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PERFECT COMPETITION, HISTORICALLY CONTEMPLATED

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NO CONCEPT in economics—or elsewhere—is ever defined fully, in the sense that its meaning under every conceivable circumstance is clear. Even a word with a wholly arbitrary meaning in economics, like “elasticity,” raises questions which the person who defined it (in this case, Marshall) never faced: for example, how does the concept apply to finite changes or to discontinuous or stochastic or multiple-valued functions? And of course a word like “competition,” which is shared with the whole population, is even less likely to be loaded with restrictions or elaborations to forestall unfelt ambiguities.

Still, it is a remarkable fact that the concept of competition did not begin to receive explicit and systematic attention in the main stream of economics until 1871. This concept—as pervasive and fundamental as any in the whole structure of classical and neoclassical economic theory—was long treated with the kindly casualness with which one treats of the intuitively obvious. Only slowly did the elaborate and complex concept of perfect competition evolve, and it was

not until after the first World War that it was finally received into general theoretical literature. The evolution of the concept and the steps by which it became confused with a perfect market, uniqueness of equilibrium, and stationary conditions are the subject of this essay.

THE CLASSICAL ECONOMISTS

“Competition” entered economics from common discourse, and for long it connoted only the independent rivalry of two or more persons. When Adam Smith wished to explain why a reduced supply led to a higher price, he referred to the “competition [which] will immediately begin” among buyers; when the supply is excessive, the price will sink more, the greater “the competition of the sellers, or according as it happens to be more or less important to them to get immediately rid of the commodity.”¹ It will be noticed that “competition” is here (and usually) used in the sense of rivalry in a race—a race to get limited supplies or a race to be

¹ *The Wealth of Nations* (Modern Library ed.), pp. 56–57.

rid of excess supplies. Competition is a process of responding to a new force and a method of reaching a new equilibrium.

Smith observed that economic rivals were more likely to strive for gain by under- or overbidding one another, the more numerous they were:

The trades which employ but a small number of hands, run most easily into such combinations.

If this capital [sufficient to trade in a town] is divided between two different grocers, their competition will tend to make both of them sell cheaper, than if it were in the hands of one only; and if it were divided among twenty, their competition would be just so much the greater, and the chance of their combining together, in order to raise the price, just so much the less.²

This is all that Smith has to say of the number of rivals.

Of course something more is implicit, and partially explicit, in Smith's treatment of competition, but this "something more" is not easy to state precisely, for it was not precise in Smith's mind. But the concept of competition seemed to embrace also several other elements:

1. The economic units must possess tolerable knowledge of the conditions of employment of their resources in various industries. "This equality [of remuneration] can take place only in those employments which are well known, and have been long established in the neighbourhood."³ But the necessary information was usually available: "Secrets . . . , it must be acknowledged, can seldom be long kept; and the extraordinary profit can last very little longer than they are kept."⁴
2. Competition achieved its results only in the long run: "This equality in the whole of the advantages and disadvantages of the different employments of labour and stock, can take place only in the ordinary, or what may be called the natural state of those employments."⁵

² *Ibid.*, pp. 126 and 342.

³ *Ibid.*, p. 114.

3. There must be freedom of trade; the economic unit must be free to enter or leave any trade. The exclusive privileges or corporations which exclude men from trades, and the restrictions imposed on mobility by the settlement provisions of the poor law, are examples of such interferences with "free competition."

In sum, then, Smith had five conditions of competition:

1. The rivals must act independently, not collectively.
2. The number of rivals, potential as well as present, must be sufficient to eliminate extraordinary gains.
3. The economic units must possess tolerable knowledge of the market opportunities.
4. There must be freedom (from social restraints) to act on this knowledge.
5. Sufficient time must elapse for resources to flow in the directions and quantities desired by their owners.

The modern economist has a strong tendency to read more into such statements than they meant to Smith and his contemporaries. The fact that he (and many successors) was willing to call the ownership of land a monopoly—although the market in agricultural land met all these conditions—simply because the total supply of land was believed to be fixed is sufficient testimony to the fact that he was not punctilious in his language.⁶

Smith did not state how he was led to these elements of a concept of competition. We may reasonably infer that the conditions of numerous rivals and of independence of action of these rivals were matters of direct observation. Every informed person knew, at least in a general

⁴ *Ibid.*, p. 60.

⁵ *Ibid.*, p. 115.

⁶ *Ibid.*, p. 145. Perhaps this is not the ideal illustration of the laxness of the period in the use of the competitive concept, for several readers of this paper have sympathized with this usage. But, to repeat, competition is consistent with a zero elasticity of supply: the fact of windfall gains from unexpected increases in demand is characteristic of all commodities with less than infinitely elastic supplies.

way, what competition was, and the essence of this knowledge was the striving of rivals to gain advantages relative to one another.

The other elements of competition, on the contrary, appear to be the necessary conditions for the validity of a proposition which was to be associated with competition: the equalization of returns in various directions open to an entrepreneur or investor or laborer. If one postulates equality of returns as the equilibrium state under competition, then adequacy of numbers and independence of rivals are not enough for equilibrium. The entrepreneur (or other agents) must know what returns are obtainable in various fields, he must be allowed to enter the fields promising high rates of return, and he must be given time to make his presence felt in these fields. These conditions were thus prerequisites of an analytical theorem, although their reasonableness was no doubt enhanced by the fact that they corresponded more or less closely to observable conditions.

This sketch of a concept of competition was not amplified or challenged in any significant respect for the next three-quarters of a century by any important member of the English school. A close study of the literature, such as I have not made, would no doubt reveal many isolated passages on the formal properties or realism of the concept, especially when the theory was applied to concrete problems. For example, Senior was more interested in methodology than most of his contemporaries, and he commented:

But though, under free competition, cost of production is the regulator of price, its influence is subject to much occasional interruption. Its operation can be supposed to be perfect only if we suppose that there are no disturbing causes, that capital and labour can be at once transferred, and without loss, from one employment to another, and that every producer has

full information of the profit to be derived from every mode of production. But it is obvious that these suppositions have no resemblance to the truth. A large portion of the capital essential to production consists of buildings, machinery, and other implements, the results of much time and labour, and of little service for any except their existing purposes. . . . Few capitalists can estimate, except upon an average of some years, the amounts of their own profits, and still fewer can estimate those of their neighbours.⁷

Senior made no use of the concept of perfect competition hinted at in this passage, and he was wholly promiscuous in his use of the concept of monopoly.

Cairnes, the last important English economist to write in the classical tradition, did break away from the Smithian concept of competition. He defined a state of free competition as one in which commodities exchanged in proportion to the sacrifices (of labor and capital) in their production.⁸ This condition was amply fulfilled, he believed, so far as capital was concerned, for there was a large stock of disposable capital which quickly flowed into unusually remunerative fields.⁹ The condition was only partly fulfilled in the case of labor, however, for there existed a hierarchy of occupational classes ("non-competing industrial groups") which the laborer found it most difficult to ascend.¹⁰ Even the extra rewards of skill beyond those which paid for the sacrifices in obtaining training were a monopoly return.¹¹ This approach was not analytically rigorous—Cairnes did not tell how to equate the sacrifices of capitalists and laborers—nor was it empirically fruitful.

⁷ N. W. Senior, *Political Economy* (New York, 1939), p. 102.

⁸ *Some Leading Principles of Political Economy Newly Expounded* (London, 1874), p. 79.

⁹ *Ibid.*, p. 68. ¹⁰ *Ibid.*, p. 72.

¹¹ *Ibid.*, p. 85. Thus Cairnes tacitly labeled all differences in native ability as "monopolistic."

Cairnes labeled as "industrial competition" the force which effects the proportioning of prices to psychological costs which takes place to the extent that the products are made in one non-competing group, and he called on the reciprocal demand theory of international trade to explain exchanges of products between non-competing groups. Hence we might call industrial competition the competition within non-competing groups, and commercial competition that between non-competing groups. But Sidgwick and Edgeworth attribute the opposite concepts to Cairnes: commercial competition is competition within an industry, and industrial competition requires the ability of resources to flow between industries.¹² Their nomenclature seems more appropriate; I have not been able to find Cairnes's discussion of commercial competition and doubt that it exists.¹³

THE CRITICS OF PRIVATE ENTERPRISE

The main claims for a private-enterprise system rest upon the workings of competition, and it would not have been unnatural for critics of this system to focus much attention on the competitive concept. They might have argued that Smith's assumptions were not strong enough to insure optimum results or that, even if perfect competition were formulated as the basis of the theory, certain deviations from optimum results (such as those associated with external economies) could occur. The critics did not make this type of criticism, however, possibly simply because they were not

¹² Henry Sidgwick, *Principles of Political Economy* (London, 1883), p. 182; F. Y. Edgeworth, *Papers Relating to Political Economy* (London, 1925), II, 280, 311.

¹³ Karl Marx once distinguished interindustry from intraindustry competition in *Theorien über den Mehrwert* (Stuttgart, 1905), II, Part 2, 14 n.

first-class analysts; and for this type of development we must return to the main line of theorists, consisting mostly of politically conservative economists.

Or, at another pole, the critics might simply have denied that competition was the basic form of market organization. In the nineteenth century, however, this was only a minor and sporadic charge.¹⁴ The Marxists did not press this point: both the labor theory of value and the doctrine of equalization of profit rates require competition.¹⁵ The early Fabian essayists were also prepared to make their charges rest upon the deficiencies in the workings of competition rather than its absence.¹⁶ The charge that competition was non-existent or vanishing did not become commonplace until the end of the nineteenth century.

The critics, to the extent that they took account of competition at all, emphasized the evil tendencies which they believed flowed from its workings. It would be interesting to examine their criticisms systematically with a view to

¹⁴ For example, Leslie repeatedly denied that resource owners possessed sufficient knowledge to effect an equalization of the rates of return (see T. E. Cliffe Leslie, *Essays in Political and Moral Philosophy* [London, 1888], pp. 47, 48, 81, 158-59, 184-85).

¹⁵ See especially Volume III of *Das Kapital* and also F. Engels, *The Condition of the Working-Classes in England*, reprinted in Karl Marx and Friedrich Engels, *On Britain* (London, 1954), pp. 109 ff. The Marxian theory of the increasing concentration of capital was a minor and inconsistent dissent from the main position (see *Capital* [Modern Library ed.], pp. 684 ff.).

¹⁶ See *Fabian Essays* (Jubilee ed.; London, 1948), especially those by Shaw and Webb. But the attention devoted to monopoly was increasing, and the essay by Clarke argued that "combination is absorbing commerce" (*ibid.*, p. 84). A few years later the Webbs used a competitive model in their celebrated discussion of "higgling in the market" and then went on to describe the formation of monopolistic structures as defences erected against the competitive pressures the Webbs did not quite understand (see *Industrial Democracy* [London, 1920], Part III, chap. ii).

their treatment of competition; it is my impression that their most common, and most influential, charge was that competition led to a highly objectionable, and perhaps continuously deteriorating, distribution of income by size.¹⁷ In their explanations of the workings of a competitive economy the most striking deficiency of the classical economists was their failure to work out the theory of the effects of competition on the distribution of income.

THE MATHEMATICAL SCHOOL

The first steps in the analytical refinement of the concept of competition were made by the mathematical economists. This stage in the history of the concept is of special interest because it reveals both the types of advances that were achieved by this approach and the manner in which alien elements were introduced into the concept.

When an algebraically inclined economist seeks to maximize the profits of a producer, he is led to write the equation

$$\text{Profits} = \text{Revenue} - \text{Cost}$$

and then to maximize this expression; that is, to set the derivative of profits with respect to output equal to zero. He then faces the question: How does revenue (say, pq) vary with output (q)? The natural answer is to *define* competition as that situation in which p does not vary with q —in which the demand curve facing the firm is horizontal. This is precisely what Cournot did:

The effects of competition have reached their limit, when each of the partial productions D_k [the output of producer k] is *inappreciable*, not

¹⁷ A second main criticism became increasingly more prominent in the second half of the nineteenth century: that a private-enterprise system allowed or compelled large fluctuations in employment. For some critics (e.g., Engels), competition was an important cause of these fluctuations.

only with reference to the total production $D = F(p)$, but also with reference to the derivative $F'(p)$, so that the partial production D_k could be subtracted from D without any appreciable variation resulting in the price of the commodity.¹⁸

This definition of competition was especially appropriate in Cournot's system because, according to his theory of oligopoly, the excess of price over marginal cost approached zero as the number of like producers became large.¹⁹ Cournot believed that this condition of competition was fulfilled "for a multitude of products, and, among them, for the most important products."²⁰

Cournot's definition was enormously more precise and elegant than Smith's so far as the treatment of numbers was concerned. A market departed from unlimited competition to the extent that price exceeded the marginal cost of the firm, and the difference approached zero as the number of rivals approached infinity.

¹⁸ *Mathematical Principles of the Theory of Wealth* (New York, 1929), p. 90. It is sufficient to assume that D_k is small relative to D if one assumes that the demand function is continuous, for then "the variations of the demand will be sensibly proportional to the variations in price so long as these last are small fractions of the original price" (*ibid.*, p. 50).

¹⁹ Let the revenue of the firm be $q_i p$, and let all firms have the same marginal costs, MC . Then the equation for maximum profits for one firm would be

$$p + q_i \frac{dp}{dq} = MC.$$

The sum of n such equations would be

$$np + q \frac{dp}{dq} = nMC,$$

for $nq_i = q$. This least equation may be written,

$$p = MC - \frac{p}{nE},$$

where E is the elasticity of market demand (*ibid.*, p. 84).

²⁰ *Ibid.*, p. 90.

But the refinement was one-sided: Cournot paid no attention to conditions of entry and so his definition of competition held also for industries with numerous firms even though no more firms could enter.

The role of knowledge was made somewhat more prominent in Jevons' exposition. His concept of competition was a part of his concept of a market, and a perfect market was characterized by two conditions:

[1.] A market, then, is theoretically perfect only when all traders have perfect knowledge of the conditions of supply and demand, and the consequent ratio of exchange; . . .

[2.] . . . there must be perfectly free competition, so that anyone will exchange with any one else upon the slightest advantage appearing. There must be no conspiracies for absorbing and holding supplies to produce unnatural ratios of exchange.²¹

One might interpret this ambiguous second condition in several ways, for the pursuit of advantages is not inconsistent with conspiracies. At a minimum, Jevons assumes complete independence of action by every trader for a corollary of the perfect market in that "in the same market, at any moment, there cannot be two prices for the same kind of article."²² This rule of a single price (it is called the "law of indifference" in the second edition) excludes price discrimination and

²¹ *Theory of Political Economy* (1st ed.; London, 1871), pp. 87 and 86.

²² *Ibid.*, p. 92. This is restated as the proposition that the last increments of an act of exchange (i.e., the last exchange in a competitive market) must be proportional to the total quantities exchanged, or that dy exchanges for dx in the same proportion that y exchanges for x , or

$$\frac{dy}{dx} = \frac{y}{x}.$$

It would have been better for Jevons simply to assert that, if x_i exchanges for y_i , then for all i

$$\frac{x_i}{y_i} = \frac{P_y}{P_x}.$$

probably requires that the market have numerous buyers and sellers, but the condition is not made explicit. The presence of large numbers is clearly implied, however, when we are told that "a single trader . . . must buy and sell at the current prices, which he cannot in an appreciable degree affect."²³

The merging of the concepts of competition and the market was unfortunate, for each deserved a full and separate treatment. A market is an institution for the consummation of transactions. It performs this function efficiently when every buyer who will pay more than the minimum realized price for any class of commodities succeeds in buying the commodity, and every seller who will sell for less than the maximum realized price succeeds in selling the commodity. A market performs these tasks more efficiently if the commodities are well specified and if buyers and sellers are fully informed of their properties and prices. Possibly also a perfect market allows buyers and sellers to act on differing expectations of future prices. A market may be perfect and monopolistic or imperfect and competitive. Jevons' mixture of the two has been widely imitated by successors, of course, so that even today a market is commonly treated as a concept subsidiary to competition.

Edgeworth was the first to attempt a systematic and rigorous definition of perfect competition. His exposition deserves the closest scrutiny in spite of the fact that few economists of his time or ours have attempted to disentangle and uncover the theorems and conjectures of the *Mathematical Psychics*, probably the

²³ *Ibid.*, p. 111. In the Preface to the second edition, where on most subjects Jevons was farseeing, the conceptual treatment of competition deteriorated: "Property is only another name for monopoly . . . Thus monopoly is limited by competition . . ." (*Theory* [4th ed.], pp. xlvii-xlviii).

most elusively written book of importance in the history of economics. For his allegations and demonstrations seem to be the parents of widespread beliefs on the nature of perfect competition.

The conditions of perfect competition are stated as follows:

The *field of competition* with reference to a contract, or contracts, under consideration consists of all individuals who are willing and able to recontract about the articles under consideration. . . .

There is free communication throughout a *normal* competitive field. You might suppose the constituent individuals collected at a point, or connected by telephones—an ideal supposition [1881], but sufficiently approximate to existence or tendency for the purposes of abstract science.

A *perfect* field of competition professes in addition certain properties peculiarly favourable to mathematical calculation; . . . The conditions of a *perfect* field are four; the first pair referable to the heading *multiplicity* or continuity, the second *dividedness* or fluidity.

I. An individual is free to *recontract* with any out of an indefinite number, . . .

II. Any individual is free to *contract* (at the same time) with an indefinite number; . . . This condition combined with the first appears to involve the indefinite divisibility of each *article* of contract (if any *X* deal with an indefinite number of *Y*s he must give each an indefinitely small portion of *x*); which might be erected into a separate condition.

III. Any individual is free to *recontract* with another independently of, *without the consent* being required of, any third party, . . .

IV. Any individual is free to *contract* with another independently of a third party; . . .

The failure of the first [condition] involves the failure of the second, but not *vice versa*; and the third and fourth are similarly related.²⁴

The natural question to put to such a list of conditions of competition is: Are the conditions necessary and sufficient to achieve what intuitively or pragmatically seems to be a useful concept of competition? Edgeworth replies, in effect, that

²⁴ *Mathematical Psychics* (London, 1881), pp. 17–19.

the conditions are both necessary and sufficient. More specifically, competition requires (1) indefinitely large numbers of participants on both sides of the market; (2) complete absence of limitations upon individual self-seeking behavior; and (3) complete divisibility of the commodities traded.²⁵

The rationale of the requirement of indefinite numbers is as follows. With bilateral monopoly, the transaction will be indeterminate—equilibrium can be anywhere on the contract curve.²⁶ If we add a second buyer and seller, it is shown that the range of permissible equilibriums (the length of the tenable contract curve) will shrink.²⁷ By intuitive induction, with infinitely many traders it will shrink to a single point; a single price must rule in the market.²⁸

Before we discuss this argument, we may take account also of the condition that individual traders are free to act independently. Edgeworth shows that combinations reduce the effective number of traders and that “combiners *stand to gain*.”²⁹ In effect, then, he must assume that the individual trader not only is free to act independently but will in fact do so.

The proof of the need for indefinite numbers has serious weaknesses. The range of indeterminacy shrinks only because one seller or buyer tries to cut out the other by offering better terms.³⁰

²⁵ Edgeworth’s emphasis upon recontract, the institution which allows tentative contracts to be broken without penalty, is motivated by a desire to assure that equilibrium will be achieved and will not be affected by the route by which it is achieved. It will not be examined here.

²⁶ *Ibid.*, pp. 20 ff.

²⁸ *Ibid.*, pp. 37–39.

²⁷ *Ibid.*, pp. 35 ff.

²⁹ *Ibid.*, p. 43.

³⁰ “. . . It will in general be possible for *one* of the *Y*s (without the consent of the other) to *recontract* with the two *X*s, so that for all those three parties the recontract is more advantageous than the previously existing contract” (*ibid.*, p. 35).

Edgeworth fails to show that such price competition (which is palpably self-defeating) will occur or that, if it does occur, why the process should stop before the parties reach a unique (competitive) equilibrium. Like all his descendants, he treated the small-numbers case unsatisfactorily.

It is intuitively plausible that with infinite numbers all monopoly power (and indeterminacy) will vanish, and Edgeworth essentially postulates rather than proves this. But a simple demonstration, in case of sellers of equal size, would amount only to showing that

Marginal revenue = Price

$$+ \frac{\text{Price}}{\text{Number of sellers} \times \text{Market elasticity}}$$

and that this last term goes to zero as the number of sellers increases indefinitely.³¹ This was implicitly Cournot's argument.

But why do we require divisibility of the traded commodity?

Suppose a market, consisting of an equal number of masters and servants, offering respectively wages and service; subject to the condition that no man can serve two masters, no master employ more than one man; or suppose equilibrium already established between such parties to be disturbed by any sudden influx of wealth into the hands of the masters. Then there is no *determinate*, and very generally *unique*, arrangement towards which the system tends under the operation of, may we say, a law of Nature, and which would be predictable if we knew beforehand the real requirements of each, or of the average, dealer; . . .³²

³¹ Let one seller dispose of q_i , the other sellers each disposing of q . Then the seller's marginal revenue is

$$\frac{d(pq_i)}{dq_i} = p + q_i \frac{dp}{dQ} \frac{dQ}{dq_i},$$

where Q is total sales, and $dQ/dq_i = 1$. Letting $Q = nq_i = nq$, and writing E for

$$\frac{dQ}{dp} \frac{p}{Q},$$

we obtain the expression in the text.

Consider the simple example: a thousand masters will each employ a man at any wage below 100; a thousand laborers will each work for any wage above 50. There will be a single wage rate: knowledge and numbers are sufficient to lead a worker to seek a master paying more than the going rate or a master to seek out a worker receiving less than the market rate. But any rate between 50 and 100 is a possible equilibrium.³³

It is not the lack of uniqueness that is troublesome, however, for a market can be perfectly competitive even though there be a dozen possible stable equilibrium positions.³⁴ Rather, the difficulty arises because the demand (or supply) functions do not possess continuous derivatives: the withdrawal of even one unit will lead to a large change in price, so that the individual trader—even though he has numerous independent rivals—can exert a perceptible influence upon price.

The element of market control arising out of the non-continuity is easily eliminated, of course. If the article which is traded is divisible, then equalities replace inequalities in the conditions of equilibrium: the individual trader can no longer influence the market price. A master may employ a variable amount of labor, and he will therefore bid for additional units so long as the wage rate is below his marginal demand price. A worker may have several employers, and he will therefore supply additional labor so long as any employer will pay more than his marginal supply price. "If the labour of the

³² *Mathematical Psychics*, p. 46.

³³ Of course, let there be one extra worker, and the wage will be 50; one extra master, and it will be 100.

³⁴ Since chance should operate in the choice of the equilibrium actually attained, it is not proper to say, as Edgeworth does (in a wider context), that the dice will be "loaded with villainy" (*ibid.*, p. 50).

assistants can be sold by the hour, or other sort of differential dose, the phenomenon of determinate equilibrium will reappear."³⁵ Divisibility was introduced to achieve determinateness, which it fails to do, but it is required to eliminate monopoly power.

Divisibility had a possible second role in the assumptions, which, however, was never made explicit. If there are infinitely many possessors of a commodity, presumably each must have only an infinitesimal quantity of it if the existing total stock is to be finite. But no economist placed emphasis upon the strict mathematical implications of concepts like infinity, and this word was used to convey only the notion of an indefinitely large number of traders.

The remainder of the mathematical economists of the period did not extend, or for that matter even reach, the level of precision of Edgeworth. Walras gave no adequate definition of competition.³⁶ Pareto noticed the possible effects of social controls over purchases and sales.³⁷ Henry Moore, in what may have been the first article on the formal definition of competition,³⁸ listed five "implicit hypotheses" of competition:

- I. Each economic factor seeks a maximum net income.
- II. There is but one price for commodities of the same quality in the same market.

³⁵ *Collected Papers Relating to Political Economy* (London, 1925), I, 36. One might also seek to eliminate the indeterminateness by appeal to the varying demand-and-supply prices of individual traders; this is the path chosen by Hicks in "Edgeworth, Marshall, and the Indeterminateness of Wages," *Economic Journal*, XL (1930), 45-31. This, however, is a complicated solution; one must make special hypotheses about the distribution of these demand-and-supply prices.

³⁶ *Elements of Pure Economics*, trans. Jaffé (Homewood, Ill., 1954), pp. 83 and 185. It is indicative that the word "competition" is not indexed.

³⁷ *Cours d'économie politique* (Lausanne, 1896, 1897), §§ 46, 87, 705, 814; cf. also *Manuel d'économie politique* (2d ed.; Paris, 1927), pp. 163, 210, 230.

- III. The influence of the product of any one producer upon the price per unit of the total product is negligible.
- IV. The output of any one producer is negligible as compared with the total output.
- V. Each producer orders the amount of his product without regard to the effect of his act upon the conduct of his competitors.³⁹

This list of conditions is noteworthy chiefly because it marked an unsuccessful attempt to revert to the narrower competitive concept of Jevons.

MARSHALL

Marshall as usual refused to float on the tide of theory, and his treatment of competition was much closer to Adam Smith's than to that of his contemporaries. Indeed, Marshall's exposition was almost as informal and unsystematic as Smith's in this area. His main statement was:

We are investigating the equilibrium of normal demand and normal supply in their most general form: we are neglecting those features which are special to particular parts of economic science, and are confining our attention to those broad relations which are common to nearly the whole of it. Thus we assume that the forces of demand and supply have free play in a perfect market; there is no combination among dealers on either side, but each acts for himself: and there is *free competition*; that is, buyers compete freely with buyers, and sellers compete freely with sellers. But though everyone acts for himself, his knowledge of what others are doing is supposed to be sufficient to prevent him from taking a lower price or paying a higher price than others are doing; . . .⁴⁰

If this quotation suggests that Marshall was invoking a strict concept of competi-

³⁸ "Paradoxes of Competition," *Quarterly Journal of Economics*, XX (1905-6), 209-30. Most of the article is concerned with duopoly.

³⁹ *Ibid.*, pp. 213-14. The fifth statement is held to be a corollary of III and IV; but see p. 13 below.

⁴⁰ *Principles of Economics* (1st ed.; London, 1890), p. 402. A comparison with the corresponding passage in the eighth edition (*op. cit.*, p. 341) will reveal the curious changes which were later made in the description of competition.

tion, we must remember that he discussed the "fear of spoiling the market" and the firms with negatively sloping demand curves in the main chapters on competition⁴¹ and that the only time perfect competition was mentioned was when it was expressly spurned.⁴²

Soon he yielded a bit to the trend toward refinement of the concept. Beginning with the third (1895) edition, he explicitly introduced the horizontal demand curve for the individual firm as the normal case and gave it the same mathematical formulation as did Cournot.⁴³ But these were patchwork revisions, and they were not carried over into the many passages where looser concepts of competition had been employed.

Marshall's most significant contribution was indirect: he gave the most powerful analysis up to his time of the relationship of competition to optimum economic organization (Book V, chap. xiii, on the doctrine of maximum satisfaction). There he found the competitive results to have not only the well-known qualification that the distribution of resources must be taken as a datum, and the precious exception that only one of several multiple stable equilibria could be the maximum,⁴⁴ but also a new and possibly extremely important exception, arising out of external economies and diseconomies. The doctrine of external economies in effect asserts that in important areas the choices of an individual are governed by only part of the consequences, and inevitably the doctrine opens up a wide range of competitive equilibria which depart from conventional criteria of optimum arrangement.

⁴¹ *Principles* (8th ed.; London, 1929), pp. 374 and 458.

⁴² *Ibid.*, p. 540.

⁴³ *Ibid.*, pp. 517 and 849-50.

⁴⁴ Both of these qualifications were of course recognized by predecessors such as Walras and Edgeworth.

It was left for Pigou to elaborate, and exaggerate, the importance of this source of disharmonies in *Wealth and Welfare*.

THE COMPLETE FORMULATION CLARK AND KNIGHT

Only two new elements needed to be added to the Edgeworth conditions for competition in order to reach the modern concept of perfect competition. They pertained to the mobility of resources and the model of the stationary economy, and both were presented, not first,⁴⁵ but most influentially, by John Bates Clark.

Clark, in his well-known development of the concept of a static economy, ascribed all dynamic disturbances to five forces:

1. Population is increasing.
2. Capital is increasing.
3. Methods of production are improving.
4. The forms of industrial establishments are changing: . . .
5. The wants of consumers are multiplying.⁴⁶

The main purpose of his treatise was to analyze the stationary economy in which these forces were suppressed, and for this analysis the assumption of competition was basic:

There is an ideal arrangement of the elements of society, to which the force of competition, acting on individual men, would make the society conform. The producing mechanism actually shapes itself about this model, and at no time does it vary greatly from it.

We must use assumptions boldly and advisedly, making labor and capital absolutely mobile, and letting competition work in ideal perfection.⁴⁷

⁴⁵ In the mathematical exposition of theory it was natural to postulate stable supply and demand functions, and therefore stable technologies and tastes, so one could trace a gradually expanding concept of the stationary economy in Walras, Auspitz and Lieben, and Irving Fisher.

⁴⁶ *The Distribution of Wealth* (New York, 1899), p. 56.

⁴⁷ *Ibid.*, pp. 68 and 71.

Although the concepts of a stationary economy and of competition are completely independent of each other, Clark somehow believed that competition was an element of static analysis:

The statement made in the foregoing chapter that a static state excludes true entrepreneurs' profits does not deny that a legal monopoly might secure to an entrepreneur a profit that would be permanent as the law that should create it—and that, too, in a social condition which, at first glance, might appear to be static. The agents, labor and capital, would be prevented from moving into the favored industry, though economic forces, if they had been left unhindered, would have caused them to move in. This condition, however, is not a true static state, as it has been defined. . . . Industrial groups are in a truly static state when the industrial agents, labor and capital, show a *perfect mobility, but no motion*. A legal monopoly destroys at a certain point this mobility. . . .⁴⁸

I shall return to this identification of competition with stationary equilibrium at a later point.

The introduction of perfect mobility of resources as an assumption of competition was new, and Clark offers no real explanation for the assumption. One could simply eliminate his five dynamic influences, and then equilibrium would be reached after a time even with "friction" (or less than instantaneous mobility). Clark was aware of this possible approach but merely said that "it is best to assume" that there is no friction.⁴⁹ The only gain in his subsequent work, of course, is the avoidance of an occasional "in the long run."

Mobility of resources had always been an implicit assumption of competition, and in fact the conditions of adequate knowledge of earning opportunities and absence of contrived barriers to movement were believed to be adequate to insure mobility. But there exist also technological limitations to the rate at which

resources can move from one place or industry to another, and these limitations were in fact the basis of Marshall's concept of the short-run normal period. Once this fact was generally recognized, it became inevitable that mobility of resources be given an explicit time dimension, although of course it was highly accidental that instantaneous mobility was postulated.

The concept of perfect competition received its complete formulation in Frank Knight's *Risk, Uncertainty and Profit* (1921). It was the meticulous discussion in this work that did most to drive home to economists generally the austere nature of the rigorously defined concept⁵⁰ and so prepared the way for the widespread reaction against it in the 1930's.

Knight sought to establish the precise nature of an economy with complete knowledge as a preliminary step in the analysis of the impact of uncertainty. Clark's procedure of eliminating historical changes was shown to be neither necessary nor sufficient: a stationary economy was not necessary to achieve complete competitive equilibrium if men had complete foresight; and it was not sufficient to achieve this equilibrium, because there might still be non-historical fluctuations, owing, for example, to drought or flood, which were imperfectly anticipated.⁵¹ Complete, errorless adjustments required full knowledge of all relevant circumstances, which realistical-

⁵⁰ Although Pigou was not concerned with the formal definition of competition, he must also be accounted an influential figure in the popularization of the concept of perfect competition. In his *Wealth and Welfare* (1912), he devoted individual chapters to the effects of immobility (with incorrect knowledge as one component) and indivisibility upon the ability of a resource to receive an equal rate of return in all uses (*ibid.*, Part II, chaps. iv and v).

⁵¹ *Risk, Uncertainty and Profit* (New York, 1921), pp. 35-38.

⁴⁸ *Ibid.*, p. 76; cf. also p. 78.

⁴⁹ *Ibid.*, p. 81.

ly can be possessed only when these circumstances do not change; that is, when the economy is stationary.

The assumptions necessary to competition are presented as part of a list that describes the pure enterprise economy, and I quote those that are especially germane to competition:

2. We assume that the members of the society act with complete "rationality." By this we do not mean that they are to be "as angels, knowing good from evil"; we assume ordinary human motives . . . ; but they are supposed to "know what they want" and to seek it "intelligently." . . . They are supposed to know absolutely the consequence of their acts when they are performed, and to perform them in the light of the consequences. . . .

4. We must also assume complete absence of physical obstacles to the making, execution, and changing of plans at will; that is, there must be "perfect mobility" in all economic adjustments, no cost involved in movements or changes. To realize this ideal all the elements entering into economic calculations—effort, commodities, etc.—must be continuously variable, divisible without limit. . . . The exchange of commodities must be virtually instantaneous and costless.

5. It follows as a corollary from number 4 that there is perfect competition. There must be perfect, continuous, costless intercommunication between all individual members of the society. Every potential buyer of a good constantly knows and chooses among the offers of all potential sellers, and conversely. Every commodity, it will be recalled, is divisible into an indefinite number of units which must be separately owned and compete effectually with each other.

6. Every member of the society is to act as an individual only, in entire independence of all other persons. . . . And in exchanges between individuals, no interests of persons not parties to the exchange are to be concerned, either for good or for ill. Individual independence in action excludes all forms of collusion, all degrees of monopoly or tendency to monopoly. . . .

9. All given factors and conditions are for the purposes of this and the following chapter and until notice to the contrary is expressly given, to remain absolutely unchanged. They must be free from periodic or progressive modi-

fication as well as irregular fluctuation. The connection between this specification and number 2 (perfect knowledge) is clear. Under static conditions every person would soon find out, if he did not already know, everything in his situation and surroundings which affected his conduct. . . .

The above assumptions, especially the first eight, are idealizations or purifications of tendencies which hold good more or less in reality. They are the conditions necessary to perfect competition. The ninth, as we shall see, is on a somewhat different footing. Only its corollary of perfect knowledge (specification number 2) which may be present even when change takes place is necessary for perfect competition.⁵²

This list of requirements of perfect competition is by no means a statement of the *minimum* requirements, and in fact no one is able to state the minimum requirements.

Consider first complete knowledge. If each seller in a market knows any n buyers, and each seller knows a different (but overlapping) set of buyers, then there will be perfect competition if the set of n buyers is large enough to exclude joint action. Or let there be indefinitely many brokers in any market, and let each broker know many buyers and sellers, and also let each buyer or seller know many brokers—again we have perfect competition. Since entrepreneurs in a stationary economy are essentially brokers between resource owners and consumers, it is sufficient for competition if they meet this condition. That is, resource owners and consumers could dwell in complete ignorance of all save the bids of many entrepreneurs. Hence knowledge possessed by any one trader need not be complete; it is sufficient if the knowledge possessed by the ensemble of individuals in the market is in a sense comprehensive.

And now, mobility. Rigid immobility of every trader is compatible with perfect

⁵² *Ibid.*, pp. 76-79; cf. also p. 148.

competition if we wish to have this concept denote only equilibrium which is not affected by the actions of individual traders: large numbers (in any market) and comprehensive knowledge are sufficient to eliminate monopoly power. If we wish perfect competition to denote also that a resource will obtain equal returns in all possible uses, mobility becomes essential, but not for all resources. If one resource were immobile and all others mobile, clearly the returns of all resources in all uses could be equalized. Even if all resources were immobile, under certain conditions free transport of consumers' goods would lead to equalization of returns.⁵³ Even in the general case in which mobility of resources is required, not all the units of a resource need be mobile. If some units of each resource are mobile, the economic system will display complete mobility for all displacements up to a limit that depends upon the proportion of mobile units and the nature of the displacement.

The condition that there be no costs of movement of resources is not necessary in order to reach maximum output for an economy; under competition only those movements of resources will take place for which the additional return equals or exceeds the cost of movement. But costless movement is necessary if equality is to obtain in the return to a resource in all uses: if the movement between *A* and *B* costs \$1.00 (per unit of time), the return to a resource at *A* can vary within \$1.00 of either direction of its return at *B*. Equilibrium could be reached anywhere within these limits (but would be uniquely determined), and this equilibrium would

depend upon the historical distribution of resources and consumers.

Next, divisibility. It is not enough to have a large number of informed traders in a market: price must change continuously with quantity if an individual trader is to have only an imperceptible influence upon the market rate, and this will generally require divisibility of the commodity traded. Infinite divisibility, however, is not necessary to eliminate significant control over price by the individual trader, and divisibility of time in the use of a resource is a substitute for divisibility in its quantity. Divisibility, however, is not sufficient to insure uniqueness of equilibriums; even in the simpler problems one must also require that the relevant economic functions display strict monotonicity, but this has nothing to do with competition.

And homogeneity. The formal condition that there be many producers of a commodity assumes homogeneity of this commodity (Knight's assumption 5). Certain forms of heterogeneity are of course unimportant because they are superficial: potatoes need not be of the same size if they are sold by the pound; laborers do not have to be equally efficient if the differences in their productivity are measurable. As these examples may suggest, heterogeneity can be a substitute for divisibility.

The final assumption, concerning collusion, is especially troublesome. If one merely postulates the absence of collusion, then why not postulate also that even two rivals can behave in such a way as to reach competitive equilibrium? Instead, one usually requires that the number of traders be large enough so that collusion will not appear. To determine this number, one must have a theory of the conditions under which collusion occurs. Economists have generally emphasized

⁵³ See P. A. Samuelson, "International Factor-Price Equalization Once Again," *Economic Journal*, LIX (1949), 181-97; and S. F. James and I. F. Pierce, "The Factor Price Equalization Myth," *Review of Economic Studies*, XIX (1951-52), 111-22.

two barriers to collusion. The first is imperfect knowledge, especially of the consequences of rivalry and of the policy which would maximize profits for the group, and of course neither of these difficulties would arise in the stationary economy with perfect knowledge. The second barrier is the difficulty of determining the division of profits among colluders, and we simply do not know whether this difficulty would increase with the number of traders under the conditions we are examining. Hence it seems essential to assume the absence of collusion as a supplement to the presence of large numbers: one of the assumptions of perfect competition is the existence of a Sherman Act.

It is therefore no occasion for complaint that Knight did not state the minimum requirements for perfect competition; this statement was impossible in 1921, and it is impossible today. The minimum assumptions for a theoretical model can be stated with precision only when the complete theory of that model is known. The complete theory of competition cannot be known because it is an open-ended theory; it is always possible that a new range of problems will be posed in this framework, and then, no matter how well developed the theory was with respect to the earlier range of problems, it may require extensive elaboration in respects which previously it glossed over or ignored.

The analytical appeal of a definition of competition does not depend upon its economy of assumptions, although gratuitously wide assumptions are objectionable.⁵⁴ We wish the definition to specify

⁵⁴ They are objectionable chiefly because they mislead some user or abusers of the concept as to its domain of applicability. That dreadful list of assumptions of perfect competition which textbooks in labor economics so often employ to dismiss the marginal productivity theory is a case in point.

with tolerable clarity—with such clarity as the state of the science affords—a model which can be used by practitioners in a great variety of theoretical researches, so that the foundations of the science need not be debated in every extension or application of theory. We wish the definition to capture the essential general content of important markets, so the predictions drawn from the theory will have wide empirical reliability. And we wish a concept with normative properties that will allow us to judge the efficiency of policies. That the concept of perfect competition has served these varied needs as well as it has is providential.

CONCLUDING REFLECTIONS

If we were free to redefine competition at this late date, a persuasive case could be made that it should be restricted to meaning the absence of monopoly power in a market. This is an important concept that deserves a name, and “competition” would be the appropriate name. But it would be idle to propose such a restricted signification for a word which has so long been used in a wide sense, and at best we may hope to denote the narrower concept by a suggestive phrase. I propose that we call this narrower concept *market competition*.

Perfect market competition will prevail when there are indefinitely many traders (no one of which controls an appreciable share of demand or supply) acting independently in a perfect market. A perfect market is one in which the traders have full knowledge of all offer and bid prices. I have already remarked that it was unfortunate that a perfect market was made a subsidiary characteristic of competition, for a perfect market may also exist under monopoly. Indeed, in realistic cases a perfect market may be

more likely to exist under monopoly, since complete knowledge is easier to achieve under monopoly.

Market competition can exist even though resources or traders cannot enter or leave the market in question. Hence market competition can rule in an industry which is not in long-run competitive equilibrium and is compatible with the existence of large profits or losses.

It is interesting to note that Chamberlin's definition of "pure" competition is identical with my definition of market competition: "competition unalloyed with monopoly elements."⁵⁵ But Chamberlin implied that pure competition could rule in an imperfect market; the only conditions he postulated were large numbers of traders and a standardized commodity. The conditions are incomplete: if one million buyers dealt with one million sellers of a homogeneous product, each pair dealing in ignorance of all others, we should simply have one million instances of bilateral monopoly. Hence pure competition cannot be contrasted with perfect competition, for the former also requires "perfect" knowledge (subject to qualifications I have previously discussed), and for this reason I prefer the term "market competition."

The broad concept of perfect competition is defined by the condition that the rate of return (value of the marginal product) of each resource be equal in all uses. If we wish to distinguish this concept from market competition, we may call it (after the terminology attributed to Cairnes) *industrial competition*. Industrial competition requires (1) that there be market competition within each industry; (2) that owners of resources be informed of the returns obtainable in each industry; and (3) that they be free

to enter or leave any industry. In addition, the resources must be infinitely divisible if there is to be strict equality in the rate of return on a resource in all uses.

An industrial competitive equilibrium will obtain continuously if resources are instantaneously mobile or in the long run if they move at a finite time rate. Since the concept of long-run competitive equilibrium is deeply imbedded in modern economic theory, it seems most desirable that we interpret industrial competition as a long-run concept. It may be noticed that a time period did not have to figure explicitly in the pre-Marshallian theory because that theory did not separate and devote special attention to a short-run normal period in which only a portion of the resources were mobile: the basic classical theory was a long-run theory.

The concept of industrial competition has a natural affinity to the static economy even though our definition does not pay any explicit attention to this problem. Rates of return on resources will be equalized only if their owners have complete knowledge of future returns (in the case of durable resources), and it seems improper to assume complete knowledge of the future in a changing economy. Not only is it misleading to endow the population with this gift of prophecy but also it would often be inconsistent to have people foresee a future event and still have that event remain in the future.

One method by which we might seek to adapt the definition to a historically evolving economy is to replace the equalization of rates of return by *expected* rates of return. But it is not an irresistibly attractive method. There are troublesome questions of what entrepreneurs seek to maximize under these conditions and of whether risk or uncertainty pre-

The Theory of Monopolistic Competition (1st Cambridge, Mass., 1933), p. 6.

miums also enter into their calculations. A more important difficulty is that this formulation implies that the historically evolving industry is in equilibrium in long-run normal periods, and there is no strong reason to believe that such long-run normal periods can be defined for the historically evolving industry. If all economic progress took the form of a secularly smooth development, we could continue to use the Marshallian long-run normal period, and indeed much progress does take this form. But often, and sooner or later always, the historical changes come in vast surges, followed by quiescent periods or worse, and it is harder to assume that the fits and starts can be foreseen with tolerable confidence or that they will come frequently enough to average out within economically relevant time periods.

It seems preferable, therefore, to adapt the concept of competition to changing conditions by another method: to insist only upon the absence of barriers to entry and exit from an industry in the long-run normal period; that is, in the period long enough to allow substantial changes in the quantities of even the most durable and specialized resources. Then we may still expect that some sort of expected return will tend to be equalized under conditions of reasonably steady change, although much work remains to be done before we can specify exactly what this return will be.⁵⁶

The way in which the competitive concept loses precision when historically changing conditions are taken into ac-

⁵⁶ It is worth noticing that even under static conditions the definition of the return is modified to suit the facts and that mobility of resources is the basic competitive requirement. Thus we say that laborers move so that the net advantages, not the current money return, of various occupations are equalized. The suggestion in the text is essentially that we find the appropriate definition of net advantages for the historically evolving economy.

count is apparent. It is also easily explained: the competitive concept can be no better than the economic theory with which it is used, and until we have a much better theory of economic development we shall not have a much better theory of competition under conditions of non-repetitive change.

The normative role of the competitive concept arises from the fact that the equality of rate of return on each resource in all uses which defines competition is also the condition for maximum output from given resources. The outputs are measured in market prices, and the maximum is relative to the distribution of ownership of resources. This well-known restriction of the competitive optimum to production, it may be remarked, should be qualified by the fact that the effects of competition on distribution have not been studied. A competitive system affects the distribution of the ownership of resources, and—given a stable distribution of human abilities—a competitive system would probably lead eventually to a stable income distribution whose characteristics are unknown. The theory of this distribution might have substantial normative value.

The vitality of the competitive concept in its normative role has been remarkable. One might have expected that, as economic analysis became more precise and as the range of problems to which it was applied widened, a growing list of disparities between the competitive allocation of resources and the maximum-output allocation would develop. Yet to date there have been only two major criticisms of the norm.⁵⁷ The first

⁵⁷ In a wider framework there have of course been criticisms of the competitive norm with respect to (i) the ability of individuals to judge their own interests and (ii) the ability of a competitive system to achieve a continuously high level of employment of resources.

is that the competitive individual ignores external economies and diseconomies, which—rightly or wrongly—most economists are still content to treat as an exception to be dealt with in individual cases. The second, and more recent, criticism is that the competitive system will not provide the right amount (and possibly not the right types) of economic progress, and this is still an undocumented charge. The time may well come when the competitive concept suitable to positive analysis is not suitable to normative analysis, but it is still in the future.

Finally, we should notice the most common and the most important criticism of the concept of perfect competition—that it is unrealistic. This criticism has been widespread since the concept was completely formulated and underlies the warm reception which the profession gave to the doctrines of imperfect and monopolistic competition in the 1930's. One could reply to this criticism that all concepts sufficiently general and sufficiently precise to be useful in scientific analysis must be abstract: that, if a science is to deal with a large class of phenomena, clearly it cannot work with concepts that are faithfully descriptive of even one phenomenon, for then they will

be grotesquely undescriptive of others. This conventional line of defense for all abstract concepts is completely valid, but there is another defense, or rather another form of this defense, that may be more persuasive.

This second defense is that the concept of perfect competition has defeated its newer rivals in the decisive area: the day-to-day work of the economic theorist. Since the 1930's, when the rival doctrines of imperfect and monopolistic competition were in their heyday, economists have increasingly reverted to the use of the concept of perfect competition as their standard model for analysis. Today the concept of perfect competition is being used more widely by the profession in its theoretical work than at any time in the past. The vitality of the concept is strongly spoken for by this triumph.

Of course, this is not counsel of complacency. I have cited areas in which much work must be done before important aspects of the definition of competition can be clarified. My fundamental thesis, in fact, is that hardly any important improvement in general economic theory can fail to affect the concept of competition. But it has proved to be a tough and resilient concept, and it will stay with us in recognizable form for a long time to come.