Effects of Monopolization in an Increasing Cost Industry

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This paper compares the private costs for a perfectly competitive industry with those of a monopoly, given an upward-sloping supply curve for an input and the assumption that the perfectly competitive firms view the input supply curve as horizontal. The analysis shows that the marginal private cost curve of the perfectly competitive industry lies above that for a monopoly-monopsonist and, under certain conditions, the latter will represent marginal social cost. Such a position is consistent with the recent literature on fair wage rates and labor effort. In this case, the perfectly competitive industry will produce a greater than socially optimal output. This result will not hold, however, if perfectly competitive firms correctly perceive that the input supply curve is upward sloping.

INTRODUCTION

In discussions of market structure, economists frequently make comparisons between monopoly and competition. Such analyses traditionally implicitly or explicitly assume that a perfectly competitive industry becomes a monopoly, perhaps through the formation of a cartel, and that the perfectly competitive industry supply curve becomes the marginal cost curve of the newly-formed monopoly. If one assumes that:

- The monopoly is formed through an effective cartelization of a perfectly competitive industry;
- Through the use of multiple plants the monopoly can achieve the same costs as that of the perfectly competitive industry;
- Input prices are constant; and
- The change in market structure has no effect on the demand for the final product,

the comparison between the monopoly price and output and those for the perfectly competitive industry is relatively straightforward in the long run.

This analysis is more complex, however, if the prices of one of the inputs increases as the industry output expands. As both George Stigler (1966) and Edgar Browning (1987) note, a monopoly-monopsony will choose different factor proportions than will a perfectly competitive firm when there is an upward-sloping supply curve of one or more

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of the inputs it employs.[1] Specifically, Browning (1987) points out that if an increasing cost perfectly competitive industry becomes a monopoly-monopsony, the perceived and actual long-run marginal private cost curve of the monopoly firm will be above the long-run supply curve for the perfectly competitive industry. The long-run average private cost curve for the monopoly, however, will be below the long-run supply curve for the perfectly competitive industry. This result occurs because the monopoly firm correctly perceives the upward-sloping supply curve of the input (or inputs) whose price must increase for the quantity supplied of it (them) to increase. In contrast, the perfectly competitive firm believes that all input prices will remain constant, even though at least one of them will increase as the competitive industry output expands. Naturally, this perception on the part of the monopolist-monopsonist will have implications for both its private and the social costs of production as compared with those under perfect competition.

This study has two objectives. First, we extend the Browning analysis in the increasing cost case. We examine in greater detail a specific example in which a perfectly competitive industry, relative to a monopoly-monopsonist, faces the same market with identical production functions and identical factor markets. Second, the paper argues that the industry marginal private cost curve under perfect competition in the increasing cost case may or may not be the marginal social cost curve and examines the implications of each case. Browning recognized that the private marginal cost of the perfectly competitive industry would be above its supply curve in the case of variable input proportions. He did not illustrate the marginal private cost curve of the competitive industry, however, because he argued that it did not reflect marginal social cost and, therefore, was irrelevant to the socially optimal level of output. In this view, marginal social cost, but not marginal private cost, is represented by the competitive industry supply curve.

Our analysis will show, consistent with the Browning analysis, that the marginal private cost curve of the perfectly competitive industry in the case of an increasing cost industry lies above the monopoly marginal private cost curve and that, under certain conditions, the latter will represent marginal social cost (when a socially efficient combination of inputs is employed). In this setting, the perfectly competitive industry will produce an output in excess of the social optimum.

[1] These analyses assume that the perfectly competitive firm both sells its product in a perfectly competitive market and views the supply curves of its inputs as horizontal. If the perfectly competitive seller firms perceive that their input supply curves are upward-sloping, then they would behave as a monopsonist. In this case, both firms would employ the input up to the point where its marginal revenue product is equal to its marginal factor cost, and both firms would perceive the marginal factor cost of the input to be greater than its price. The marginal revenue product of the input would be equal to the value of its marginal product for the perfectly competitive firm, however, but MRP would be less than VMP for the monopoly-monopsony. In this case, *ceteris paribus*, the output of the perfectly competitive-monopsonist firms more closely would approximate the socially optimal level of output than would that of the monopolist-monopsonist firm. We use the term *monopsonist* in the most general sense to refer to a firm that perceives the supply curve of an input to be upward sloping. We do not mean necessarily to imply that the firm is the sole purchaser of the input.

RELATION OF LONG-RUN COST MINIMIZATION UNDER MONOPOLY TO THAT UNDER PERFECT COMPETITION

One approach to comparing monopoly with perfect competition is to proceed along the lines of the centralized cartel model, assuming for heuristic purposes that the industry in question is at first perfectly competitive and viable but later becomes monopolized through some feat of organization (e.g., the National Farm Organization in the United States successfully forms a centralized cartel for wheat). In the long run, of course, the monopoly firm is able to adjust its factor proportions. Moreover, we assume that the monopoly can achieve the same cost-output relationships as can a perfectly competitive industry through the use of multiple plants.

Let us first address the issue of private costs, assuming variable factor proportions in the long run. The condition for a least-cost combination of inputs for a given level of output is that

$$(1)\ \frac{MFC_1}{MP_1} = \frac{MFC_2}{MP_2} = \ldots = \frac{MFC_n}{MP_n},$$

where:

MFC = The marginal factor cost of an input;
MP = The marginal physical product of an input; and
1, 2, ... n = Inputs.

The marginal factor cost of input n is equal to $MFC_n = (dTFC_n/dn) = P_n + n(dP_n/dn)$, where n is the quantity of input n. If the supply curve of the input is horizontal, then MFC_n is equal to P_n. If the supply curve of the input is upward sloping, however, then $(dP_n/dn) > 0$, and $MFC_n >$ than P_n. If the prices of all other inputs are fixed, the least cost combination of inputs is given by

$$(2)\ \frac{P_1}{MP_1} = \frac{P_2}{MP_2} = \ldots = \frac{P_n + n(dP_n/dn)}{MP_n}.$$

If a firm incorrectly views the price of input n as fixed, it will consider the least cost combination of inputs condition to be

$$(3)\ \frac{P_1}{MP_1} = \frac{P_2}{MP_2} = \ldots = \frac{P_n}{MP_n}.$$

$P_n < MFC_n$, however, and the additional cost of a marginal unit of output from a marginal unit of input n will be greater than for the other inputs. Thus, if a perfectly competitive firm does not perceive that the input supply curve is upward-sloping, it will not employ a least cost combination of inputs. As a result, *ceteris paribus*, the perfectly competitive firm's costs will be higher for a given level of output than those of a monopoly firm that correctly perceives the rising supply price of the input.

To illustrate the divergence of the costs of the two types of firms in this situation, we employ a Cobb-Douglas production function and a simple linear input supply function of labor. Utilizing these specific functional forms, we can derive and compare the marginal and average private cost functions for the monopoly firm and the actual marginal and average private cost functions for the perfectly competitive industry.[2] Accordingly, consider the two factor case with the following assumptions:

- The industry production function is linearly homogeneous of the Cobb-Douglas form, written as

  (4) $Q = K^{\alpha}L^{\beta}$,

  where:

  Q = Quantity of output;
  K = Quantity of capital; and
  L = Quantity of labor.

- The input supply curve of labor is upward sloping and, for simplicity, emanates from the origin, written as

  (5) $P_L = \gamma L$.

- The input supply curve for capital is horizontal, so that any amount of K can be purchased at a fixed price of P_K per unit.

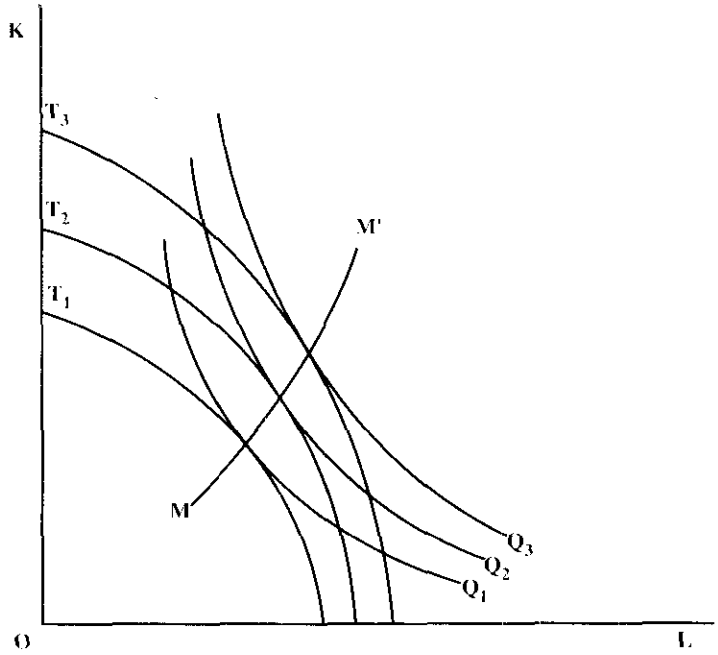
In this situation, the monopoly firm will perceive correctly that the supply curve of labor is upward sloping and, therefore, that the firm has some monopsony power. It typically is assumed, however, that an individual perfectly competitive firm in this situation will consider the price of labor to be constant because the quantity of labor utilized by the firm is small relative to the total quantity demanded of labor.[3] Because of the rising supply price of labor, the monopoly firm's isocost function will be a curve that is concave toward the origin. The slope of this function will be equal in absolute value to MFC_L/P_K. The absolute value of this ratio will be greater than the absolute value of P_L/P_K at the corresponding quantity of labor. With an upward-sloping supply curve of labor and the absence of price discrimination among workers, MFC_L is greater than P_L.

If P_K is a constant and MFC_L depends on the amount of labor employed, the slope depends strictly on the amount of labor utilized. The result, as illustrated in Figure 1, is

[2] It is assumed that the perfectly competitive firms have the same production function and that capital and labor always are allocated among the firms as a group so that the maximum total output possible from a given aggregate quantity of capital and labor is obtained. This assumption allows us to write an aggregate production function for the perfectly competitive industry. See Fisher (1969). The general results in this paper as well as those of Browning hold as long as the input-output combinations of the perfectly competitive industry reflect constant returns to scale and the monopoly firm can achieve the same production relationships.

[3] This assumption is consistent with the approach of Browning and other authors. A referee pointed out that perfectly competitive seller firms may act as monopsonist purchasers of an input and suggested that the bituminous coal industry may be an example of this situation.

Figure 1—Long-Run Optimum Input Combinations, Monopoly-Monopsonist With Rising Supply Prices of Labor

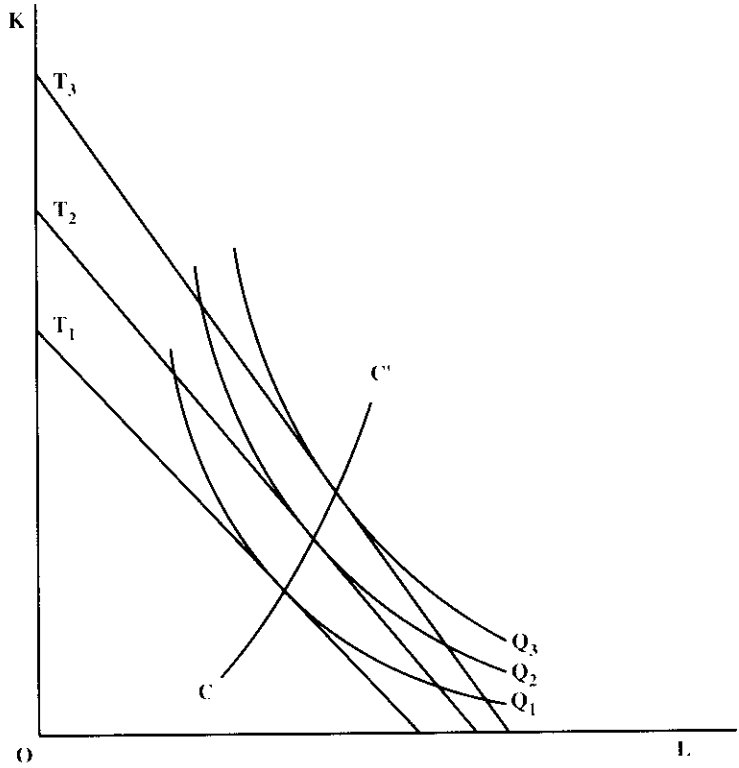


that all of the monopoly's isocost curves (T_i) are vertically parallel to one another.[4] For any output, the profit-maximizing monopoly must fulfill the cost-minimizing condition $(MFC_L/P_K) = (MP_L/MP_K)$, so the monopoly will expand along the path indicated by the tangency points of successively higher isocost curves with isoquants. As long-run output increases, both the capital/labor ratio and the slope of the isoquants will increase at the tangency points because the firm must adjust for the ever-rising marginal factor cost of labor. Thus, the expansion path of the firm will be a rising curve of increasing slope, such as MM' in Figure 1.

Consider the long run under perfect competition. Each perfectly competitive firm views the price of labor as fixed, perceiving that cost will be minimized for a given level of output where $(P_L/P_K) = (MP_L/MP_K)$. Thus, with an upward-sloping supply curve of labor the path of expansion followed by a perfectly competitive industry will lie below

[4] Browning (1987, p. 538) defines similar isocost curves but does not point out that the curves would be vertically parallel.

Figure 2—Long-Run Perceived Optimum Input Combinations, Perfectly Competitive Firm With Rising Supply Price of Labor



that of the monopoly firm. This result follows because $P_L < MFC_L$ for any quantity of labor employed. In fact, as the supply price of labor rises with increased utilization of labor, each perfectly competitive firm may be viewed as facing a new isocost line of steeper slope. In Figure 2, the expansion path for perfect competition is curve CC'. The nonparallel isocost lines (T_i) reflect the increasing supply price of labor. If Figure 2 is superimposed on the monopoly diagram of Figure 1, CC' will lie below MM', the monopoly expansion path. In both market structures, the capital/labor ratio increases as output is increased as a result of the increasing price of labor. The capital/labor ratio always remains higher under monopoly, however, because the monopoly firm correctly perceives that the price of labor will increase as output increases.

COMPARISON OF MONOPOLY AND COMPETITIVE LONG-RUN UNIT COSTS

For the monopoly case, given the assumed production function and labor supply function, it is possible to derive the marginal cost of output from the cost-minimizing

condition as follows. From the aforementioned production function and input supply function, the total factor cost of labor is

(6) $TFC_L = L(P_L) = \gamma L^2$,

and its marginal factor cost is
(7) $MFC_L = 2\gamma L$.

From the monopoly cost-minimizing condition ($MFC_L/P_K = MP_L/MP_K$), it follows that for the monopoly a least-cost input combination will occur where

$$(8)\ K = \frac{2\gamma\alpha L^2}{P_k\beta}$$

and that the firm's production function can be restated as

$$(9)\ Q_M = \left[\frac{2\gamma\alpha}{P_k\beta}\right]^{\alpha} L^{2\alpha+\beta}.$$

Assuming $\alpha + \beta = 1$, the following expressions will represent the total and marginal costs of the monopoly firm:

$$(10)\ TC_M = P_K\left[\frac{2\gamma\alpha L^2}{P_k\beta}\right] + \gamma L^2 = \frac{\gamma L^2(1+\alpha)}{\beta}, \text{ and}$$

$$(11)\ MC_M = \frac{2\gamma L(1+\alpha)}{\beta}\left\{\frac{1}{1+\alpha}\left[Q\left(\frac{P_k\beta}{\gamma\alpha}\right)^{\alpha}\frac{1}{2^{\alpha}}\right]^{-\alpha/(1+\alpha)}\left[\frac{P_k\beta}{\gamma\alpha}\right]^{\alpha}\frac{1}{2^{\alpha}}\right\}$$

On the other hand, utilization of the perfectly competitive firms' perceived cost-minimizing condition ($P_L/P_K = MP_L/MP_K$) instead of the actual cost-minimizing condition ($MFC_L/P_K = MP_L/MP_K$) recognized by the monopoly firm, yields the following restatement of the production function for the perfectly competitive industry, assuming the same production function and labor supply curve as for the monopoly:

$$(12)\ Q_C = \left[\frac{\gamma\alpha}{P_K\beta}\right]^{\alpha} L^{2\alpha+\beta}$$

It follows that the marginal private cost for the competitive industry will be given by

$$(13)\ MC_C = \frac{2\gamma L}{\beta}\left\{\frac{1}{1+\alpha}\left[Q\left(\frac{P_k\beta}{\gamma\alpha}\right)^{\alpha}\right]^{-\alpha/(1+\alpha)}\left[\frac{P_k\beta}{\gamma\alpha}\right]^{\alpha}\right\}$$

Assuming $Q_M = Q_C$, the ratio of the two marginal costs is

$$(14)\ \frac{MC_C}{MC_M} = \frac{2^{2\alpha/(1+\alpha)}}{(1+\alpha)}$$

This ratio will be 1.0 if α is either 1 or 0. It will be greater than 1 if $0 < \alpha < 1$. Thus, in all nontrivial cases where $\alpha + \beta = 1$, the marginal cost of the competitive firms will be greater than the marginal cost of the monopoly at any given level of output.

A comparison of monopoly *average* private cost with perfectly competitive *average* private cost, given the production function and input supply assumptions above, can be effected by first utilizing the definitions of output and total cost from equations (9) and (10) to obtain the monopoly result. Dividing equation (10) by (9) and assuming $\alpha + \beta = 1$ yields

$$(15)\ AC_M = \frac{\gamma(\alpha+1)L^{1-\alpha}}{\beta\left[\frac{2\gamma\alpha}{P_k\beta}\right]^{\alpha}}$$

For perfect competition, average cost can be stated as

$$(16)\ AC_C = \frac{\gamma L^{1-\alpha}}{\beta\left[\frac{\gamma\alpha}{P_k\beta}\right]^{\alpha}}$$

It follows that when $Q_M = Q_C$,

$$(17)\ \frac{AC_C}{AC_M} = \frac{2^{2\alpha/(1+\alpha)}}{(1+\alpha)}.$$

Note that this is the same ratio obtained in equation (14) in the preceding section. As stated previously, this ratio will be greater than 1 whenever $0 < \alpha < 1$. Therefore, in all nontrivial cases where $\alpha + \beta = 1$, the average private cost of the competitive firms will exceed that of the monopoly at any given level of output.[5]

Tables 1 and 2 present a numerical illustration of the foregoing relationships and were developed by assuming that $\alpha = \beta = 0.5$, the supply curve for labor is the straight

[5] The ratio of the average private cost of a perfectly competitive industry to that of a monopoly and the ratio of their respective marginal private costs will not be constant for input supply curves that do not have unitary price elasticity.

Table 1—Cost Example: Monopoly-Monopsonist Firm

Input L	Input K	Q (Output)	TC_M (Total Cost)	AC_M (Average Cost)	MC_M (Discrete Marginal Cost)
0	0	0.0000	0.0	-	
5	5	5.0000	37.5	7.5000	7.5000
10	20	14.1421	150.0	10.6066	12.3057
15	45	25.9808	337.5	12.9904	15.8379
20	80	40.0000	600.0	15.0000	18.7243
25	125	55.9017	937.5	16.7705	21.2241

Table 2—Cost Example: Perfectly Competitive Industry

Input L	Input K	Q (Output)	TC_C (Total Cost)	AC_C (Average Cost)	MC_C (Discrete Marginal Cost)
0	0	0.0	0.0000	-	
6.2996	3.9685	5.0000	39.6850	7.9370	7.9370
12.5992	15.8740	14.1421	158.7398	11.2246	13.0227
18.8988	35.7165	25.9808	357.1646	13.7473	16.7607
25.1984	63.4959	40.0000	634.9594	15.8740	19.8153
31.4980	99.2124	55.9017	992.1240	17.7477	22.4608

line $L = 2P_L$, and that $P_K = \$5$. In this case, equations (9) and (10) for the monopoly-monopsonist become

(9') $Q_M = (.2)^{1/2} L_M^{3/2}$ and

(10') $TC_M = 1.5L_M^2$.

The corresponding equation for MC_M becomes

(11') $MC_M = 2(5)^{1/3} L_M Q_M^{-1/3}$

Similarly, the equations for output, total cost, and marginal cost for perfect competition become

(12') $Q_C = (.1)^{1/2} L_C^{3/2}$

$TC_C = L_C^2$, and

(13') $MC_C = (4/3)(10)^{1/3} L_C Q_C^{-1/3}$.

The corresponding values for average cost are given by

(15') $AC_M = (3/2)(5L_M)^{1/2}$ and

(16') $AC_C = (10L_C)^{1/2}$.

When $Q_M = Q_C$, then $L_C^{\wedge} = 2^{\alpha/(1+\alpha)} L_M^{\wedge}$,

(14') $\frac{MC_C}{MC_M} = (2/3)(2)^{2/3}$, and

(17') $\frac{AC_C}{AC_M} = (2/3)(2)^{2/3}$.

Comparison of the two tables shows clearly that both the average and marginal private costs under monopoly are lower than under perfect competition. In addition, if one calculates either the ratio of perfectly competitive average cost to monopoly average cost or the ratio of perfectly competitive marginal cost to monopoly marginal cost, the result will be the same, which follows from equations (14') and (17') above.

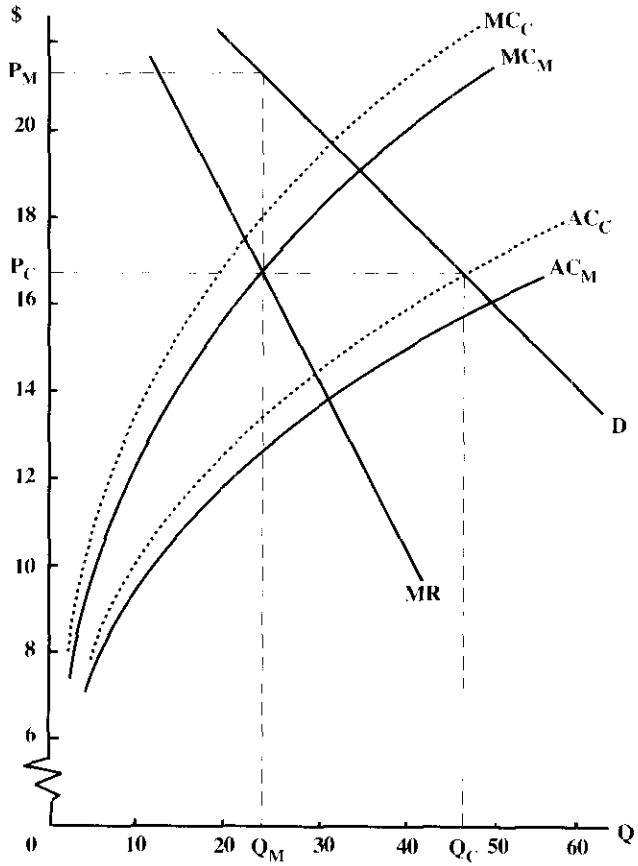
The marginal and average cost data from the Tables 1 and 2 are plotted in Figure 3. The rising supply price of labor ensures that these functions will be curvilinear and of decreasing slope. Given the linear demand curve, D, and its marginal revenue curve, the monopoly firm will operate at output Q_M and charge price P_M. Because the competitive market always will adjust to P = AC, the long-run industry output for the *group* of competitive firms is Q_C, with price equal to P_C. It should be noted that in this case the perfectly competitive firms do not recognize the industry marginal *private* cost curve; from their perspective their marginal cost is equal to long-run average cost at each equilibrium point. Nevertheless, we find that monopolization results in both output restriction and a higher price, despite the lower private costs (average, marginal, and total) attainable by the monopoly firm at all output levels.[6]

THE RELATIONSHIP BETWEEN PRIVATE AND SOCIAL COSTS

The comparison of the *private* costs of the monopoly firm with those of the perfectly competitive industry is relatively straightforward. A comparison of the perfectly competitive industry equilibrium, the monopoly firm equilibrium, and the *socially optimal* level of output and efficient input combinations, however, presents potential theoretical difficulties. It is at this point that the analysis in this paper departs substantially from that of Browning.

[6] Again, perfectly competitive-monopsonist firms would perceive correctly the rising supply curve of labor and, as a result, would perceive that their least cost input combinations would be the same as those of the monopoly-monopsony.

Figure 3—Cost, Price, and Quantity Comparisons, Monopoly-Monopsonist and Perfectly Competitive Industry



The first issue relates to the nature of the marginal social cost of output in a situation where larger quantities of one input can be obtained only at a higher price that must be paid for all units of the input.[7] In this case, the marginal *private* factor cost of the input is greater than its price. The question that caused a great deal of debate among economists early in the twentieth century, however, was the nature of the marginal *social* factor cost of the input.[8]

The matter was laid to rest at least temporarily by Ellis and Fellner (1943). The argument they present is that the marginal social factor cost of the input is represented by the price of the marginal unit, which is the sum that would be necessary to entice its ser-

[7] As Browning notes, the divergence between the marginal private cost of the monopoly firm and the perceived marginal cost of the perfectly competitive firm would not arise if the monopoly firm could behave as a perfectly price-discriminating monopsonist in the purchase of the input with the increasing supply price.

[8] See, for example, Edgeworth (1913), Knight (1924), Pigou (1912), Robinson (1933), and Young (1913).

vices. If the same price is paid for all units of the input, some units of the input are receiving a greater amount than would be necessary to obtain their services. This additional amount is termed *rent* and, because it would not be necessary to pay this sum to receive the services of these inputs if perfect price discrimination in their purchase were possible, Ellis and Fellner conclude that this cost is not a part of social costs.

If we accept Ellis and Fellner's conclusion, in the long run the marginal social cost curve for the final product output will be represented by the long-run supply curve for the perfectly competitive industry. This curve also will coincide with the long-run average private cost of the perfectly competitive industry, or the average cost of the industry including the average rent payment. It follows that although a firm in the perfectly competitive industry does not perceive its marginal private cost correctly, it does produce the level of output where price is equal to marginal social cost, using the socially, but not privately, efficient input combination.

This analysis implicitly assumes that there is a long-run upward-sloping supply curve of the input in question, and that this supply curve represents the marginal and not the average social cost of supplying that input. For example, suppose one unit of labor could be obtained for $2 an hour, a second one for $3, and a third one for $4. Because one person is willing to work for $2 an hour, it follows that the marginal social factor cost of that individual's services is $2 per hour. A similar result holds for the second and third individuals. If a firm employing all three workers pays them each $4 an hour, Ellis and Fellner would argue that the excess payment over the minimum necessary to obtain their services [($4 x 3 or $12) less ($2 + $3 + $4 or $9) = $3] is merely a rent payment received by the first and second workers.

Suppose that the input is produced under the conditions of a true external diseconomy.[9] In this situation, points on the long-run supply curve will represent long-run average cost of production if the input is produced by a perfectly competitive industry, but they will not represent marginal social cost.[10]

With a true external diseconomy to the input-supplying industry, the input could not be obtained for less than the total revenue corresponding to each quantity of it as given by the long-run input supply curve; if a smaller total sum were paid for the input, the supplying firms would incur economic losses. The marginal private cost curve of the industry producing the final product would reflect the marginal social cost of the input: all payments for that input would represent socially necessary payments; however, the perfectly competitive industry still would follow the path traced by its average private cost curve. In this case, the perfectly competitive firms would produce a level of output greater than the socially optimal one and use a combination of inputs that is not optimal (both

[9] Browning (1987, p. 539) notes that the presence of externalities would affect his conclusions regarding the socially optimal level of output, but he does not discuss this case. See the Ellis and Fellner (1943) discussion of external economies (especially pp. 254-255 as reprinted in the *Readings in Price Theory*, for the decreasing cost counterpart case. It is odd that Ellis and Fellner employ the externality argument for that case but fail to discuss the equally important external diseconomy case.

[10] Like Ellis and Fellner (1943) in the case of external economies, we shall not pause at this point to argue whether such external diseconomies to the input-supplying industry could exist. In passing, we note that perhaps the reverse of their comment about the development of labor and the better rendering of services in the economies case could be applied here. An example will be provided after we consider the theoretical result.

from a social and a private cost point of view). This result occurs because the perfectly competitive firms in the final product industry do not perceive the true value of the marginal social factor cost. On the other hand, while the monopoly-monopsonist firm would produce a less than socially optimal level of output, it would produce that output using a socially efficient combination of inputs.[11] Thus, the monopoly marginal private cost curve would represent the marginal social cost curve with a socially efficient combination of inputs.

One could argue that the above analysis, although theoretically correct, is irrelevant and, therefore, useless because industries with decreasing returns do not exist. In a well-known and cleverly written article J.H. Clapham (1922, p. 127) contended that the boxes containing examples of industries with increasing or decreasing returns "are, in fact, empty." He suggested that abstract theorizing about such possibilities posed "grave danger to an essentially practical science such as Economics in the elaboration of hypothetical conclusions about, say, human welfare and taxes in relation to industries which cannot be specified." In his response, Pigou (1922, p. 135) states:

> Even regarded as boxes, and empty ones at that, the categories of increasing and diminishing returns are not mere ornaments. Knowledge about them cannot, indeed, on the hypothesis of their eternal emptiness, help us in a positive way, but it can help us a great deal in a negative one. *It enables us to discover with absolute precision what assumptions are implicit in the statements about economic causation (upon which action is often based) that politicians and other such persons are accustomed to make for the guidance of the public.* [Emphasis added.]

Most economists would agree with Pigou that economic theory can serve a useful purpose even if it involves abstractions for which examples cannot be found readily in the real world, if such abstractions allow comparisons with or increased understanding about what does exist. As Sraffa (1926, p. 187) long ago indicated, the entire theory of perfect competition as an industry structure likely would have to be deemed useless if it were to be judged by a strict standard of realism.

THE FAIR WAGE HYPOTHESIS AND INCREASING COSTS

Before we assume Professor Clapham's box is empty and dismiss the increasing cost case too quickly, let us reconsider the labor supply example. The Ellis and Fellner approach assumes that the marginal social cost of labor (the marginal disutility of working) is represented by the labor supply curve. The marginal disutility of offering one's services at a given wage rate, however, may be affected by the wage rates paid other employees for similar services.

It is common to observe employees who have been content working at one salary suddenly to become discontented when an additional employee is hired at a higher salary. At this point, these employees experience greater disutility from doing their jobs. In other words, one's wage rate relative to that of one's peer work group is an important variable

[11] In this case, *ceteris paribus*, perfectly competitive monopsonist firms would produce the socially optimal level of output using a socially efficient combination of inputs.

in the utility function. It seems unreasonable to conclude that this increased disutility—which probably eventually will lead either to higher salaries or to lower productivity of inframarginal inputs—is not a social cost.[12]

Recent efficiency wage models are consistent with this fairness view, for they recognize that it is not merely a worker's real wage rate that matters but also the worker's wage rate relative to those of other workers.[13] Akerlof and Yellen (1988, p. 45) state that compensation textbooks assume that the most important attribute of a compensation system is that employees perceive it to be fair. They continue:

> ... in contrast to the marketplace, where traders have little personal contact, in the workplace, where personal contact is close, other emotions such as "concern for fairness," pejoratively called "jealousy," are also important.

Thus, the incremental wages paid to inframarginal workers when the marginal worker is employed become an economic necessity for maintaining the productivity of those workers or retaining them in the work force. In an earlier article, Frank (1984) also discussed the role of interdependent preferences among workers in determining the profit-maximizing wage rate structure for a firm and cited some evidence to support his thesis. In such situations, these incremental payments to inframarginal workers arguably would be social costs of production rather than economic rents.

CONCLUSIONS

In the long run, given an increasing cost industry with a linearly homogeneous production function and the assumption that perfectly competitive firms perceive their input supply curves to be horizontal, marginal, average, and total private economic costs will be lower for a monopoly than under perfect competition. In general, as output rises both perfectly competitive and monopolistic-monopsonistic production will become increasingly intensive in the use of fixed-price inputs as opposed to those with positively-sloped supply curves, as one might expect from the price relationship. For the two factor case, a monopoly that has monopsony or oligopsony power in the purchase of one of the inputs operates with a set of vertically parallel isocost curves and has an upward-sloping expansion path of increasing slope.[14] With the same input supply curve, the expansion path for the perfectly competitive industry will lie below that of the monopoly.

With a two factor linearly homogeneous production function of the Cobb-Douglas form, a unitarily elastic upward-sloping input supply curve for one input results in perfectly competitive marginal and average private costs that at any output exceed monopoly

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[12] An anonymous referee pointed out that a similar phenomenon could occur in the product market and suggested the following example. Suppose that a consumer purchases a BMW for $40,000, and then a neighbor purchases the same model for $30,000. It is likely that learning of the latter event will result in a reduction in utility for the first consumer, who will probably resent the fact that the neighbor was able to buy the car more cheaply.

[13] This and similar phenomena also have been observed in experiments and discussed extensively in the literature on social exchange theory in sociology and on equity theory in psychology. See Lawler and O'Gara (1983) and the articles by Adams cited in the references.

[14] Given that the input with the rising supply price is on the horizontal axis.

marginal and average private costs by a common multiple. If we assume that the demand curve does not shift, however, the monopoly nonetheless will choose to produce a lower output and charge a higher price than would be the case under perfect competition.

If we consider the marginal social cost of an input to be equal to its price, we can conclude that the increasing cost perfectly competitive industry in long-run equilibrium will produce the socially optimal level of output with the socially, but not privately, efficient combination of inputs. In situations where the marginal social cost of an input is greater than its price, the perfectly competitive industry will produce a greater than socially optimal level of output with a combination of inputs that is also socially not efficient. (This appears to be a likely result in the long run when the supply curve of labor is upward sloping and workers are aware of wage rates received by their counterparts). Under identical conditions, the monopoly firm still will produce a less than socially optimal level of output, but will use a socially efficient combination of inputs.

REFERENCES

1. Adams, J.S., "Injustice in Social Exchange," in L. Berkowitz (ed.) *Advances in Experimental Social Psychology*, 2. (New York: Academic Press, 1965) pp. 267-299.

2. Adams, J.S., "Toward an Understanding of Inequity," *Journal of Abnormal and Social Psychology*, 67 (1963a), pp. 422-436.

3. Adams, J.S., "Wage Inequities, Productivity, and Work Quality," *Industrial Relations*, 3 (1963b), pp. 9-16.

4. Adams, J.S., and P.R. Jacobsen, "Effects of Wage Inequities on Work Quality," *Journal of Abnormal and Social Psychology*, 69 (1964), pp. 19-25.

5. Adams, J.S., and W.E. Rosenbaum, "The Relationship of Worker Productivity to Cognitive Dissonance About Wage Inequities," *Journal of Applied Psychology*, 46 (1962), pp. 161-164.

6. Akerlof, George A., and Janet L. Yellen, "Fairness and Unemployment," *The American Economic Review*, 78 (1988), pp. 44-49.

7. Akerlof, George A., and Janet L. Yellen, "The Fair Wage-Effort Hypothesis and Unemployment," *The Quarterly Journal of Economics*, 105 (1990), pp. 256-283.

8. Blinder, Alan S., "The Challenge of High Unemployment," *The American Economic Review*, 78 (1988), pp. 1-15.

9. Browning, Edgar K., "Comparing Monopoly and Competition: The Increasing-Cost Case," *Economic Inquiry*, 25 (1987), pp. 535-542.

10. Clapham, J.H., "Of Empty Economic Boxes," *The Economic Journal*, 32 (1922), pp. 305-314. Reprinted in George J. Stigler and Kenneth E. Boulding (eds.) *A.E.A. Readings in Price Theory* (Chicago: Richard D. Irwin, Inc., 1952), pp. 119-130.

11. Edgeworth, F.Y., "Contributions to the Theory of Railroad Rates, IV: A Digression on Professor Pigou's Thesis," *The Economic Journal*, 23 (1913), pp. 206-226.

12. Ellis, Howard S., and William Fellner, "External Economies and Diseconomies," *The American Economic Review*, 33 (1943), pp. 493-511. Reprinted in George J. Stigler and Kenneth E. Boulding (eds.) *A.E.A. Readings in Price Theory* (Chicago: Richard D. Irwin, Inc., 1952), pp. 242-263.

13. Fisher, Franklin M., "The Existence of Aggregate Production Functions," *Econometrica*, 37 (1969), pp. 553-577.

14. Frank, Robert, "Are Workers Paid Their Marginal Products?" *The American Economic Review*, 74 (1984), pp. 549-571.

15. Kahneman, Daniel, Jack Knetsch and Richard Thaler, "Fairness as a Constraint on Profit Seeking: Entitlements in the Market," *The American Economic Review*, 76 (1986), pp. 728-741.

16. Knight, F.H., "Some Fallacies in the Interpretation of Social Cost," *The Quarterly Journal of Economics*, 38 (1924), pp. 582-606. Reprinted in George J. Stigler and Kenneth E. Boulding (eds.) *A.E.A. Readings in Price Theory* (Chicago: Richard D. Irwin, Inc., 1952), pp. 160-179.

17. Lawler, Edward E. and Paul W. O'Gara, "The Effects of Inequity Produced by Underpayment on Work Output, Work Quality, and Attitudes Toward the Work," *Journal of Applied Psychology*, 51 (1967), pp. 403-410.

18. Pigou, A.C., *The Economics of Welfare*, lst. ed. (London: Macmillan & Co., 1920).

19. Pigou, A.C., "Empty Economic Boxes: A Reply," *The Economic Journal*, 32 (1922), pp. 458-465. Reprinted in George J. Stigler and Kenneth E. Boulding (eds.) *A.E.A. Readings in Price Theory* (Chicago: Richard D. Irwin, Inc., 1952), pp. 131-139.

20. Pigou, A.C., *Wealth and Welfare* (London: Macmillan & Co., 1912).

21. Robertson, D.H., "Those Empty Boxes," *The Economic Journal*, 34 (1924), pp. 16-30. Reprinted in George J. Stigler and Kenneth E. Boulding (eds.) *A.E.A. Readings in Price Theory* (Chicago: Richard D. Irwin, Inc., 1952), pp. 143-159.

22. Robinson, Joan, *The Economics of Imperfect Competition*. (London: Macmillan & Co., 1933). See especially Chapter 10.

23. Sraffa, Piero, "The Laws of Returns Under Competitive Conditions," *The Economic Journal*, 36 (1926), pp. 535-550. Reprinted in George J. Stigler and Kenneth E. Boulding (eds.) *A.E.A. Readings in Price Theory* (Chicago: Richard D. Irwin, Inc., 1952), pp. 180-197.

24. Stigler, George J., *The Theory of Price*, 3rd. ed. (London: Macmillan & Co., 1966).

25. Young, Allyn A., "Pigou's Wealth and Welfare," *The Quarterly Journal of Economics*, 27 (1913), pp. 672-686.