

TWO CONCEPTS OF EXTERNAL ECONOMIES¹

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THE concept of external economies is one of the most elusive in economic literature. Our understanding of it has been greatly enhanced by the active controversy of the twenties over the nature of the "empty economic boxes"; but full clarity has never been achieved. Definitions of external economies are few and unsatisfactory. It is agreed that they mean services (and dis-services) rendered free (without compensation) by one producer to another; but there is no agreement on the nature and form of these services or on the reasons for their being free. It is also agreed that external economies are a cause for divergence between private profit and social benefit and thus for the failure of perfect competition to lead to an optimum situation; but for this there are many reasons, and it is nowhere made clear how many and which of these reasons are subsumed under the heading of "external economies." Nor do examples help to clarify the concept. The literature contains many examples of external economies; but they are as varied and dissimilar as are discussions of the subject. Some give the impression that external economies are exceptional and unimportant; others suggest that they are important and ubiquitous. Indeed, one might be tempted to explain this strange dichotomy by ideological differences between the different authors; but

such an explanation would be both unwarranted and unnecessary. For, with the increasing rigor of economic thinking and separation of the different branches of economic theory, it is becoming increasingly clear that the concept of external economies does duty in two entirely different contexts. One of these is equilibrium theory, the other is the theory of industrialization in underdeveloped countries. It is customary to discuss these two subjects at different levels of abstraction and on the basis of very different sets of assumptions: no wonder that "external economies" stand for very different things in the two contexts. Indeed, I shall argue that there are two entirely different definitions of external economies, one much wider than the other; and that external economies as defined in the theory of industrialization include, but go far beyond, the external economies of equilibrium theory. The latter have been discussed and rigorously defined in Professor Meade's "External Economies and Diseconomies in a Competitive Situation";² but, since they form part of external economies as defined in the theory of industrialization, we shall deal with them briefly here.

I

Equilibrium theory, in both its general and its partial form, is a static theory, concerned with the characteristics of the economic system when it is in equilibrium. Most of its conclusions are based on the assumptions of (1) perfect com-

¹ I am indebted to Professor Bernard Haley and Mr. Ralph Turvey for many helpful suggestions. The responsibility for errors, however, is entirely mine.

² *Economic Journal*, LXII (1952), 54-67.

petition on both sides of every market and (2) perfect divisibility of all resources and products. These assumptions underlie the main conclusion of general equilibrium theory, viz., that the market economy leads to a situation of economic optimum (in Pareto's sense), provided that every economic influence of one person's (or firm's) behavior on another person's well-being (or firm's profit) is transmitted through its impact on market prices. Expressed differently, equilibrium in a perfectly competitive economy is a situation of Paretian optimum, except when there is interdependence among the members of the economy that is direct, in the sense that it does not operate through the market mechanism. In general equilibrium theory, then, direct interdependence is the villain of the piece and the cause for conflict between private profit and social benefit.

One can distinguish four types of direct (i.e., nonmarket) interdependence (and one of these—the last one in the following enumeration—is known as “external economies”): (1) The individual person's satisfaction may depend not only on the quantities of products he consumes and services he renders but also on the satisfaction of other persons. In particular, the high income or consumption of others may give a person pain or pleasure; and so may his knowledge that some others are less well off than he is. This is known as the “interdependence of consumers' satisfaction.” (2) A person's satisfaction may be influenced by the activities of producers not only through their demand for his services and supply of the products he buys but also in ways that do not operate through the market mechanism. These may be called the producer's “direct” (i.e., nonmarket) influence on personal satisfaction and are best known by

the example of the factory that inconveniences the neighborhood with the fumes or noise that emanate from it. (3) The producer's output may be influenced by the action of persons more directly and in other ways than through their offer of services used and demand for products produced by the firm. This is a counterpart of the previous case, and its main instance is inventions that facilitate production and become available to producers without charge. (4) The output of the individual producer may depend not only on his input of productive resources but also on the activities of other firms. This is a counterpart of case 1 and may be called “direct interdependence among producers” but is better known under the name of “external economies and diseconomies.”³

Of these four cases of direct interdependence, the first, interdependence among consumers, is undoubtedly important. It is (together with the case mentioned in n. 3) among the main reasons for the current controversy in welfare economics and the reluctance of economists to make any welfare statements concerning the consumer. Nowadays, welfare statements are usually confined to the field of production, where the main conclusion of general equilibrium theory seems to stand on firmer ground, primarily because the remaining three cases of direct interdependence (all of which involve the producer) seem exceptional and unimportant. The second case seems exceptional, because most instances of it can be and usually are eliminated by zoning ordinances and industrial regulation concerned with public health and safety. The third case

³ A fifth and important case, which, however, does not quite fit into the above classification, is that where society provides social services through communal action and makes them available free of charge to all persons and firms.

is unimportant, because patent laws have eliminated the main instance of this form of direct interdependence and transformed it into a case of interdependence through the market mechanism.⁴ The fourth case seems unimportant, simply because examples of it seem to be few and exceptional.

The last statement appears at first to be contradicted by the many examples of external economies and diseconomies quoted in the literature; but most of these are *not* examples of direct interdependence among producers, which is the only meaning that can be attributed to the term "external economies" within the context of equilibrium theory. It will be useful in this connection to have a rigorous definition of direct interdependence among producers. Meade gave such a definition when he defined external economies; and I can do no better than to reproduce it. According to him, external economies exist whenever the output (x_1) of a firm depends not only on the factors of production (l_1, c_1, \dots) utilized by this firm but also on the output (x_2) and factor utilization (l_2, c_2, \dots) of another firm or group of firms.⁵ In symbols,

$$x_1 = F(l_1, c_1, \dots; x_2, l_2, \dots),$$

where the existence of external economies is indicated by the presence of the variables to the right of the semicolon. Since $F(*)$ is a production function, external economies as here defined are a peculiarity of the production function. For this reason it is convenient to call them "technological external economies."⁶ While

⁴ I.e., patent laws have created a market and a market price for the inventor's services, which in the absence of such laws would often be free goods. The case where the results of government-sponsored research into industrial and agricultural methods are made gratuitously available to industrialists and farmers belongs in the category mentioned in n. 3 above.

⁵ *Op. cit.*

this will distinguish them from another category of external economies to be introduced presently, we must bear in mind that technological external economies are the only external economies that can arise, because of direct interdependence among producers and within the framework of general equilibrium theory.

The examples of external economies given by Meade are somewhat bucolic in nature, having to do with bees, orchards, and woods. This, however, is no accident: it is not easy to find examples from industry. Going through the many examples of external economies quoted in the literature, I found only two that fit the above definition: the case in which a firm benefits from the labor market created by the establishment of other firms and that in which several firms use a resource which is free but limited in supply.⁷ For a more detailed discussion the reader is referred to Meade's article, which will, I think, convince him of the scarcity of technological external economies.

II

The other field in which the concept of external economies occurs frequently is the theory of industrialization of underdeveloped countries, where the concept is used in connection with the special problem of allocating savings among alternative investment opportunities. This last is one of the many practical problems to which economists are wont to

⁶ The term is used in Jacob Viner's "Cost Curves and Supply Curves," *Zeitschrift für Nationalökonomie*, III (1931), 23-46.

⁷ Instances of this are the oil well whose output depends on the number and operation of other wells on the same oil field; the fisherman whose catch depends on the operations of other fishermen in the same waters; and the firm that uses a public road (or other publicly owned utility) and is partly crowded out of it by other firms using the same road.

apply the conclusions of general equilibrium theory. Most of them realize, of course, that general equilibrium theory is limited in its assumptions and applicability; but the only limitation taken seriously by most economists is that imposed by the assumption of perfect competition; and this—as is well known—is not always a necessary condition for the conclusions of equilibrium theory to hold good. In particular, many economists regard a uniform degree of monopoly as all that is necessary for market forces to bring about an optimum allocation of investment funds; and this weaker condition is held to be more nearly fulfilled in our society. Whether for this reason or for some other, the private profitability of investment is usually considered a good index of its social desirability, at least as a general rule.

To this rule, however, the exceptions are too great and obvious to be ignored, especially in underdeveloped countries; and it is customary to impute most of them to external economies. While the nature of these external economies is often discussed, I have been unable to find a definition of the concept in the literature dealing with underdeveloped countries. It is possible, however, to infer a definition from the many examples, discussions, and obiter dicta. It seems that external economies are invoked whenever the profits of one producer are affected by the actions of other producers. To facilitate comparison with Meade's definition, we can express this in symbols by the function

$$P_1 = G(x_1, l_1, c_1, \dots; x_2, l_2, c_2, \dots),$$

which shows that the *profits* of the firm depend not only on its own output and factor inputs but also on the output and factor inputs of other firms; and we shall

say that in the context of underdeveloped countries external economies are said to exist whenever the variables to the right of the semicolon are present.

This definition of external economies obviously includes direct or nonmarket interdependence among producers, as discussed above and defined by Meade. It is much broader, however, than his definition, because, in addition to direct interdependence among producers, it also includes interdependence among producers through the market mechanism. This latter type of interdependence may be called "pecuniary external economies" to distinguish it from the technological external economies of direct interdependence.⁸

Interdependence through the market mechanism is all-pervading, and this explains the contrast between the exceptional and often awkward examples of external economies cited in discussions of equilibrium theory and the impression one gains from the literature on underdeveloped countries that the entrepreneur creates external economies and diseconomies with his every move.

What is puzzling, however, is that interdependence through the market mechanism should be held to account for the failure of the market economy to lead to the socially desirable optimum, when equilibrium theory comes to the opposite conclusion and *relies* on market interdependence to bring about an optimum situation. Pecuniary external economies clearly have no place in equilibrium theory. The question is whether the concept is meaningful elsewhere. To answer this question we must first investigate the nature of the pecuniary external economies, to which interdependence through the market mechanism gives rise.

⁸ Cf. Viner, *op. cit.*

Investment in an industry leads to an expansion of its capacity and may thus lower the prices of its products and raise the prices of the factors used by it. The lowering of product prices benefits the users of these products; the raising of factor prices benefits the suppliers of the factors. When these benefits accrue to firms, in the form of profits, they are pecuniary external economies—Marshall called, or would have called, them (together with the benefits accruing to persons) consumers' and producers' surplus, respectively. According to the theory of industrialization, these benefits, being genuine benefits, should be explicitly taken into account when investment decisions are made; and it is usually suggested that this should be done by taking as the maximand not profits alone but the sum of the profits yielded and the pecuniary external economies created by the investment.

This prescription seems to be in direct conflict with the results of equilibrium theory. For, according to the latter and subject to its usual assumptions and limitations, market interdependence in the competitive system insures that the maximization of profit by each firm and of satisfaction by each person brings about an optimum situation, which, as is well known, is sometimes described as a situation in which consumers' and producers' surpluses are maximized. In other words, equilibrium theory tells us that in equilibrium the sum of consumers' and producers' surpluses will be maximized, although they do not enter explicitly, as part of the maximand, the economic decisions of any producer.⁹ Assuming that these conflicting views are both right, the conflict can be resolved only if we should find that the limitations of general equilibrium theory render it inapplicable to the problems of investment.

This, indeed, must often be so; but in the following we shall single out three special cases, which seem especially important and in which the above conflict is resolved.

a) One reason why the conclusions of general equilibrium theory may be inapplicable to the practical problem of investment is that the former's assumption of perfect divisibility is not always fulfilled. Perfect competition leads to a position of economic optimum, because under perfect competition the marginal conditions of economic optimum are contained (in the absence of direct interdependence) in the marginal conditions of profit maximization by producers and satisfaction maximization by householders. Indivisibilities, however, may prevent the producer from fulfilling these marginal conditions. For example, he may find himself unable to equate marginal costs to price and, instead, face the choice of producing either less or more than the output that would equate these two quantities. In such a case one of the available alternatives will still yield him a higher profit than all others; but this need no longer be the one that is also the best from society's point of view. Hence the need, in such cases, to take society's point of view explicitly into consideration.

This fact was recognized as early as 1844 by Dupuit.¹⁰ He was looking for a criterion of the social desirability of investment in such public utilities as

⁹ Cf. J. R. Hicks, "The Rehabilitation of Consumers' Surplus," *Review of Economic Studies*, VIII (1941), 108-16. We need not enter here the debate on the usefulness of this terminology. Nor is it necessary to stress that this way of stating the results of perfect competition is characteristic of partial equilibrium analysis.

¹⁰ Cf. Jules Dupuit, "De la mesure de l'utilité des travaux publics," *Annales des ponts et chaussées*, 2d ser., Vol. VIII (1844); reprinted in *International Economic Papers*, No. 2 (1952), pp. 83-110.

canals, roads, bridges, and railways—the typical examples of indivisibilities in economics—and he found this criterion not in the actual profitability of such investments but in what their profitability would be in the hypothetical case in which the operator of the utility practiced price discrimination and thus appropriated to himself the consumers' surplus that would normally (i.e., in the absence of price discrimination) accrue to the users of the public utility. In other words, Dupuit's test of social desirability is whether the sum of profit and consumers' surplus is positive.¹¹ Dupuit's test and his use of the consumers' surplus concept underlying it were vindicated by Professor Hicks;¹² but neither Hicks nor Dupuit makes clear the role of indivisibilities in rendering the above test necessary. For this last point, as well as for an excellent statement of the entire argument, the reader should consult chapter xvi of Professor Lerner's *Economics of Control*.¹³

b) The second reason for the inapplicability of general equilibrium theory to the problems of investment is that the former is a static or equilibrium theory, whereas the allocation of investment funds is not a static problem at all. According to equilibrium theory, the pro-

ducer's profit-maximizing behavior brings about a socially desirable situation *when the system is in equilibrium*; or, to give this result a more dynamic, if not entirely correct, interpretation, profit-maximizing behavior brings closer the socially desirable optimum if it also brings closer equilibrium. Investment, however, need not bring the system closer to equilibrium; and, when it does not, the results of equilibrium theory may not apply.

Profits are a sign of disequilibrium; and the magnitude of profits, under free competition, may be regarded as a rough index of the degree of disequilibrium.¹⁴ Profits in a freely competitive industry lead to investment in that industry; and the investment, in turn, tends to eliminate the profits that have called it forth. This far, then, investment tends to bring equilibrium nearer. The same investment, however, may raise or give rise to profits in other industries; and to this extent it leads away from equilibrium. For example, investment in industry A will cheapen its product; and if this is used as a factor in industry B, the latter's profits will rise. This, then, is a case where the price reduction creates, not a consumers' surplus proper, accruing to persons, but pecuniary external economies, benefiting firms. Is this difference sufficient to render the conclusions of general equilibrium theory inapplicable?

To answer this question, we must pursue the argument a little further. The profits of industry B, created by the lower price of factor A, call for investment and expansion in industry B, one result of which will be an increase in industry B's demand for industry A's product. This in its turn will give rise to profits and call for further investment

¹¹ This is so whether the consumers' surplus accrues to persons or represents external economies accruing to firms.

¹² Cf. J. R. Hicks, "L'Économie de bien-être et la théorie des surplus du consommateur," and "Quelques applications de la théorie des surplus du consommateur," both in *Économie appliquée*, No. 4 (1948), pp. 432–57.

¹³ A. P. Lerner, *Economics of Control* (New York: Macmillan Co., 1944). Lerner's solution is slightly different and, I believe, more correct than Dupuit's, in that he takes account also of producers' surplus. It might be added in passing that the type of indivisibility considered by Dupuit establishes a relation among the users of the public utility that is similar in all essentials to direct interdependence among consumers.

¹⁴ However, the absence of profits is not a sufficient condition of equilibrium.

and expansion in industry A; and equilibrium is reached only when successive doses of investment and expansion in the two industries have led to the simultaneous elimination of profits in both. It is only at this stage, where equilibrium has been established, that the conclusions of equilibrium theory become applicable and we can say (on the usual assumptions and in the absence of direct interdependence) that the amount of investment profitable in industry A is also the socially desirable amount. This amount is clearly greater than that which is profitable at the first stage, before industry B has made adjustment. We can conclude, therefore, that when an investment gives rise to pecuniary external economies, its private profitability understates its social desirability.

Unfortunately, however, the test of social desirability applicable in the previous case is not applicable here, although it would probably give a better result than a simple calculation of profitability. This can easily be seen by comparing the situation under consideration with that which would obtain if industries A and B were integrated (although in such a way as to preserve the free competition assumed so far). In this case the pecuniary external economies created by investment in industry A would become "internal" and part of the profits of the investors themselves. Investment in A would be more profitable and pushed further than in the absence of integration; but, *without investment and expansion also in industry B*, it would not be pushed far enough. For what inhibits investment in A is the limitation on the demand for industry A's product imposed by the limited capacity of industry B, the consumer of this product; just as investment in industry B is inhibited by the limited capacity of industry A,

the supplier of one of industry B's factors of production. These limitations can be fully removed only by a simultaneous expansion of both industries. We conclude, therefore, that only if expansion in the two industries were integrated and planned together would the profitability of investment in each one of them be a reliable index of its social desirability.

It hardly needs adding that the relation between industries A and B discussed above illustrates only one of the many possible instances of pecuniary external economies that belong in this category. Expansion in industry A may also give rise to profits (i) in an industry that produces a factor used in industry A, (ii) in an industry whose product is complementary in use to the product of industry A, (iii) in an industry whose product is a substitute for a factor used in industry A, or (iv) in an industry whose product is consumed by persons whose incomes are raised by the expansion of industry A—and this list does not include the cases in which the expansion causes external *diseconomies*. It is apparent from this list that vertical integration alone would not be enough and that complete integration of all industries would be necessary to eliminate all divergence between private profit and public benefit. This was fully realized by Dr. Rosenstein-Rodan, who, in dealing with the "Problems of Industrialisation of Eastern and South-Eastern Europe,"¹⁵ considered most instances of pecuniary external economies listed above and advocated that "the whole of the industry to be created is to be treated and planned like one huge firm or trust."¹⁶ To put this conclusion differently, profits in a market economy are a bad guide to economic optimum as far as

¹⁵ *Economic Journal*, LIII (1943), 202-11.

¹⁶ *Ibid.*, p. 204.

investment and industrial expansion are concerned; and they are worse, the more decentralized and differentiated the economy.

This entire argument can be restated in somewhat different terms. In an economy in which economic decisions are decentralized, a system of communications is needed to enable each person who makes economic decisions to learn about the economic decisions of others and co-ordinate his decisions with theirs. In the market economy, prices are the signaling device that informs each person of other people's economic decisions; and the merit of perfect competition is that it would cause prices to transmit information reliably and people to respond to this information properly. Market prices, however, reflect the economic situation as it is and not as it will be. For this reason, they are more useful for co-ordinating current production decisions, which are immediately effective and guided by short-run considerations, than they are for co-ordinating investment decisions, which have a delayed effect and—looking ahead to a long future period—should be governed not by what the present economic situation is but by what the future economic situation is expected to be. The proper co-ordination of investment decisions, therefore, would require a signaling device to transmit information about present plans and future conditions as they are determined by present plans; and the pricing system fails to provide this.¹⁷ Hence the belief that there is need either for centralized investment planning or for some additional communication system to supple-

ment the pricing system as a signaling device.

It must be added that the argument of this section applies with especial force to underdeveloped countries. The plant capacity most economical to build and operate is not very different in different countries; but, as a percentage of an industry's total capacity, it is very much greater in underdeveloped than in fully industrialized economies. In underdeveloped countries, therefore, investment is likely to have a greater impact on prices, give rise to greater pecuniary external economies, and thus cause a greater divergence between private profit and social benefit.

c) I propose to consider yet another reason for divergence between the profitability of an investment and its desirability from the community's point of view; but this is very different from those discussed in the last two sections and has to do with the difference between the national and international points of view. In appraising the social desirability of an economic action from the international point of view, all repercussions of that action must be fully taken into account, whereas, from the national point of view, the welfare of domestic nationals alone is relevant and the losses suffered and benefits gained by foreigners are ignored. The two points of view need not necessarily lead to different appraisals; but they usually do when the economic action considered is the allocation of investment funds among purely domestic, import-competing, and export industries. From the international point of view, all external economies and diseconomies must be taken into consideration; from the national point of view, one must count only the external economies and diseconomies that accrue to domestic

¹⁷ Professor Kenneth Arrow pointed out to me, however, that, in a formal sense, futures markets and futures prices could provide exactly such a signaling device.

nationals and leave out of account the pecuniary external economies accruing to foreign buyers from the expansion of export industries and the diseconomies inflicted on foreign competitors by the expansion of import-competing industries. Accordingly, investment in export industries is always less, and that in import-competing industries is always more, desirable from the national, than from the international, point of view.

In discussions on investment policy this difference between the national and international points of view usually appears in the guise of a difference between the criteria of social benefit and private profit. For social benefit, when considered explicitly, is usually identified with national benefit in our society, whereas private profit, although an imperfect index of social desirability, accounts or fails to account for external economies and diseconomies without national bias and therefore probably comes closer to registering the social welfare of the world as a whole than that of a single nation. Hence investment tends to be more profitable in export industries and less profitable in import-competing industries than would be desirable from a narrow nationalistic point of view.

It is worth noting that this argument is in some respects the reverse of the argument of Section II*b* above. There it was the failure of profit calculations to

take into account pecuniary external economies that caused the divergence between private profit and social benefit; here the divergence is caused by the entry into the profit criterion of pecuniary external economies and diseconomies that accrue to foreigners and should therefore be excluded from social accounting concerned with national, rather than world, welfare. The argument is well known as the "terms-of-trade argument" and has been used to explain the failure of foreign investments in colonial areas to benefit fully the borrowing countries.¹⁸ The divergence between national welfare and private profit depends on the foreigners' import-demand and export-supply elasticities; and it can be offset by an appropriate set of import and export duties. This has been shown by Mr. J. de V. Graaff, in his "Optimum Tariff Structures."¹⁹ De Graaff presents his optimum tariff structure as one that will bring about that flow of goods and services which optimizes²⁰ the nation's welfare; but the same tariff structure will also bring about the allocation of investment funds that is optimal from the national point of view.

¹⁸ Cf. H. W. Singer, "The Distribution of Gains between Investing and Borrowing Countries," *American Economic Review (Proceedings)*, XL (1950), 473-85.

¹⁹ *Review of Economic Studies*, XVII (1949-50), 47-59.

²⁰ In Pareto's sense.