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"THE LAWS OF RETURNS UNDER COMPETITIVE CONDITIONS":
PROGRESS IN MICROECONOMICS SINCE SRAFFA (1926)?

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"...the human mind finds it easier to alter the conclusions arrived at within an accepted framework, than to alter the framework itself."
(Kaldor, 1934a, p.122)

Despite the numerous advances made in microeconomic theory during the twentieth century, the theory of the cost conditions of the firm in a perfectly competitive industry remains mired in contradictions. On some level, increasing, constant and decreasing costs are all incompatible with a partial equilibrium analysis of perfect competition. Although this incompatibility between perfect competition and the entire range of cost functions was first pointed out by Piero Sraffa in a famous 1926 paper entitled "The Laws of Returns Under Competitive Conditions", the theory of perfect competition persists. The purpose of the present paper is threefold: to illustrate the contradictions that persist to this day in this area, to trace those contradictions back to Sraffa's 1926 paper and to suggest why the contradictions have remained unresolved.

I

The contradictions between the theory of perfect competition and the cost conditions of firms are apparent to anyone who has ever taught undergraduate microeconomics. The contradictions cause some uncomfortable moments when justifying the assumptions of "U-shaped" cost curves underlying the partial equilibrium analysis of perfect competition. Mansfield's intermediate microeconomics text (1982) provides excellent examples of the discomfort that arises for both the short run and long run justifications.

In the short run, costs are said to ultimately increase with increasing output because of the "law" of diminishing marginal returns. Mansfield argues that this law "is an empirical generalization, not a deduction from physical or biological laws. In fact, it seems to hold for most production functions in the real world" (pp.149-150). But when the real world results are presented fifty pages later, Mansfield notes that an "interesting conclusion of the empirical studies is that marginal cost in the short run tends to be constant . . . This result seems to be at variance with the theory presented earlier which says that marginal cost curves should be U-shaped" (p.203). Mansfield attempts to resolve the contradiction this way:

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To explain this variance, critics have asserted that the empirical studies are biased toward constant marginal cost by the nature of accounting data and the statistical methods used. Another reason why marginal costs appear constant is that the data used in these studies often do not cover periods when the firm was operating at the peak of its capacity. Although marginal costs may well be relatively constant over a wide range, it is inconceivable that they do not eventually increase with increases in output. (p.203)

If the law of diminishing returns is nothing more than an "empirical generalization," why does Mansfield question the validity of the empirical evidence? This attempted resolution amounts to a denial of the empirical evidence and a mere assertion that short run cost curves must be U-shaped. There must be something else at stake to explain why Mansfield resorts to verbal contortions and a denial of empirical evidence in order to preserve the assumption of U-shaped cost curves.

The resolution of the contradiction surrounding long run cost curves is equally unsatisfactory. Since the law of diminishing returns assumes the existence of a fixed factor, it cannot be used to explain why long run average cost curves turn upward. According to Mansfield, long run cost curves are U-shaped because "beyond a point, increases in scale result in inefficiencies in management. More and more responsibility and power must be given by top management to lower level employees. Co-ordination becomes more difficult, red tape increases, and flexibility is reduced" (p.199). But, as before, the empirical studies show that "the long-run average cost function in most industries seems to be L-shaped, not U-shaped. That is, there is no evidence that it turns upward, rather than remaining horizontal, at high output levels..." (p.203). This long run contradiction is "resolved," once again, by simply asserting the existence of U-shaped long run average cost curves and ignoring the empirical evidence: "Eventually, however, one would expect the long-run average cost function to rise" (p.199).

These illustrations of the contradictions in both the short run and long run cases are not intended as a personal criticism of Professor Mansfield. On the contrary, it is because he at least has the candor to present the empirical evidence that the contradictions are placed in such sharp relief. These contradictions that emerge in Mansfield's text are the contradictions of the general state of the microeconomic theory of perfect competition.

II

Before turning to the question of why a profession that pays such copious obeisance to the principle of empirical testing chooses to discard the facts instead of a theory that contradicts the facts, it will prove useful to trace the historical origins of this contradiction in order to show how we arrived at the present position.

The current contradiction between the theory of perfect competition and the empirical reality of cost curves has its origins in Marshall. Sraffa's 1926 paper exposed what has come to be known as "Marshall's dilemma": the incompatibility of various forms of cost functions with the partial equilibrium analysis of perfect competition.

Marshall himself had recognized (in a footnote) that decreasing costs for the individual firm would ultimately lead to monopoly (1920, p. 459n). Thus, as Sraffa put it, consideration of decreasing costs "was entirely abandoned, as it was seen to be incompatible with competitive conditions" (pp.537-538).

Sraffa's contribution was not to beat the dead horse of decreasing costs. Instead, he challenged the strongest case for perfect competition--increasing costs. He argued that increasing costs were inconsistent with a partial equilibrium analysis of perfect competition for the following reasons. With increasing costs, the usual supply curve for a perfectly competitive industry (industry X) obtains, as well as what appears to be a determinate equilibrium position at the intersection of supply and demand. But if a factor input used in industry X is in limited supply (or can be increased only at an increased cost), an increase in industry X's output will raise the price of the input. Since this input is likely to be an input in the production of commodities that are substitutes for "X", the prices of substitutes change and the demand curve for industry X shifts. Without the independence of demand and supply, there is no determinate partial equilibrium.

While these problems could be overcome by general equilibrium analysis, Sraffa rejects this approach, "whose complexity... prevents it from bearing fruit, at least in the present state of our knowledge, which does not permit of even much simpler schemata being applied to the study of real conditions" (p.541).

How is partial equilibrium analysis to be saved from this problem? According to Sraffa, excluding "that minute class of commodities in the production of which the whole of a factor of production is employed" (p. 539), the only escape is to assume that the industry employs only a small fraction of the factor so that increased utilization will not affect factor price. In other words, we must assume perfect competition in factor markets in that the firm and industry face perfectly elastic factor supplies.

This escape, however is from the frying pan into the fire. The assumption of constant factor prices suggests constant marginal costs, which in turn suggests constant (or falling) average total costs in both the short and long runs. In the short run, this implies that a firm in a perfectly competitive industry has no determinate equilibrium output. In the long run, with constant or decreasing costs there is nothing to prevent the firm from growing until it obtains significant market power and perfect competition disappears. Thus, decreasing, increasing and constant costs were all viewed as inconsistent with a partial equilibrium analysis of perfect competition.

This scenario lead Sraffa to suggest the abandonment of perfect competition in favour of a classical cost of production theory (where cost is independent of demand) combined with demand-side limitations (instead of cost limitations) on the output and size of the firm. While his suggestion has been followed to a limited extent (more in a moment), the dominant response of the profession has been to retain perfect competition by focusing on additional assumptions to deal with Marshall's dilemma. Both shortrun and long run assumptions were required to jump out of the fire back to the cool, axiomatic domain of perfect competition.

In the short run, constant factor prices suggest constant costs, but do not guarantee them. Constant factor prices can also yield increasing costs if productivity falls with increasing output. With the firm's plant and equipment fixed in the short run, the law of diminishing returns can be used to logically justify increasing costs even with constant factor prices. With increasing costs, the equilibrium output of the firm is determined. Thus, on a purely theoretical level, the assumption of diminishing returns in the short run (coupled with perfect competition in factor markets) preserves the determinateness and internal consistency of both the theory of perfect competition and partial equilibrium analysis.

This happy resolution of Marshall's dilemma is spoiled by the overwhelming

empirical evidence which denies the existence of the theoretically convenient "law" of diminishing returns. However, theoretically, there is much to be lost by not making the leap of faith over the fiery abyss of empirical reality to the axiomatic domain of perfect competition.

The long run problem for the theory of perfect competition is what limits the growth of the firm. Since there are no fixed factors, the law of diminishing returns cannot be invoked to provide a rationale for increasing costs. Constant or decreasing costs allow the firm to grow large enough to acquire market power, destroying the conditions for perfect competition. How is the contradiction between perfect competition and non-increasing costs to be resolved?

One resolution, which Sraffa favoured, was to sacrifice perfect competition. He was willing to make this sacrifice because "the theory of perfect competition differs radically from the actual state of things" (p.542) in (erroneously) assuming that 1) competitive firms cannot affect market prices and, 2) firms normally produce in the range of increasing costs. According to Sraffa:

Business men, who regard themselves as being subject to competitive conditions, would consider absurd the assertion that the limit to their production is to be found in the internal conditions of production in their firm, which do not permit of the production of a greater quantity without an increase in cost. The chief obstacle against which they have to contend when they want gradually to increase their production does not lie in the cost of production--which, indeed, generally favours them in that direction--but in the difficulty of selling the larger quantity of goods without reducing the price, or without having to face increased marketing expenses. This necessity of reducing prices, in order to sell a larger quantity of one's own product is only an aspect of the usual descending demand curve, with the difference that instead of concerning the whole of a commodity, whatever its origin, it relates only to the goods produced by a particular firm....(p.543)

Sraffa's suggestion of a downward-sloping demand curve facing the individual firm is generally recognized as the seminal contribution that bore fruit in the theories of imperfect and monopolistic competition. This conception of demand provided a creative resolution of the contradiction between perfect competition and non-increasing costs. Even with non-increasing costs, there was a determinate equilibrium for the firm as long as marginal revenue fell faster than marginal cost (with increasing output).

There were, however, substantial theoretical costs to this resolution. With a downward-sloping demand curve facing the firm, marginal revenue depends not only on price, but also on the price elasticity of demand. This dependence eliminates the possibility of a traditional supply curve because output is no longer a single-valued function of price, as Robinson (1965, p.86) explains:

When competition is not perfect,...marginal revenue will not be equal to price; it is marginal revenue, not price, which determines the output of the individual producer, and any number of different prices are compatible with the same marginal revenue.

The relationship between marginal revenue and price will depend upon the shapes of the individual demand curves, and the

effect of a given increase in the total demand for the commodity upon output will depend upon the manner in which it affects the individual demand curves.

Thus, Sraffa's suggested resolution retained neither perfect competition nor partial equilibrium analysis. Once again, theoretically, there was much to lose.

Another resolution to the long run contradiction between perfect competition and non-increasing costs was to eliminate non-increasing costs in order to retain perfect competition. This could be accomplished on the theoretical level by postulating a factor that yielded increasing costs that more than offset constant or declining costs of production. Managerial limitations in co-ordinating large scale enterprise were postulated as the factor that ultimately produced increasing costs, and that justification survives to this day (as evidenced in Mansfield).

Despite the long run nature of the contradiction it is intended to resolve, this postulate amounts to the assumption of management as a fixed factor (Kaldor 1934b, p. 67). The inconsistency of a long run fixed factor does not stand up to even casual logical scrutiny, let alone to the empirical evidence on non-increasing costs. Just as there is a range of available techniques of production in the long run, we should expect a range of available techniques of management, including techniques better adapted to large scale enterprise. Work by Penrose (1959), Chandler (1962, 1977) and others indicates there is no necessary reason why management cannot efficiently change or adapt to larger scale output.

III

Thus, on both short and long run levels, there is no adequate resolution of contradictions between the partial equilibrium theory of perfect competition and the empirical evidence of non-increasing costs. Instead of a constructive resolution, perfect competition continues to be justified by the unsatisfactory verbal and logical contortions, denials of empirical evidence and proofs by assertion that originated more than fifty years ago. How are we to account for this extraordinary state of affairs?

These unsatisfactory justifications of perfect competition are resorted to because what is at stake is the entire theoretical apparatus associated with perfect competition. Hicks (1946) made this perfectly clear in Value and Capital:

It has to be recognized that a general abandonment of the assumption of perfect competition, a universal adoption of the assumption of monopoly, must have very destructive consequences for economic theory. Under monopoly the stability conditions become indeterminate; and the basis on which economic laws can be constructed is therefore shorn away.

.....It is, I believe, only possible to save anything from this wreck--and it must be remembered that the threatened wreckage is that of the greater part of general equilibrium theory--if we can assume that the markets confronting most of the firms with which we shall be dealing do not differ very greatly from perfectly competitive markets. ... At least, this get-away seems well worth trying. We must be aware, however, that we are taking a dangerous

step, and probably limiting to a serious extent the problems with which our subsequent analysis will be fitted to deal. Personally, however, I doubt if most of the problems we shall have to exclude for this reason are capable of much useful analysis by the methods of economic theory. (pp. 83-85)

This passage in Hicks touches on most of the reasons why the economics profession has retained the theory of perfect competition. There are a number of ways in which the entire theoretical apparatus of equilibrium economics is at stake. Without increasing costs, there is nothing limiting the growth of the firm, and the elegant determinateness of perfect competition degenerates into the chaotic indeterminateness of oligopoly. An indeterminate theory serves little useful purpose. In elaborating on this theme, Andrews (1964) suggests that perfect competition has been retained (despite its empirical irrelevance) because it provides an optimal standard by which to judge the deviations of the actual economy. Perfect competition is useful as a basis for welfare and policy judgments.

Recent work in the philosophy of science sheds additional light on the situation. Hicks, while recognizing the dangers of the assumption of perfect competition, cannot conceive of any alternative for theoretical analysis. This restricted vision suggests Kuhn's (1970) concept of normal science—problem-solving activity within the context of an accepted theoretical framework or paradigm. As the passage by Hicks implies, it is only the acceptance of the equilibrium paradigm (including perfect competition) that allows the posing and solution of theoretical problems.

Normal science is a period of steady refinement of the basic theoretical framework. During this period, contrary evidence does not lead to the rejection of the basic theory, but instead leads to the development of more detailed, secondary hypotheses that account for discrepancies between facts and the basic theory. Lakatos (1978), in developing Kuhn's ideas about secondary hypotheses, formulated the concept of a "protective belt" of auxiliary assumptions that protects the basic theoretical framework from empirical refutation.

In applying these concepts to the case at hand, perfect competition and increasing costs that yield firms of determinate size are integral aspects of the basic theoretical framework of equilibrium analysis. The auxiliary assumptions of diminishing marginal returns and management as a fixed factor form a protective belt immunizing the theory from empirical refutation. These auxiliary assumptions provide a basis for questioning and discounting the empirical evidence of non-increasing costs and thereby retaining the theory and the possibility of normal science.

Probably the most significant reason why the theory of perfect competition has persisted despite its problems is that no acceptable alternative theory has come along to take its place. According to Blaug (1978, p. 703), "Economists abhor a theoretical vacuum as much as nature abhors a physical one, and in economics, as in the other sciences, theories are overthrown by better theories, not simply by contradictory facts." As the opening quotation from Kaldor suggests, it is easier to grapple with the sometimes inconsistent solutions to a clearly defined set of problems than to reformulate the entire set of problems.

The theory of the cost conditions of the firm was derived from the conditions necessary for equilibrium in a perfectly competitive industry rather than being derived from historical observations of firms. It is this procedure that accounts for both the empirical inconsistency of the theory and why it cannot be sacrificed without sacrificing

the more general theoretical framework of equilibrium economics. Given the stakes involved, it is the empirical evidence that is sacrificed in order to save the theoretical framework.

This history of the theory of the cost conditions of the firm is evidence that the vision of hypothesis testing, in which empirically falsified theories are discarded and only non-falsified theories retained, is not always applicable. A corollary of this conclusion is that previous classical theories of the firm may have been discarded not because they were empirically false, but because they were not compatible with the dominant conception of equilibrium economics. The history of thought is one place, among others, to look for transcendence of the contradiction between perfect competition and the empirical fact of non-increasing costs.

Any transcendence of the contradiction will require a theory of the firm built up from empirical evidence in conjunction with a general theoretical framework that offers an alternative to the equilibrium conception associated with perfect competition. Until that event occurs, we are likely to continue to live with the contradictions of perfect competition.

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