M.Com.(Applied Economics) semester-II

Advanced Economic Analysis-II

Unit-IV

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GENERAL EQUILIBRIUM ANALYSIS

As against partial equilibrium analysis, general equilibrium analysis is concerned with economic system as a whole. It recognises the fact that economic system is a network in which all the parts are mutually dependent on one another and in mutual interaction with one another.

Goods are either competitive or substitutes. Some goods are used in the manufacture of other goods. Factors of production are complementary to each other to the extent they can be substituted for each other, they are competitive also. Resources also face competitive demand from producers.Therefore, change in the demand or supply of any commodity or factor of production sets in motion a chain reaction. A disturbance in one sector of the economy produces its repercussions on all sides. General equilibrium analysis is concerned with the overall effects of a disturbance.Instead of taking only a few variables at a time, we take into consideration all the relevant variables which may affect the particular phenomenon in hand. In this type of analysis, all the side-affects of an economic disturbance are analysed in full.

An example will make the concept of general equilibrium clearer. Suppose the demand for India-manufactured consumer goods suddenly increases in Western Europe. Indian exports will increase thereby increasing output, employment and profits in the export industries. Resources will be diverted from other industries to the export industries.The demand and prices of the substitute commodities will also increase. The increased demand for exports will have economy-wide effects.

An all-round analysis of the repercussions of the economic disturbance increased demand for manufactured consumer goods for export can be done only through general equilibrium theory.

General equilibrium analysis deals with the equilibrium of the whole organisation in the economy consumers, producers, resource-owners, firms and industries. Not only should individual consumers and firms be in equilibrium in themselves but also in relation to each other. Business firms enter product markets as suppliers, but they enter factor markets as buyers. Households, on the other hand, are buyers in product markets but suppliers in factor markets. General equilibrium prevails when both the product and factor markets are in equilibrium in relation to each other.

Objectives of General Equilibrium Analysis:
General equilibrium analysis serves many important purposes.

Firstly, it provides us with a theoretical tool to understand the economy in its entirely the mechanics of its working, it structure, and the major forces making it work. The theory is analysis of the interrelationships of the various sectors of an economy. As such, it helps us in knowing clearly the economy-wide implications of an economic change.

Secondly, we can apply general equilibrium theory to determine the primary, secondary and tertiary effects of an economic disturbance which has an intersectoral impact. Whenever there is an economic disturbance say, like the defence programmes in the wake of Chinese aggression in 1962 it has some immediate effects in one sector of the economy.Gradually, the impact of such a disturbance is felt in other sectors. The whole economy goes into disequilibrium. Process of adjustment to the economic disturbances starts to establish a new equilibrium.

As Richard Leftwich put it, ñFirst comes the big splash from the disturbance. Particular equilibrium analysis handles the splash. But waves and then ripples are set up from it, affecting one another and affecting the area of the splash. The ripples run farther and farther, becoming smaller and smaller, until eventually they dwindle away. The tools of general equilibrium are required for analysis of the entire series of readjustments.ò

Thus, general equilibrium theory is of great value in stressing the interdependence of various parts of the economic system, which is easily lost sight of in the use of partial equilibrium theory in micro-economic analysis.Failure to recognise this interdependence is responsible for many errors in popular reasoning on economic policy.

Some Key Highlights

- General equilibrium analysis is useful when there is strong inter-relationship between commodities or factors.
- General equilibrium analysis considers simultaneous equilibrium of all markets.
- This analysis is useful when changes in conditions in one market have significant repercussions on other market.
- Economic system as whole is inter-dependent and inter-related .
- There are large number of decision making agents- consumers, producers, workers etc. All these agents self interested and would behave to maximize their goals.
- General equilibrium would occur when markets for all commodities and factors and all decision making agents- consumers, producers, resource owners are simultaneously in equilibrium.
- Partial equilibrium analysis ignores the inter-relations or inter- dependence between prices of commodities and factor of productions.
- In partial analysis each firm is considered independent or self contained.
- This analysis is not useful to apply when there is strong inter-relationship between commodities or factors.

Å Partial analysis is useful when the changes in conditions in one market have little repercussions on other markets.

To sum up, partial equilibrium analysis focuses on explaining the determination of price and quantity in a given product or factor market when one market is viewed as independent of other markets. General equilibrium analysis on other hand deals with explaining simultaneous equilibrium in all markets when prices and quantities of all products and factors are considered variable.

Walrasian equilibrium

The first attempt in neoclassical economics to model prices for a whole economy was made by Léon Walras. Walras' *Elements of Pure Economics* provides a succession of models, each taking into account more aspects of a real economy (two commodities, many commodities, production, growth, money). Some think Walras was unsuccessful and that the later models in this series are inconsistent.[2][3]

In particular, Walras's model was a long-run model in which prices of capital goods are the same whether they appear as inputs or outputs and in which the same rate of profits is earned in all lines of industry. This is inconsistent with the quantities of capital goods being taken as data. But when Walras introduced capital goods in his later models, he took their quantities as given, in arbitrary ratios. (In contrast, Kenneth Arrow and Gérard Debreu continued to take the initial quantities of capital goods as given, but adopted a short run model in which the prices of capital goods vary with time and the own rate of interest varies across capital goods.)

Walras was the first to lay down a research program much followed by 20th-century economists. In particular, the Walrasian agenda included the investigation of when equilibria are unique and stableð Walras' Lesson 7 shows neither uniqueness, nor stability, nor even existence of an equilibrium is guaranteed. Walras also proposed a dynamic process by which general equilibrium might be reached, that of the tâtonnement or groping process.

The tâtonnement process is a model for investigating stability of equilibria. Prices are announced (perhaps by an "auctioneer"), and agents state how much of each good they would like to offer (supply) or purchase (demand). No transactions and no production take place at disequilibrium prices. Instead, prices are lowered for goods with positive prices and excess supply. Prices are raised for goods with excess demand. The question for the mathematician is under what conditions such a process will terminate in equilibrium where demand equates to supply for goods with positive prices and demand does not exceed supply for goods with a price of zero. Walras was not able to provide a definite answer to this question

Marshall and Sraffa

In partial equilibrium analysis, the determination of the price of a good is simplified by just looking at the price of one good, and assuming that the prices of all other goods remain constant. The Marshallian theory of supply and demand is an example of partial equilibrium analysis. Partial equilibrium analysis is adequate when the first-order effects of a shift in the demand curve do not shift the supply curve. Anglo-American economists became more interested in general equilibrium in the late 1920s and 1930s after Piero Sraffa's demonstration that Marshallian economists cannot account for the forces thought to account for the upward-slope of the supply curve for a consumer good.

If an industry uses little of a factor of production, a small increase in the output of that industry will not bid the price of that factor up. To a first-order approximation, firms in the industry will experience constant costs, and the industry supply curves will not slope up. If an industry uses an appreciable amount of that factor of production, an increase in the output of that industry will exhibit increasing costs. But such a factor is likely to be used in substitutes for the industry's product, and an increased price of that factor will have effects on the supply of those substitutes. Consequently, Sraffa argued, the first-order effects of a shift in the demand curve of the original industry under these assumptions includes a shift in the supply curve of substitutes for that industry's product, and consequent shifts in the original industry's supply curve. General equilibrium is designed to investigate such interactions between markets.

Continental European economists made important advances in the 1930s. Walras' proofs of the existence of general equilibrium often were based on the counting of equations and variables. Such arguments are inadequate for non-linear systems of equations and do not imply that equilibrium prices and quantities cannot be negative, a meaningless solution for his models. The replacement of certain equations by inequalities and the use of more rigorous mathematics improved general equilibrium modeling.

Modern concept of general equilibrium in economics

The modern conception of general equilibrium is provided by a model developed jointly by Kenneth Arrow, Gérard Debreu, and Lionel W. McKenzie in the 1950s.[4][5] Debreu presents this model in *Theory of Value* (1959) as an axiomatic model, following the style of mathematics promoted by Nicolas Bourbaki. In such an approach, the interpretation of the terms in the theory (e.g., goods, prices) are not fixed by the axioms.

Three important interpretations of the terms of the theory have been often cited. First, suppose commodities are distinguished by the location where they are delivered. Then the Arrow-Debreu model is a spatial model of, for example, international trade.

Second, suppose commodities are distinguished by when they are delivered. That is, suppose all markets equilibrate at some initial instant of time. Agents in the model purchase and sell contracts, where a contract specifies, for example, a good to be delivered and the date at which it is to be delivered. The Arrowï Debreu model of intertemporal equilibrium contains forward markets for all goods at all dates. No markets exist at any future dates.

Third, suppose contracts specify states of nature which affect whether a commodity is to be delivered: "A contract for the transfer of a commodity now specifies, in addition to its physical properties, its location and its date, an event on the occurrence of which the transfer is conditional. This new definition of a commodity allows one to obtain a theory of [risk] free from any probability concept..."[6]

These interpretations can be combined. So the complete Arrowï Debreu model can be said to apply when goods are identified by when they are to be delivered, where they are to be delivered and under what circumstances they are to be delivered, as well as their intrinsic nature. So there would be a complete set of prices for contracts such as "1 ton of Winter red wheat, delivered on 3rd of January in Minneapolis, if there is a hurricane in Florida during December". A general equilibrium model with complete markets of this sort seems to be a long way from describing the workings of real economies, however its proponents argue that it is still useful as a simplified guide as to how real economies function.

Some of the recent work in general equilibrium has in fact explored the implications of incomplete markets, which is to say an intertemporal economy with uncertainty, where there do not exist sufficiently detailed contracts that would allow agents to fully allocate their consumption and resources through time. While it has been shown that such economies will generally still have an equilibrium, the outcome may no longer be Pareto optimal. The basic intuition for this result is that if consumers lack adequate means to transfer their wealth from one time period to another and the future is risky, there is nothing to necessarily tie any price ratio down to the relevant marginal rate of substitution, which is the standard requirement for Pareto optimality. Under some conditions the economy may still be constrained Pareto optimal, meaning that a central authority limited to the same type and number of contracts as the individual agents may not be able to improve upon the outcome, what is needed is the introduction of a full set of possible contracts. Hence, one implication of the theory of incomplete markets is that inefficiency may be a result of underdeveloped financial institutions or credit constraints faced by some members of the public. Research still continues in this area.

Basic questions in general equilibrium analysis are concerned with the conditions under which an equilibrium will be efficient, which efficient equilibria can be achieved, when an equilibrium is guaranteed to exist and when the equilibrium will be unique and stable.

First Fundamental Theorem of Welfare Economics

The First Fundamental Welfare Theorem asserts that market equilibria are Pareto efficient. In a pure exchange economy, a sufficient condition for the first welfare theorem to hold is that preferences be locally nonsatiated. The first welfare theorem also holds for economies with production regardless of the properties of the production function. Implicitly, the theorem assumes complete markets and perfect information. In an economy with externalities, for example, it is possible for equilibria to arise that are not efficient.

The first welfare theorem is informative in the sense that it points to the sources of inefficiency in markets. Under the assumptions above, any market equilibrium is tautologically efficient. Therefore, when equilibria arise that are not efficient, the market system itself is not to blame, but rather some sort of market failure.

Second Fundamental Theorem of Welfare Economics

Even if every equilibrium is efficient, it may not be that every efficient allocation of resources can be part of an equilibrium. However, the second theorem states that every Pareto efficient allocation can be supported as an equilibrium by some set of prices. In other words, all that is required to reach a particular Pareto efficient outcome is a redistribution of initial endowments of the agents after which the market can be left alone to do its work. This suggests that the issues of efficiency and equity can be separated and need not involve a trade-off. The conditions for the second theorem are stronger than those for the first, as consumers' preferences and production sets now need to be convex (convexity roughly corresponds to the idea of diminishing marginal rates of substitution i.e. "the average of two equally good bundles is better than either of the two bundles").

Existence

Even though every equilibrium is efficient, neither of the above two theorems say anything about the equilibrium existing in the first place. To guarantee that an equilibrium exists, it suffices that consumer preferences be strictly convex. With enough consumers, the convexity assumption can be relaxed both for existence and the second welfare theorem. Similarly, but less plausibly, convex feasible production sets suffice for existence; convexity excludes economies of scale.

Proofs of the existence of equilibrium traditionally rely on fixed-point theorems such as Brouwer fixed-point theorem for functions (or, more generally, the Kakutani fixed-point theorem for set-valued functions). See Competitive equilibrium#Existence of a competitive equilibrium. The proof was first due to Lionel McKenzie,[7] and Kenneth Arrow and Gérard Debreu.[8] In fact, the converse also holds, according to Uzawa's derivation of Brouwer's fixed point theorem from Walras's law.[9] Following Uzawa's theorem, many mathematical economists consider proving existence a deeper result than proving the two Fundamental Theorems.

Another method of proof of existence, global analysis, uses Sard's lemma and the Baire category theorem; this method was pioneered by Gérard Debreu and Stephen Smale.

Uniqueness

Although generally (assuming convexity) an equilibrium will exist and will be efficient, the conditions under which it will be unique are much stronger. The Sonnenscheinï Mantelï Debreu theorem, proven in the 1970s, states that the aggregate excess demand function inherits only certain properties of individual's demand functions, and that these (Continuity, Homogeneity of degree zero, Walras' law and boundary behavior when prices are near zero) are the only real restriction one can expect from an aggregate excess demand function. Any such function can represent the excess demand of an economy populated with rational utility-maximizing individuals.

There has been much research on conditions when the equilibrium will be unique, or which at least will limit the number of equilibria. One result states that under mild assumptions the number of equilibria will be finite (see regular economy) and odd (see index theorem). Furthermore, if an economy as a whole, as characterized by an aggregate excess demand function, has the revealed preference property (which is a much stronger condition than revealed preferences for a single individual) or the gross substitute property then likewise the equilibrium will be unique. All methods of establishing uniqueness can be thought of as establishing that each equilibrium has the same positive local index, in which case by the index theorem there can be but one such equilibrium.

Determinacy

Given that equilibria may not be unique, it is of some interest to ask whether any particular equilibrium is at least locally unique. If so, then comparative statics can be applied as long as the shocks to the system are not too large. As stated above, in a regular economy equilibria will be finite, hence locally unique. One reassuring result, due to Debreu, is that "most" economies are regular.

Work by Michael Mandler (1999) has challenged this claim.[17] The Arrowï Debreuï McKenzie model is neutral between models of production functions as continuously differentiable and as formed from (linear combinations of) fixed coefficient processes. Mandler accepts that, under either model of production, the initial endowments will not be consistent with a continuum of equilibria, except for a set of Lebesgue measure zero. However, endowments change with time in the model and this evolution of endowments is determined by the decisions of agents (e.g., firms) in the model. Agents in the model have an interest in equilibria being indeterminate:

Indeterminacy, moreover, is not just a technical nuisance; it undermines the price-taking assumption of competitive models. Since arbitrary small manipulations of factor supplies can dramatically increase a factor's price, factor owners will not take prices to be parametric.[17]:17

When technology is modeled by (linear combinations) of fixed coefficient processes, optimizing agents will drive endowments to be such that a continuum of equilibria exist:

The endowments where indeterminacy occurs systematically arise through time and therefore cannot be dismissed; the Arrow-Debreu-McKenzie model is thus fully subject to the dilemmas of factor price theory.[17]:19

Some have questioned the practical applicability of the general equilibrium approach based on the possibility of non-uniqueness of equilibria.

Stability

In a typical general equilibrium model the prices that prevail "when the dust settles" are simply those that coordinate the demands of various consumers for various goods. But this raises the question of how these prices and allocations have been arrived at, and whether any (temporary) shock to the economy will cause it to converge back to the same outcome that prevailed before the shock. This is the question of stability of the equilibrium, and it can be readily seen that it is related to the question of uniqueness. If there are multiple equilibria, then some of them will be unstable. Then, if an equilibrium is unstable and there is a shock, the economy will wind up at a different set of allocations and prices once the convergence process terminates. However stability depends not only on the number of equilibria but also on the type of the process that guides price changes (for a specific type of price adjustment process see Walrasian auction). Consequently, some researchers have focused on plausible adjustment processes that guarantee system stability, i.e., that guarantee convergence of prices and allocations to some equilibrium. When more than one stable equilibrium exists, where one ends up will depend on where one begins.

For detailed references see:

H.L. Ahuja, Advanced Economic Theory, S. Chand &Co.-Chapter on General Equilibruim;

A. Koutsoyannis, Modern Microeconomics,Macmillan-Chapter on general Equilibrium.