Excess Capacity in Monopolistic Competition

Yoram Barzel

University of Washington

Will a monopolistic competitor operate at the minimum point of his average cost curve? Demsetz argues that this is possible (1959, 1964). In this paper Demsetz's argument is critically examined and then rejected in favor of a necessarily negative slope at equilibrium and, hence, "excess capacity" in that average cost is higher than marginal cost.

According to Chamberlin (1957, chaps. 5 and 6) the firm under monopolistic competition faces a downward-sloping demand curve. Since the firm is forced to operate at zero profit, the average cost curve is tangent to such a demand curve at the equilibrium point. With falling average cost "excess capacity" is said to exist. Furthermore, since marginal cost is lower than price, a Pareto-optimum condition is thereby violated.[1]

Demsetz (1959, 1964) claims that Chamberlin's analysis is based on a partial relation between quantity and price that fails to recognize that at different levels of output the profit-maximizing firm will attempt to shift the demand curve facing it by changing its expenditures on quality, location, and promotion simultaneously with changes in its expenditures on quantity. Consequently, the demand curve associated with one quantity is obtained for a given level of selling expenditures and in general will differ from that associated with another quantity, since the selling expenditures change with quantity. The market-equilibrium locus of consumers' quantities and prices then is not on a single demand curve, and the negative-slope property of a demand curve does not apply to the market-equilibrium locus. So far so good. Demsetz, however, claims that the market-equilibrium locus is the relevant curve and says that since a zero slope is a likely result, the excess-capacity argument no longer holds. The purpose of this paper is to refute Demsetz's claim.[2]

I wish to thank G. C. Archibald, S. N. S. Cheung, J. E. Floyd, J. A. Hynes, L. G. Telser, J. S. McGee, and E. Silberberg for their comments.

[1] It should be pointed out that while he recognized the problem of nonoptimality, Chamberlin did not wholly subscribe to it (1962, chap. 5).

[2] The market-equilibrium locus for consumers is denoted by Demsetz as MAR (*mutatis mutandis* average revenue). A substantial part of the argument between

We should first note that if one does not view expenditures on quality, location, or promotion as utility-generating expenditures, misallocation occurs by definition. We will follow Demsetz, however, in proposing that such expenditures, including those on promotion, do in fact generate utility. We want to show that when price and quantity are appropriately measured, contrary to Demsetz's argument, average cost necessarily falls at equilibrium. We will proceed by first showing that for quality-improving costs, if the quantity-price locus has a zero slope at equilibrium the slope is negative at equilibrium for quality-adjusted units. The argument will be extended to cover other types of cost, and it will be shown that regardless of the slope of the quantity-price locus at equilibrium, the slope of the properly measured average cost curve has to be negative.

In figure 1 (following in general outline Demsetz's figure 1), the demand curve D_1 and the average cost curve F_1 are derived when quality per unit of output is held constant.[3] These two curves are tangent at X_1—the "Chamberlinian" equilibrium point. At levels of output other than Q_1, the optimum level of expenditures on quality is likely to change, and when expenditures on quality are accounted for and included as part of the total cost we may obtain a (*mutatis mutandis*) cost curve such as C, with X_1 at its minimum point. According to Demsetz, the cost curve C, rather than F_1, is the one relevant to a determination of whether "excess capacity" is present. He argues further that since this curve may have a minimum point at X_1,[4] excess capacity is not a necessary result in monopolistic competition.

But the switch from F_1 to C is not the innocent operation that Demsetz implicitly makes it appear. To draw our demand schedule properly we should deal with homogeneous units. Expenditures on the quality of the product are explicitly designed to change the product; while D_1 is obtained for a homogeneous set of units, C must deal with heterogeneous units as a result of the product improving expenditures. Even though C may have a zero slope at X_1, this can no longer be used to determine any optimal properties for such a point. Into the two-dimensional discussion

---

Archibald (1967) and Demsetz (1967) is an attempt to determine what can be said about the shape of that curve. In this paper it is shown that the presence of excess capacity is independent of the properties of the MAR curve, and that the MAR curve is not only of little use but also is likely to mislead.

[3] Demsetz sets *total* outlays on quality at a constant level for deriving his D_1 and F_1. Constant total outlays imply that per unit outlays vary inversely with the number of units and, consequently, that quality declines when quantity increases. The failure to maintain a set of homogeneous units appears to be the source of Demsetz's error, as will be shown below. Defining D_1 and F_1 conventionally, as we do, still requires a negative tangency for the zero-profit equilibrium.

[4] Where it is tangent to the *mutatis mutandis* demand curve MAR (not shown in fig. 1).

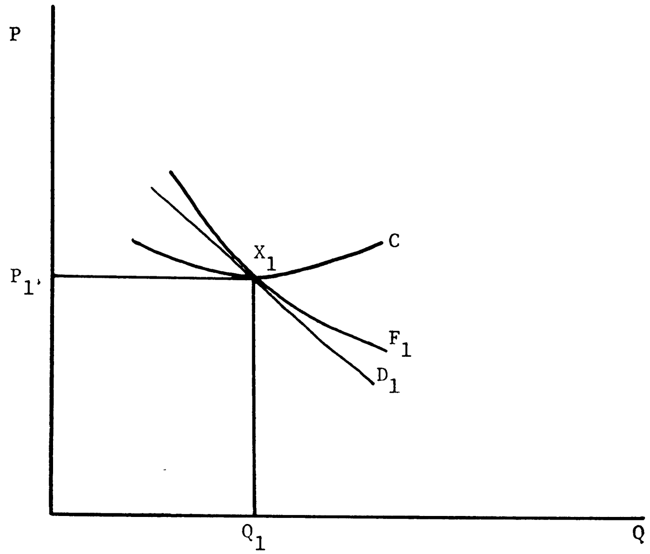

FIG. 1

of quantity and price Demsetz introduces a third dimension more fully than Chamberlin has done, but yet not fully enough. In particular, he does not sufficiently examine the relation between quality change and utility.

To achieve Demsetz's result that C has zero slope at Q_1, quality must rise in the neighborhood of Q_1. If it were to remain constant, D_1 and F_1 would be the relevant curves, and we would be back at the original Chamberlin model. If quality were to deteriorate, production costs would be less than with constant quality and utility would be smaller, too; so the quantity-price path for consumers and that for producers both would have even steeper slopes (in absolute terms) at X_1, which would also disallow Demsetz's results. We may concentrate, then, on the case where, in the neighborhood of the optimal mix, quality per unit is positively related to quantity. Following Demsetz, let us assert that the average cost, C, of producing this optimal quantity-quality mix has a minimum point at X_1. But since the mix itself changes with quantity, the price and the quantity axes fail to deal with homogeneous units. When we move along the quantity axis from Q_1 to $Q_1 + 1$, we move to a set of improved units. If we try to adjust the horizontal scale to bring the old and the new units into a common denominator, the distance between the two quantities is not 1, but $1 + \Delta$ where Δ is the positive correction factor for quality. Similarly, when we consider the price axis and note that due to the zero slope of C at X_1 the equilibrium price is P_1 for both Q_1 and $Q_1 + 1$

along the unadjusted axis, then it is clear that for the unit-adjusted axis the price associated with the larger quantity has to be less. Total revenue at Q_1 is P_1Q_1 and average revenue is $(P_1Q_1)Q_1 = P_1$; total revenue at the new point is $P_1(Q_1 + 1)$, and average revenue for the quality-adjusted units is $[P_1(Q_1 + 1)]/(Q_1 + 1 + \Delta) < P_1$ since Δ is positive. The real price is less, because the nominal price is constant and the product is improved in quality. So, contrary to Demsetz's contention, at equilibrium the demand and the average cost adjusted for quality slope downward, even though for the unadjusted units the slope is zero.

This result is by no means just an arithmetic by-product of the above example. It is rather a reflection of the fundamental proposition that demand for differentiated products is downward sloping,[5] and of the zero-profit equilibrium. No matter what mix of quantity and quality may be demanded by consumers, once we manage to obtain constant-quality units demand has to have a negative slope; so at the point of tangency average revenue and average cost (correctly measured) are bound to have negative slopes.

In one respect Demsetz brings up an attractive way of handling demand-increasing costs by considering such costs as contributing to the value of the good produced and to the utility generated by it, but he does not pursue this approach far enough. Such a relation will be now made explicit. We add to the price and quantity dimensions a third dimension—R/Q—where R reflects attributes of the commodity such as its quality, its closeness to the consumer, and even the image of pretty girls provided by the advertiser.[6] We assume that R can be measured quantitatively along a continuous scale.[7] Improvements in quality may sometimes come in discrete steps rather than along a continuous scale; the analytical difficulties due to such discontinuities, however, are shared by us and by Demsetz alike.

The demand function can be written as $P^* = D(Q, R/Q)$[8] where P^* is not the observed market price (per unit of Q) but the real price of the quantity-quality package as viewed by the consumer. The size of the package will increase with an increase in conventional quantity as well

[5] I doubt that Demsetz will try to preserve his argument by applying it only to Giffen goods; the possibility of such goods will be ignored in the rest of the paper.

[6] Each of these attributes should be separately treated for the argument to be more general. It is clear, however, that the three-dimensional results can be easily extended to more dimensions without altering any of the basic conclusions, and the presentation is simpler if the dimensions are thus restricted.

[7] This is similar to the approach adopted by Robert Dorfman and Peter O. Steiner (1954). Fat content of milk provides a good illustration: the amount of fat is a continuous variable, and its total as well as its amount per quart of milk can readily be changed.

[8] Analytically it is preferable to have P^* as a function of Q and R rather than of Q and R/Q. The substantive results are invariant between the two formulations, and the latter is used in the text since it better corresponds both to usage in the literature and to popular characterization of commodities.

as with an improvement in quality. And the consumer will buy a larger package only if its price per unit is declining. Holding quality constant, we obtain the usual demand curve such that $\partial P^*/\partial Q < 0$. Similarly, holding Q constant we have $\partial P^*/\partial(R/Q) < 0$, indicating that the amount of the quality characteristic demanded is inversely related to price.[9]

Average cost can now be treated symmetrically with demand. We write $AC^* = F(Q, R/Q)$ where the relation between AC^* and the conventional AC parallels that between P^* and P. The equilibrium point of the monopolistically competitive firm earning zero profits has to satisfy two conditions simultaneously. Average cost has to equal average revenue both when quantity changes but quality per unit is held constant, and when quality per unit changes but quantity is held constant.

Diagrammatically, figure 2*a* shows the relation between P and Q for different levels of R/Q; X_1 is the tangency point between $D_1[(R/Q)_1, Q]$ for which R/Q is held constant at $(R/Q)_1$, and the average cost curve $F_1[(R/Q)_1, Q]$ which is also obtained for $(R/Q)_1$. For another value of R/Q—$(R/Q)_2$—the demand curve is $D_2[(R/Q)_2, Q]$. Figure 2*b* portrays the relation between the price per unit of quality and R/Q for different levels of Q. The demand curves $D^1(R/Q, Q_1)$ and $D^2(R/Q, Q_2)$ drawn for constant levels of Q—Q_1 and Q_2, respectively—are implicit in figure 2*a*.[10] Given Q_1, the average cost function for R/Q is $F^1(R/Q, Q_1)$. The zero-profit condition requires a tangency between $F^1(R/Q, Q_1)$ and $D^1(R/Q, Q_1)$ at X_1 which is, of course, the same point as X_1 in figure 2*a*. In both figures the cost curve is tangent to a demand curve and consequently slopes down in both directions.

We can now return to the basic argument. According to Demsetz, given the zero-profit (hence price = average cost) equilibrium point X_1 with coordinates P_1 and Q_1, a point such as X_2 for which $Q_2 > Q_1$ and $P_2 > P_1$ could at the same time be both on the optimal selling path of the firm and on a constant or rising portion of its average cost curve. We will show that this cannot hold without contradicting demand theory and that the appropriately defined average cost function necessarily slopes down in the neighborhood of X_1.

What can be said about the demand curve on which X_2 lies? If we denote this curve as $D_2[(R/Q)_2, Q]$, the condition $(R/Q)_2 > (R/Q)_1$ has to be satisfied. This is so since, if quality is held constant, quantity demanded

[9] This statement should not be confused with the consumer's willingness to pay a higher price per unit of Q when quality improves. The P^* is the price index of quantity and quality combined, and may be obtained as the ratio of total revenue to some weighted average of quantity and quality. An improvement in quality is a move along the demand curve to a larger quantity of the composite good. The numerator of this ratio may increase, but the denominator will increase relatively more.

[10] Vertical sections of fig. 2*a* represent varying values of R/Q, holding Q constant, and corresponding values of total revenues. These are translated in 2*b* into quantity demanded of R/Q for different unit prices of R/Q, holding Q constant.

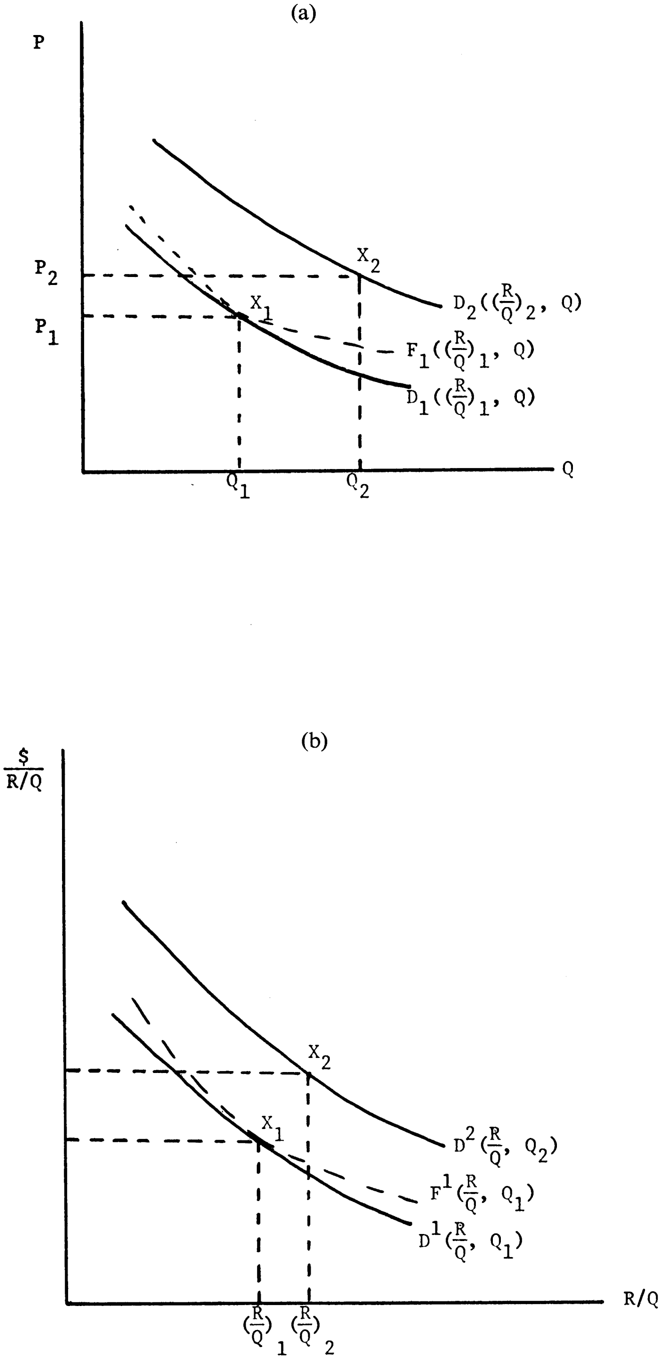
(a)
P
P_2
P_1
X_2
X_1
$D_2((\frac{R}{Q})_2, Q)$
$F_1((\frac{R}{Q})_1, Q)$
$D_1((\frac{R}{Q})_1, Q)$
Q
Q_1
Q_2
(b)
$\frac{\$}{R/Q}$
X_2
X_1
$D^2(\frac{R}{Q}, Q_2)$
$F^1(\frac{R}{Q}, Q_1)$
$D^1(\frac{R}{Q}, Q_1)$
R/Q
$(\frac{R}{Q})_1$
$(\frac{R}{Q})_2$

FIG. 2

will increase only if (nominal) price falls, and only if quality is improved may a larger quantity be demanded without a fall in nominal price. So if X_2 satisfied Demsetz's specification that $Q_2 > Q_1$ and $P_2 > P_1$, it also has to satisfy $(R/Q)_2 > (R/Q)_1$. Given demand theory, the consumers' willingness to move from X_1 to X_2 (which involves an increase in both dimensions of the composite commodity) is indicative that consumers view the real price P_2^* as lower than P_1^*. Otherwise they would not buy more of this composite commodity.[11]

The three-dimensional demand surface (due to the zero-profit condition) is tangent to the three-dimensional cost surface at X_1, and the two have the same slope in any direction. Since $P_2^* < P_1^*$ when the correct set of units is used, it follows that AC_2^*, the correctly measured average cost of producing X_2, is less than AC_1^*, the average cost of producing X_1. So in the neighborhood of X_1 the average cost must fall, and X_1 cannot possibly be the minimum point of the average cost surface. Regardless of the shape of the *mutatis mutandis* curve C, equilibrium necessarily is at the downward-sloping range of the average cost surface, marginal cost is less than average cost and price, and "excess capacity" is still with us. "Excess capacity," of course, implies that marginal cost is less than price. What the above argument brings up most clearly is that marginal cost is less than price not only in the conventional quantity dimension, but also in the quality dimension.[12] To achieve a Pareto optimum, not only output has to be expanded but quality as well (and, for that matter, advertising too!).

This is hardly a surprising result. We deal here basically with two commodities, each subject to the "law of demand." They are produced at a point where the average cost of producing each is declining. It does not seem reasonable to expect a Pareto-optimum solution under such circumstances.

Demsetz's claim that the presence of demand-increasing costs precludes the use of the conventional demand curve in welfare economics falls with the rest of his argument. If such costs are present, one should use demand curves either where quality is held constant or where both price and quantity are adjusted for changes in quality. It is totally inappropriate to disregard changes in quality (and in location and promotion) in defining quantity and price. Similarly, we cannot accept Demsetz's argument (1968) that there are no substantive reasons to distinguish between competition and monopolistic competition, since this contention is based on the argument that no excess capacity exists in the latter.

[11] Analytically, given that $\partial P^*/\partial Q < 0$ and $\partial P^*/[\partial(R/Q)] < 0$, we can unambiguously state that $dP^* = \partial P^*/\partial Q \; dQ + \partial P^*/[\partial(R/Q)]d(R/Q) < 0$, since, when moving from X_1 to X_2, both dQ and $d(R/Q)$ are positive. So P^*_2, the real price of X_2, is less than P^*_1, that of X_1.

[12] I am indebted to D. F. Gordon for bringing this point to my attention. This is not unlike the argument made by Levhari and Srinivasan (1969).

References

Archibald, G. C. "Monopolistic Competition and Returns to Scale." *Econ. J.* 77 (June 1967): 405–12.

Chamberlin, E. H. *Towards a More General Theory of Value*. New York: Oxford Univ. Press, 1957.

———. *The Theory of Monopolistic Competition*. Cambridge, Mass.: Harvard Univ. Press, 1962.

Demsetz, H. "The Nature of Equilibrium in Monopolistic Competition." *J.P.E.* 67 (February 1959): 21–30.

———. "The Welfare and Empirical Implications of Monopolistic Competition." *Econ. J.* 74 (September 1964): 623–41.

———. "Monopolistic Competition: A Reply." Ibid. 77 (June 1967): 412–20.

———. "Do Competition and Monopolistic Competition Differ?" *J.P.E.* 76 (January/February 1968): 146–48.

Dorfman, Robert, and Steiner, Peter O. "Optimal Advertising and Optimal Quality." *A.E.R.* 44 (December 1954): 26–36.

Levhari, David, and Srinivasan, T. N. "Durability of Consumption Goods: Competition versus Monopoly." *A.E.R.* 59 (March 1969): 102–7.