contributing firms have lower average costs. However, since no adjustment is made for variations in tax payments, it is not clear that the contributors fully offset their tax advantages with revenue contributions.

[4]While Peltzman's model does not preclude negative profits, such a situation is actually very rare. A recent study [17, p. 23] found that city-operated electric utilities reported positive net incomes 98.8 percent of the time during 1951-1971. However, these results ignore the costs shifted to taxpayers as a consequence of public firms not paying taxes. Were these costs considered, negative profits may not have been found to be so rare.

[5]Peltzman actually suggests--what amounts to the same thing--that likelihood of votes is proportional to the <u>percent</u> change in consumer surplus.

[6]Although less obvious, the same result is obtained by using proportionate demand curves, which only requires that the linear demand curves have the same vertical intercept.

[7]This hypothesis is supported not only by Peltzman's empirical study [13, pp. 130-135] but also by Mann and Seifried's study [10], which indicates that <u>public</u> firms have residential rates that are more cost-determined than the rates of other customer classes. In addition, two studies of <u>private</u> electric utilities by Jackson [7] and Mann and Mikesell [9] indicate that private firms have rates which are equally cost-determined among the three customer classes. An excellent review of this literature is provided by De Alessi [4].

[8]The optimal profit loss is the voluntary forfeiture of profits. This can be assumed unchanged although--in addition to this--there is an involuntary profit reduction caused by the decrease in demand. For example, government may continue to forfeit $20 although possible total profit has fallen from $90 to $50.

[9]The conditions necessary for these results appear to be (a) all demand curves are negatively sloped, (b) all AC curves are nonvertical, (c) each group's demand curve is more negatively sloped than its AC curve if the latter is negatively sloped, and (d) vote-maximization precludes profit-maximization.

[10]The symmetry of Peltzman's elegant graph [13, p. 116; and 14, p. 235] is beguiling: it is intuitively appealing to believe that the tangency of a convex iso-profit curve to a concave iso-vote curve will somehow occur (as Peltzman shows it) about midway between the two price axes, causing both prices to be nearly equal. However, there is no reason to believe that a ray from the origin through this equilibrium point is any more likely to have a slope near unity than is a ray intersecting the point of profit maximization. Thus, the vote maximizing price ratio is just as likely to exceed the profit-maximizing price ratio as to fall short of it.

[11]For publicly owned electric utilities, the neglected groups might include the resale of electricity to other (nonvoting) utilities. For many firms these resales are quite substantial in size. Even though other utilities would presumably be charged the profit-maximizing price, their highly elastic demand ensures that they will pay the very lowest price. Hence, if the neglected groups have greater price elasticity of demand (or lower costs) than the benefitted groups, the former groups may have lower prices than the latter. This would make price uniformity more likely as the neglected groups grow in size. However, we are unable to say a priori that the neglected groups are different in any way except for their inability to vote.

[12]The possibility of below-MC pricing is considered below in footnote 13.

[13]One possible explanation for Peltzman's empirical results is that public utilities

avoid price uniformity by charging below-MC prices. The proximity of MC to their (relatively low) top price would thus no longer be constraining. Another explanation is Hansman's argument [6] that the necessity for regulated firms to obtain permission to alter rate schedules raises private costs, causing private firms to be less responsive than public firms to cost or demand changes. Hansman's view is supported by Crain and Zardkoohi's suggestion [3] that private prices will change systematically if cost or revenue changes affect all consumer groups alike. But government prices, they believe, will exhibit less correlation since public firms must respond to a set of considerations including more than just wealth maximization.

[14]As generally used, price discrimination between two classes implies $P_1/MC_1 \neq P_2/MC_2$ or $P_1 - MC_1 \neq P_2 - MC_2$. The first of these two conditions is the version favored by Stigler [16, p. 209n], and it appears to be the more popular.

[15]When Peltzman is referred to in the regulatory literature, he is credited with showing that government will tend to empoy less price discrimination--not simply less profit-seeking price discrimination. He is interpreted in this way by at least two empiricists [5 and 6] and four theorists [4, 18, 19 and 20].

[16]It has been supported by De Alessi [5], discussed earlier, and also by Hansman [6], whose study of 18 matched pairs of water utilities shows private firms to use more service categories than are employed by public firms.

[17]Much of the output difference is explained by the fact that private firms generally serve larger cities than do public firms. Even taking this into account, however, Peltzman still finds the private output levels to be significantly greater.

[18]Even within the context of Peltzman's Figure 1 [13, p. 116], this statement is easily shown to be valid. Although our change in the voter support premise would make the iso-vote curves convex in that graph, the vote-maximizing equilibrium solution would still be given by the tangency of a (now convex) iso-vote curve to an iso-profit curve. It is clear that the latter curve must be more convex than the former, since iso-profit curves curves have positive-, zero- and negative-slope

segments while the iso-vote curves must be everywhere negatively sloped. The negatively sloped iso-vote curve cannot be tangent to the vertical or horizontal portion of the iso-profit curve, a necessary condition if only one group is to be charged the profit-maximizing price. Hence, a cost or demand change for one group alone will alter price for both groups. (Note that Peltzman's Figure 1 mistakenly shows an intersection of iso-profit curves π_1^{O} and π_1'', which are correctly shown to be nonintersecting in a more recent article [14, p. 235].)

[19]Therefore, the second rule would be much easier to implement than the first, since it is simpler to estimate an absolute change in consumer surplus than a proportional change. Naturally, it is easier to formulate a tiny demand segment than the entire curve above that segment. This is not meant to imply, however, that government would choose the second rule over the first because the second is easier to implement; the decision rule is imposed upon government by voter behavior.

[20]For example, most electric utilities are now of such large scale that economists are in disagreement as to whether these enterprises are operating on the positively or negatively sloped portion of their LATC curves.

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