The price-iso return locus and rational rate regulation

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The price-iso return locus and rational rate regulation

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The price-iso return locus for a regulated multiproduct firm shows all price vectors giving the rate of return permitted by regulation. The locus for any two products is shown to have both negatively and positively sloping segments. A price vector on a positively sloped segment is socially inefficient, because both prices can be cut without reducing rate of return. Yet, regulatory policy may force firms into such parts of the locus. Other significant properties of the locus are derived, including the relation of its shape to demand elasticities and its implications for cross subsidy and for Ramsey optimality.

1. Introduction

■ This paper uses a simple construct, the price-iso return locus, to describe and analyze the full range of pricing options for the multiproduct firm under rate of return regulation. This is the locus of all points in price space which yield exactly the rate of return permitted by the regulator. A characteristic shape is derived for that locus and is shown to have significant implications for controversies in the area of rate regulation such as the appropriate test of cross subsidy and the use of a full-cost pricing criterion, on the assumption that strictly static analysis is appropriate throughout.

Specifically, the following results emerge from the analysis. First, there will generally be some segments of the locus along which there is cross subsidy of one product by the other, while along other portions of the locus no cross subsidy occurs. These sections are readily distinguished by the shape of the locus. Second, there will generally be a segment of the locus which involves inefficiency in the sense that from any point in such a segment one can move to another price vector which is preferable to all consumers of any of the firm's products and is, at the very least, not detrimental to the regulated supplying firm.

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Third, regulatory pricing principles, such as fully distributed cost pricing, which are often advocated by competitors of the regulated firm, can drive prices to a point on an inefficient segment of the locus. Finally, a Ramsey price vector (a vector of prices that are Pareto optimal under a profit constraint) will generally not lie at a point in an inefficient segment of the locus. But it may conceivably lie on a segment along which there is cross subsidy of one product by another.

One of the major implications of the analysis is that a piecemeal criterion for the testing of cross subsidy is highly unsatisfactory. It is not possible to analyze this issue by means of a procedure which deals with a firm's products in isolation and ignores the multiproduct character of the enterprise.[1]

It should be emphasized that the price-iso return locus is simply an iso (rate of) profit curve in price space. Such curves have appeared in the literature before (see, for example, Panzar and Willig (1977), Baumol (1959)). But so far as we know, the shape of these loci has never been explored systematically before.[2] And, indeed, some previously unanticipated features of this locus turn up in the analysis.

2. The construct and its basic properties

■ To determine the set of price vectors available to a regulated firm which is subject to a rate of return constraint, let

R = the total revenue function
C = the total cost function (excluding the cost of capital)[3]
k = the quantity of capital input (measured in money terms)
y = the output vector
p = the vector of output prices
r = the cost of capital (the normal or competitive rate of return), and
r^* = the regulated rate of return on capital (the "fair rate of return").

Then constancy of rate of return requires

$$(R - C)/k = r^* = \text{constant} \qquad \text{or} \qquad \pi = R - C - r^*k = 0. \tag{1}$$

We shall refer to π as the excess profit, that is, the profit in excess of the "fair return on capital," r^*k. Taking input prices to be given, each of the variable components of the excess profit is a function of y (with R also a function of p), which is itself a function of p. Therefore, our excess profit relationship (1) can be written

$$\pi(p) = 0. \tag{2}$$

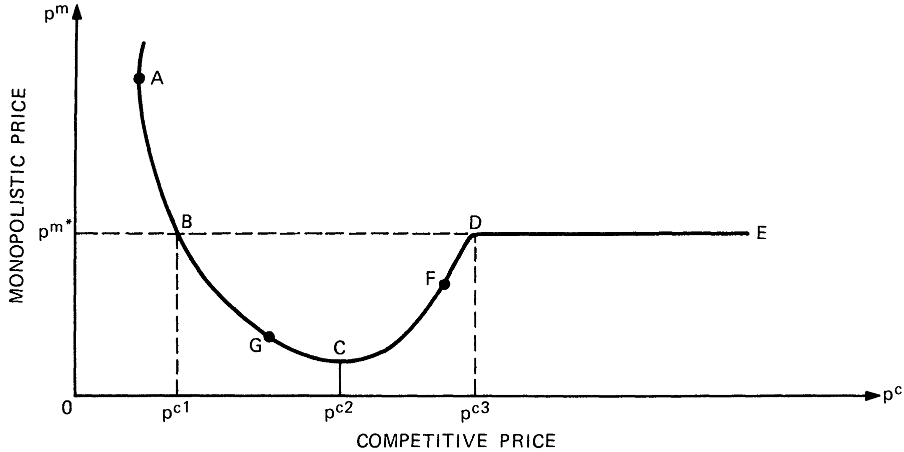
[1] It should be emphasized that in mentioning cross subsidy we do not pretend to be dealing with the more complex issue of predatory pricing which is sometimes associated with it. Williamson (1977) and Baumol (1979) have emphasized elsewhere that predatory pricing involves strategic and timing elements which no static test of cross subsidy can encompass.

[2] This impression has been confirmed in conversation with Panzar and Willig, who have suggested that it may be worth reexamining their analysis in light of what is now known about the shape of the locus. Where the iso profit locus in price space has been used before, it has been used for other purposes not related directly to the regulatory issues that have just been listed, and which constitute the subject of this paper.

[3] If this cost function is to be interpreted as that obtained from duality analysis of the production set, it must be assumed that the firm employs efficient factor proportions so that the firm's operations occur in the efficient region of the production set. However, our analysis does not require this assumption. We may take the cost function to be whatever its degree of efficiency dictates, so long as that cost function can be assumed to be given.

FIGURE 1

A PRICE–ISO RETURN LOCUS



This is the equation of the price-iso return locus, the locus of all price vectors which just yield the "fair rate of return" to the regulated firm.

Restricting price changes to two products, we can show the price-iso return locus in a two dimensional graph (Figure 1) in price space. To suggest its nature think in terms of a case that often appears in regulatory discussions: a firm, one of whose products is sold in markets in which the seller holds a monopoly, while the other product of the firm has at least *some* competitors.[4]

Under plausible assumptions, the price-iso return locus will be shown to have the form depicted in Figure 1 over the relevant range. Intuitively, the negatively sloped segment of the locus AC (with price of the competitive good $p^c < p^{c2}$) is the relation most commonly expected—here, if only the price of the competitive product, p^c, is reduced, the rate of return falls. Therefore, to keep the rate of return constant, the monopoly price, p^m, must be increased. Thus, the locus has a negative slope in this region.

But it is not generally recognized[5] that *the curve will normally have a positively sloping segment*, one which has important implications for policy because it represents vectors of inefficient prices. To the right of point C, any *rise* in the price of the competitive product begins to erode its market sufficiently to reduce the rate of return. In this interval, therefore, a *rise* in p^c requires an

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[4] It is somewhat misleading to refer to the market for such goods as "competitive," rather than "oligopolistic," but the former usage is more common in applied regulatory discussions. The distinction between the competitive and the monopoly products plays no significant role in the analysis and is used primarily for mnemonic convenience.

In our analysis, as in reality, the price of the "competitive" product is not fixed by impersonal market forces, though they may well influence its magnitude. Rather, the price is selected by the regulator or by the regulated firm, whose decision is subject to review by the regulator.

[5] Thus, for example, in Panzar and Willig (1977) the price-iso profit loci for multiproduct firms are drawn to be negatively sloping throughout, having neither the horizontal rightward segment DE nor the upward-sloping segment, CD, depicted in Figure 1. It may be noted, incidentally, that there is a minor conceptual difference between the Panzar-Willig loci and ours. Theirs depict all price vectors which keep *total* profits constant while ours represent all prices which yield the same *rate of return*, because we are dealing with rate of return regulation. However, the two curves coincide when total profit is zero, i.e., when the regulated rate of return equals the cost of capital.

accompanying *rise* in p^m if rate of return $(R - C)/k$ is to remain constant. Consequently, the slope of segment CD of the locus is positive. Finally, at price $p^c \geq p^{c3}$ the firm is driven out of the competitive market altogether.[6] Therefore, any further rise in p^c will make no difference to $(R - C)/k$, which now becomes a function of p^m alone. Thus, to the right of p^{c3} the locus will be horizontal, because the monopoly price will be fixed at p^{m*}, the level which, by itself, suffices to yield the fair rate of return.

A price-iso return locus of the shape depicted has some immediate implications for regulatory policy:

(1) Referring to Figure 1, suppose the price of the competitive product is set at p^{c2}. (This is the price at which the corresponding price for the monopoly product is minimized.) And suppose that competitors argue that p^{c2} is less than "fully distributed cost," however they may calculate it. Then, a decision to force a rise in the competitive price, allegedly to protect the interests of the customers of the monopoly product, must, because of the positive slope of the locus to the right of C, cause buyers of both the competitive product and the monopoly product to pay higher prices. No one gains except the competitor of the regulated firm.

(2) Any price for the competitive product below p^{c1} can reasonably be considered to involve a cross subsidy. That is, it requires buyers of the monopoly product to pay a price higher than the price p^{m*}, which they would pay if the competitive output were eliminated altogether from the regulated firm's product line. Thus, a competitive price $p^c < p^{c1}$ can be said to impose a *burden* on the consumers of other company products.

It follows from all this that any price vector which involves neither cross subsidy nor any opportunity cost to all customer groups must be represented by points on the segment BC.

(3) To relate our construct to standard welfare analysis, we shall also show that the Ramsey price combination for the regulation firm, i.e., the price combination which is Pareto optimal subject to the constraint that the firm earn its fair rate of return, will (under certain appropriate assumptions, which we specify later) never lie above the price range in the acceptable segment, BC. But, while the Ramsey point must lie to the left of p^{c2} in Figure 1, it may fall to the left of p^{c1}. Thus, the Ramsey prices will not fall in the inefficient, upward sloping portion of the price-iso return locus, but may conceivably involve some cross subsidy.

3. Derivation of the shape of the locus

■ By inspection of our basic relationship (2) we observe that the price-iso return locus for any pair of products is an iso excess profit curve in the price plane. This observation permits us to carry out a standard analysis of this curve. Throughout the graphic analysis, all prices but those for one of the competitive products and one of the monopolistic products are held constant. Any iso excess profit curve is then characterized by

$$\partial\pi/\partial p^c dp^c + \partial\pi/\partial p^m dp^m = 0. \tag{3}$$

[6] There need be no sharp corner at p^{c3}—the firm may be driven out of the competitive market gradually. However, though it makes no difference for the analysis, it is perhaps plausible that there typically will be some price at which the firm will lose its market completely to its competitors.

To provide a geometric interpretation of this equation, we define in the usual way the locus direction vector as (dp^c,dp^m), and the excess profit gradient as $(\partial\pi/\partial p^c,\partial\pi/\partial p^m)$. It will be recalled that π is a function of p alone, so that this must also be true of its partial derivatives, the gradient. Hence at every point in the price plane we can draw in gradient $(\partial\pi/\partial p^c,\partial\pi/\partial p^m)$. Equation (3) is equivalent to the statement that the inner product of the locus direction vector, (dp^c,dp^m), and the excess profit gradient, $(\partial\pi/\partial p^c,\partial\pi/\partial p^m)$, is zero, that is, the locus is everywhere perpendicular to the gradient, $(\partial\pi/\partial p^c,\partial\pi/\partial p^m)$. Clearly, the shape of the locus is determined by $\partial\pi/\partial p^c$ and $\partial\pi/\partial p^m$ as functions of p.[7]

By definition, any $\partial\pi/\partial p^i$ indicates the effect of a change in p^i on π, when all other prices of our firm are held constant.[8] At a zero price for commodity i, its profit contribution will be zero or negative, while at a price sufficiently high, it will be priced out of the market altogether. We follow the usual premise that in the intermediate region its profit contribution will have a unique maximum which is approached gradually from either direction. In these circumstances, if we let p^i vary from zero through infinity, π must initially increase, then decrease, and become constant when p^i becomes so large that product i is driven from the market, so that further increases in i are irrelevant. That is, $\partial\pi/\partial p^i$ will be positive, negative, and zero in these respective regions. In particular, for every value of p^m, $\partial\pi/\partial p^c$ will be positive for small values of p^c, negative for intermediate values of p^c, and zero for high values of p^c. Hence we have three regions in the (p^c,p^m)-plane, such that $\partial\pi/\partial p^c$ is positive in the western region, negative in the more or less vertical central region, and constant in the eastern region.[9] Similarly, we have three other regions, such that $\partial\pi/\partial p^m$ is positive in the southern region, negative in the more or less horizontal central region, and constant in the northern region. Combining these observations, it follows that the price plane can be divided into nine regions, such that in each of them the gradient $(\partial\pi/\partial p^c,\partial\pi/\partial p^m)$ points in the general direction indicated in Figure 2.

However, in reality only part of the price plane may be relevant. To illustrate how this may occur we assume that the demand for the monopolistic product is sufficiently inelastic that $\partial\pi/\partial p^m > 0$.[10] The absence of competition,

[7] It may seem that the shape is also directly dependent on the cross partial derivative $\partial^2\pi/\partial p^c\partial p^m$. This cross partial does, of course, have an *indirect* influence, but when we use (3) to analyze the shape of the locus, it is clear that the value of the cross partial enters the matter *only* through its effects on $\partial\pi/\partial p^c$ and $\partial\pi/\partial p^m$.

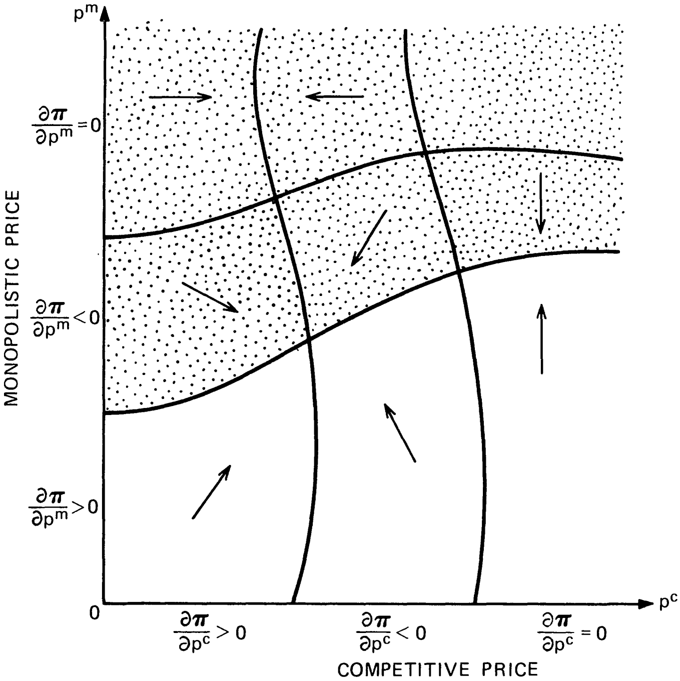
[8] On the other hand, competitors' prices are not taken to be given. Presumably, our firm will have some conjectures about the reactions of rivals, perhaps based on experience, and this will determine the firm's views about the precise shape of the locus.

[9] The values of the second-order derivatives cannot change these relationships. Whether, for example, $\partial^2\pi/\partial p^{c2}$ is negative or positive, the qualitative properties of the first derivatives in the three regions will be unaffected, since they follow from our three basic premises for every value of p^m: the uniqueness of the value of p^c which maximizes profit, the gradual approach of π from either direction to its maximal value, and the existence of a finite value of p^c beyond which that product is driven from the market. Cross effects only influence the shapes of the boundaries between the regions. To illustrate this, consider a border point at which there is a nonzero cross effect. For example, let $\partial^2\pi/\partial p^c\partial p^m$ be positive at a point between the western and central regions. Then the border will not be vertical there, but will have a positive slope. For then one can enter the western region, where $\partial\pi/\partial p^c$ is positive, just by moving upward, that is, by increasing p^m, since that will then raise $\partial\pi/\partial p^c$.

[10] It is easily shown (and is intuitively clear) that if demand for the monopoly product is inelastic, only strong complementarity in the demands for pairs of products can cause this inequality to be violated.

FIGURE 2

DIRECTION OF THE GRADIENT $(\partial\pi/\partial p^c, \partial\pi/\partial p^m)$ IN 9 SUBREGIONS OF THE PRICE PLANE



of course, reduces the elasticity of the firm's demand curve, so that this premise is not implausible. Now the price plane is restricted to the southern region in Figure 2, which we may consider the relevant range.

Since the price-iso return locus is everywhere perpendicular to the gradient, over the relevant range it must decrease throughout the western subregion, increase in the central subregion, and be horizontal in the eastern subregion. These are the basic properties of the locus which are depicted in Figure 1.

With the aid of Proposition 1 (below) we prove that the slope of the segment AC of the locus, the portion of the segment to the left of the minimum, will be steeper (i) the greater the elasticity of demand of the monopoly product, (ii) the smaller the elasticity of demand of the competitive product, (iii) the greater the ratio of the marginal cost of the competitive product to its price, and (iv) the smaller the ratio of marginal cost of the monopoly product to its price. In addition, we prove that the slope of CD, the rising segment of the locus, will be greater the greater the demand elasticity of either product and the smaller the ratio of marginal cost to price of either product.

One can prove these results with the aid of a slightly more formal characterization of the shape of the locus, providing an explicit expression for its derivative, dp^m/dp^c. For this purpose, let $R^i = p^i y^i$ be total revenue of product i and let E^i_j represent the elasticity of demand for product i with respect to price j. In addition, we define the marginal cost-price ratio $M_i = (C + r^*k)_i/p^i$. Here $(C + r^*k)_i = \partial(C + r^*k)/\partial y^i$ is the marginal cost when cost of capital equals the fair rate of return, and where the subscript denotes partial differentiation with respect to the indicated variable. The slope of the price-iso return locus is then determined by Proposition 1.

Proposition 1.

$$\frac{p^c}{p^m}\frac{dp^m}{dp^c} = -\frac{R^c + \sum_j R^j(1 - M_j)E^j_c}{R^m + \sum_j R^j(1 - M_j)E^j_m},$$

where in the summation j refers to all of the firm's products, including c, m, and any other items it produces.

Proof. Differentiating (2) totally, we have $\sum_i (\partial\pi/\partial p^i)dp^i = 0$. In particular, setting $dp^i = 0$ for $i \neq c, i \neq m$, we obtain $(\partial\pi/\partial p^c)dp^c + (\partial\pi/\partial p^m)dp^m = 0$ or $(p^c/p^m)(dp^m/dp^c) = (-p^c\partial\pi/\partial p^c)/(p^m\partial\pi/\partial p^m)$. Clearly, we have to show that $p^i\partial\pi/\partial p^i = R^i + \sum_j R^j(1 - M_j)E^j_i$. Using subscripts to denote partial differentiation, we obtain from (1), $\partial\pi/\partial p^i = y^i + \sum_j (p^j - C_j - r^*k_j)\partial y^j/\partial p^i$. Multiplying through by p^i, and multiplying and dividing the jth term in the summation sign by p^jy^j, we obtain $p^i\partial\pi/\partial p^i = p^iy^i + \sum_j p^jy^j(p^j - C_j - r^*k_j)/p^j(p^i/y^j)\partial y^j/\partial p^i = R^i + \sum_j R^j(1 - M_j)E^j_i$.

From this result it is easy to deduce some of the relationships between elasticities and cross elasticities of demands for the two products and the slope of the price-iso return locus that were described in the text preceding Proposition 1. For this purpose we do, however, assume, in addition, that $M_j < 1$ for all products, i.e., that every product's price is above its marginal cost.[11]

There is another previously unrecognized feature of the price-iso return locus which has not yet emerged from the discussion. Figure 3 represents a surface showing the firm's rate of return, rCP, as a function of its prices.[12]

Setting $r(p) = r^*$ for various values of r^* means that the "rate of return hill" in Figure 3 is cut by horizontal planes whose intersections are the price-iso

[11] Whether or not this is true for any particular regulated firm is a matter for empirical investigation. However, we may note that if the firm is subject to economies of scale, it must lose money unless *some* $M_j < 1$. We may note also that while in our analysis marginal cost is well defined, some Averch-Johnson bias may enter if r^* is not equal to the cost of capital.

[12] This graph is derived from specific demand and cost functions. For simplicity, the demand and cost curves are linear and independent, though we have other examples involving interdependence, and they have the same qualitative properties. The demand functions used are

$$y^m = \begin{cases} 1 - p^m & \text{if} \quad 0 \le p^m \le 1 \\ 0 & \text{if} \quad p^m > 1 \end{cases} \quad \text{and} \quad y^c = \begin{cases} 1 - p^c & \text{if} \quad 0 \le p^c \le 1 \\ 0 & \text{if} \quad p^c > 1. \end{cases} \tag{i}$$

Operating costs are assumed to be proportional to outputs:

$$C(y) = C_my^m + C_cy^c. \tag{ii}$$

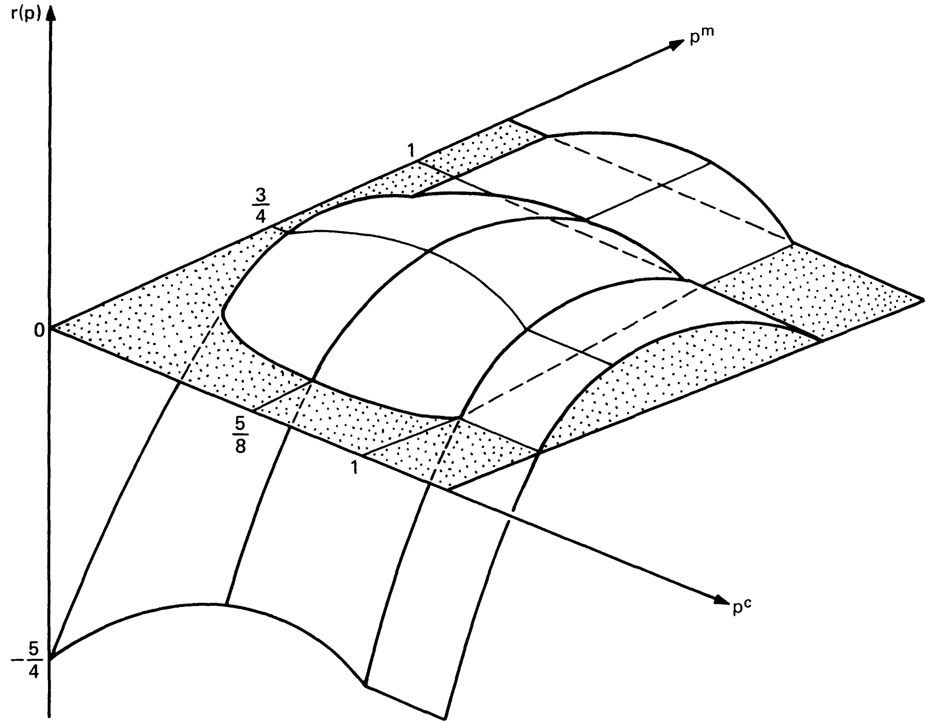
If total required capital is constant, e.g., $k(y) = 1$, then rate of return is given by

$$\begin{aligned} r(p) &= [R(p) - C(p)]/k(p) \\ &= p^my^m + p^cy^c - C_my^m - C_cy^c \\ &= \begin{cases} (p^m - C_m)(1 - p^m) + (p^c - C_c)(1 - p^c) & \text{if} \quad 0 \le p^m, \quad p^c \le 1 \\ (p^m - C_m)(1 - p^m) & \text{if} \quad 0 \le p^m \le 1 \quad \text{and} \quad p^c > 1 \\ (p^c - C_c)(1 - p^c) & \text{if} \quad 0 \le p^c \le 1 \quad \text{and} \quad p^m > 1 \\ 0 & \text{if} \quad p^m, p^c > 1. \end{cases} \end{aligned} \tag{iii}$$

The shape of $r(p)$ is represented for $C_c = 1/4$ and $C_m = 1/2$. The point of maximum return can be shown to be $r(p) = 13/64$ for $p^m = 3/4$ and $p^c = 5/8$.

FIGURE 3

THE RATE OF RETURN, r(p), AS A FUNCTION OF PRICES p^m AND p^c



return loci in Figure 4.[13] This shows that the price-iso return locus of Figure 1 is only a segment of a more symmetric locus, such as *ST* and *WV* in Figure 4, whose relation is like that between the usual negatively sloped indifference curve and the closed indifference locus obtained when one considers product quantities beyond the point of consumer satiety. Note that such a complete price-iso return locus will characteristically have *two* horizontal and *two* vertical segments corresponding to a price of one product which drives it completely from the market, while the other is priced just sufficiently below or just sufficiently above the profit maximizing price to yield exactly the authorized rate of return, r^*.

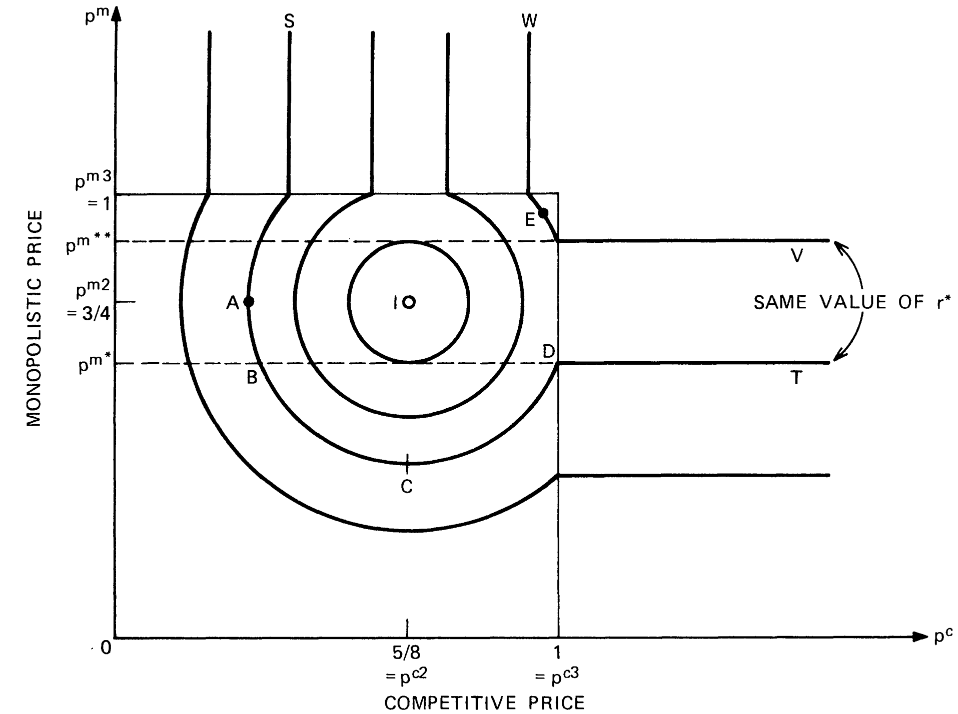
Incidentally, Figure 4 also shows that a constraint on the rate of return alone does not necessarily lead to a socially desirable outcome. With a given value of r^*, the firm may choose a combination of two high prices (e.g., point *E*) which is even worse for consumers than the profit-maximizing price combination (point *I*).[14]

[13] Using the transformation $p^m = p^{m'} + (1 + C_m)/2$ and $p^c = p^{c'} + (1 + C_c)/2$, the iso return locus can be rewritten as $p^{m'2} + p^{c'2} = ((1 + C_m)/2)^2 + ((1 + C_c)/2)^2 - r^*$. This describes circles with the center at $p^{m2} = (1 + C_m)/2$ and $p^{c2} = (1 + C_c)/2$, within the unit square $0 \leq p^m, p^c \leq 1$. The simple functions used here require sharp kinks at the point where a linear segment of a locus joins its curved segment.

[14] In this case, even the firm is made better off by certain combinations of lower prices, which, however, violate the regulatory constraint.

FIGURE 4

A SERIES OF PRICE–ISO RETURN LOCI IN AN EXAMPLE WITH LINEAR DEMAND CURVES



If the amount of capital needed increases with output, as one would normally expect, then at low prices, where output is high and more capital is used, a higher amount of profit is required to yield the same rate of return. This means that for a given value of r^*, the profit hill of Figure 3 is intersected by surfaces that slope downward from the origin towards higher prices (and then become flat where prices are sufficiently high to reduce demand to zero). As a result, the price-iso return loci in Figure 4 will shift towards the upper right.

4. Relationship to Ramsey pricing

■ We turn next to the conjecture (which will be proved under somewhat restrictive assumptions) that the point representing a Ramsey price vector[15] always falls in the efficient region in which it is not possible for the firm to reduce all of its prices without a reduction in its rate of return (segment AC in Figure 1 or 4). But it has also been shown that Ramsey prices need not meet the burden test (that is, it may lie in segment AB in Figure 1 or 4). Here, Ramsey prices are defined, as usual, as the vector of prices which is Pareto optimal subject to the pertinent budget (rate of return) constraint.

We shall make the following assumption, which seems quite natural:

Assumption 1. The demand functions are such that if all $p^i \leq p^{i'} (i = 1, \ldots, n)$, the firm's capital use will increase or at least not decline.

[15] See, for example, Ramsey (1927) and Boiteux (1971).

That is, if all prices are reduced or at least remain constant, then, since we expect the demand for most products either increases or remains constant, capital use will not decline. We also use

Assumption 2. The firm actually earns rate of return, r^*, imposed by regulation.

Then we have

Proposition 2. If the interests of competitors do not enter the calculation or if they are constrained by competition, regulation, or other circumstances to earn zero economic profit (i.e., their rate of return equals their cost of capital), then if p^r is the Ramsey price vector, there cannot exist another price vector p^* which also satisfies the rate of return constraint and for which $p^{i*} \leq p^{ir}$ for all i.

Proof. Consider two price vectors $(p^1, \ldots, p^n)$ and $(p^{1'}, \ldots, p^{n'})$ with $p^i \leq p^{i'}$, $i = 1, \ldots, n$, where strict inequality applies in at least one component and with identical rates of return, $r(p^1, \ldots, p^n) = r(p^{1'}, \ldots, p^{n'})$. Since no price in p is higher than the corresponding price in p', and at least one is lower, consumers' surplus must be greater under p. The *rate of return* of the firm is, by hypothesis, the same under p and p'. But since by Assumption 1 it must use no smaller an amount of capital (at a price assumed to be fixed), and since by Assumption 2 it earns at least the fair rate of return on its capital under either price vector, its total net profit cannot be lower under p. Since the price vector $(p^1, \ldots, p^n)$ leaves all consumers better off than $(p^{1'}, \ldots, p^{n'})$, and does not harm the supplier, and since either no other firm is involved or its net economic profit (producers' rent) is fixed, $(p^{1'}, \ldots, p^{n'})$ cannot be a Ramsey price vector. This completes the proof of Proposition 2, and shows that the Ramsey price vector cannot fall in any positively sloping segment of the price-iso return locus.

Of course, in practice, competing firms will often benefit if the regulated firm is forced to adopt the higher prices, and this leaves us with a problem which is, as yet, unsettled: should the effects upon competing firms enter the Ramsey calculation and, if so, how?

Faulhaber and Zajac (1976) have proved the following proposition in an unpublished paper.

Proposition 3. Ramsey prices need not pass the burden test.

This implies that the prohibition of cross subsidies, which is often regarded as a criterion of fair pricing practices, may in fact reduce total welfare. It raises interesting issues about the basis upon which a tradeoff between the two should be decided upon, a topic which, however, goes beyond the bounds of our subject. It is easy to prove Proposition 3 by counterexample, as is done by Faulhaber (1975, p. 973 ff.).

5. Concluding comment

■ In this paper we have sought to describe graphically, in both the literal and figurative sense, the range of price options available to a regulator using a rate of return ceiling to restrict profits. At least in principle, the price-iso return locus should be amenable to econometric estimation[16] and may therefore be

[16] It should be clear from equation (1) that the econometric problems involved in estimation of the price-iso return locus are neither more nor less than those besetting the estimation of its

helpful in depicting clearly to regulatory agencies the full menu of choices before them. Perhaps more important, it should dramatize the damage to consumer welfare of pricing decisions often urged upon regulators by competitors of the regulated firms who claim that prices current or proposed are improper because they do not exceed "fully distributed costs," however defined. If the result is to drive the price vector into a positively sloping segment of the locus, the consumers of every product must end up the losers.

References

BAUMOL, W.J. *Business Behavior, Value, and Growth* [1959] (Revised Edition, New York: Harcourt Brace Jovanovich, 1967).

———. "Quasi-Permanence of Price Reductions—A Policy for Prevention of 'Predatory Pricing'." *Yale Law Journal* (1979).

BOITEUX, M. "On the Management of Public Monopolies Subject to Budgetary Constraints." *Journal of Economic Theory*, Vol. 3 (September 1971), pp. 219–240.

FAULHABER, G.R. "Cross Subsidization: Pricing in Public Enterprise." *The American Economic Review*, Vol. 65 (December 1975), pp. 966–977.

——— AND ZAJAC, E.E. "Some Thoughts on Cross Subsidization in Regulated Industries." Bell Laboratories Economic Discussion Paper 48, 1976.

PANZAR, J.C. AND WILLIG, R.D. "Free Entry and the Sustainability of Natural Monopoly." *The Bell Journal of Economics*, Vol. 8 (Spring 1977), pp. 1–22.

RAMSEY, F.P. "A Contribution to the Theory of Taxation." *Economic Journal*, Vol. 37 (March 1927), pp. 47–61.

WILLIAMSON, O.E. "Predatory Pricing: A Strategic and Welfare Analysis." *Yale Law Journal*, Vol. 87 (1977), p. 284.

demand and cost functions. In saying this we do not intend to minimize the difficulties involved in estimation of demand and cost relationships. Rather, we mean only to indicate that the price-iso return locus introduces no new and unrecognized econometric issues.

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References

Quasi-Permanence of Price Reductions: A Policy for Prevention of Predatory Pricing
William J. Baumol
The Yale Law Journal, Vol. 89, No. 1. (Nov., 1979), pp. 1-26.
Stable URL:
http://links.jstor.org/sici?sici=0044-0094%28197911%2989%3A1%3C1%3AQOPRAP%3E2.0.CO%3B2-%23

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The American Economic Review, Vol. 65, No. 5. (Dec., 1975), pp. 966-977.
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Free Entry and the Sustainability of Natural Monopoly
John C. Panzar; Robert D. Willig
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Stable URL:
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