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General Equilibrium Theory and History of Economics

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I. An Encounter with Economics and After

Perhaps my case is peculiar in comparison with other contributors of this volume, since I started my economics with the study of classical school of economics, and am still interested in history of economics. My first teacher of economics, Shigeru Aihara, ordered students in the freshman course in economics to study Adam Smith, Ricardo and Marx, i.e., to read Wealth of Nations, Principles and Das Kapital, rather than to read modern text books. This was not very unusual in Japan almost forty years ago. Japan was then a less developed country as far as economics was concerned. Japanese economists were trying to import theories developed in the western countries rather than to develop their own theories based on Japanese economy and society. This is because they wished to analyze and criticize the backwardness and

peculiarity of Japanese society and economy by applying theories developed in advanced and model society of western countries. Being a Marxian, Aihara might not be interested in economics after the marginal revolution. Or, perhaps, he might consider that we must study classical economics developed in the formation period of modern economy in western countries to apply it on and to criticize Japanese society and economy, which are yet to be modernized. Anyway, this is the reason why I had to start my study of economics with the study of classical school.<sup>1)</sup>

The study of the classical economics was not uninteresting but very difficult, since literal arguments of classical economists seemed to me ambiguous and their propositions shown by numerical examples did not convinced me of the general applicability. I wondered why mathematics cannot be used in economics, as in astronomy and meteorology, which I was interested in but thought too difficult for me to major in. I was, naturally, attracted by the early mathematical economics of Cournot. I was very lucky to have Yasuhiko Oishi as my undergraduate adviser, who was one of a few non-Marxian economists in University of Tokyo at that time and suggested me to read Hicks's Value and Capital and Keynes's General Theory. I gave up the study of classical economics and was interested first in mathematical models of Keynesian macro dynamics which was a very popular subject in the early 1950's. Being aware of the existence of an active group of Japanese mathematical economists, like Yasui, Morishima, Ichimura, Nikaido, Inada and Uzawa, I decided to do graduate study on economic theory, wishing to join in the group, if possible.

My research on the general equilibrium theory was started in

my first two years (1956-1958) of graduate study at Tokyo, and then was refined in K.J. Arrow's project at Stanford, which was supported by the office of naval research. I returned to Tokyo in 1960, finished my graduate study in 1965 and began to teach. Making the acquaintance of M.C. Kemp, then, I was also interested in the application of the general equilibrium theory to the problems of international trade. My studies made in the late 1950's and 1960's are collected in my General Equilibrium Theory and International Trade (1972). One of the problems I tackled in 1970's was micro-foundations of macroeconomics, though I had felt already in my undergraduate days that something should be done to connect the world of Hicks's Value and Capital and that of Keynes's General theory. Results of my research are collected in Microeconomic Foundations of Keynesian Macroeconomics (1979).<sup>2)</sup>

This study of Keynesian economics from the point of view of general equilibrium theory led me to the strong recognition of the existence of different points of view in current economics, each of which has its own origin and predecessors. My interest in the history of economics was revived. Being elected to a member of Science Council of Japan in 1985 and engaged in editing a white book on scientific researches in Japan, I found that, except mathematical economics and econometrics, most of Japanese contributions to economics remained internationally unknown, though they are regarded very high by Japanese economists themselves. The history of economics is of no exception. This fact also encouraged my study of the history of economics. What I could do was the history of economics from the point of view of modern theory, which implies to follow works of Samuelson and

Morishima. My studies in 1980's are collected in Economic Theories in a Non-Walrasian Tradition (1985) and History of Economic Theory (1989).<sup>3)</sup>

## II. General Equilibrium Theory

General equilibrium theory was initiated by a French economist Leon Walras in 1870's at Lausanne (Switzerland). It may be called a paradigm of modern economics in the sense of Kuhn. Most of economists consider that the normal science of economics consists in refinements and development of the Walrasian general equilibrium theory. In short, the gist of Walrasian theory is to grasp the economy by the equilibria of infinitely many consumers' households and firms, and the equilibria of demand and supply in markets of multiple commodities.

According to an internationally well known advance text book of general equilibrium theory, General Competitive Analysis (1971) by K.J. Arrow and F.H. Hahn, my contributions to the general equilibrium theory are recognized in the following problems.

[1]. An alternative proof of the existence of a general equilibrium by the use of the optimum property of competitive equilibria.

[2]. The introduction of the imperfect competition into the general equilibrium theory.

[3]. Stability analysis of equilibrium, particularly the study of the so-called non-tâtonnement processes.

Let us explain them briefly.<sup>4)</sup>

## Existence of Equilibrium

The perfect competition is assumed in the Walrasian theory so that consumers and firms are assumed to take prices in markets as given. Their demand and supply of commodities can, therefore, be obtained as functions of prices of commodities, and a general equilibrium in which demand and supply are equalized for all commodities is given as a solution for unknown prices of simultaneous equations. The problem of the existence of a general equilibrium is whether there exists an economically meaningful solution of these equations. Walras could not solve the problem, since he merely demonstrated that the number of independent equations is equal to the number of unknowns. The proof for this problem is given in 1950's by Arrow and Debreu, and some others.

My own method to prove the existence of the general equilibrium is, unlike those of others, not to consider it as a solution of equations of the equality of demand and supply, but to note that the social welfare is maximized in a certain sense at the general equilibrium under perfect competition and to consider it as a solution of the maximization of a social welfare function  $\sum_i a_i u_i$ , where  $u_i$  is the utility of the  $i$ -th consumer and  $a_i$  is a positive constant equalized to the inverse of the marginal utility of income of the  $i$ -th consumer so that his budget constraint can be satisfied at equilibrium. The maximization is done, of course, being subject to the availability ( including production ) of commodities and Lagrange's multipliers corresponding to availability conditions of commodities can be interpreted as equilibrium prices which show the scarcity of commodities. In other words, the existence of a competitive general equilibrium is

proved by searching a Pareto optimal allocation of resources ( i.e., a proper set of  $a_1$ 's ), at which budget constraints of all the consumers are satisfied with efficiency prices.

This proof, which is first published in Metroeconomica (1960), is merely an alternative proof of the existence problem which is already solved by others. It has, however, its own merit since it makes clear some mutual implications of the existence and optimality problems of a competitive equilibrium. For the numerical computation of a general equilibrium, furthermore, it is convenient to use the method of this proof, since it considers the general equilibrium as a solution of a kind of maximization problem.<sup>5)</sup>

### Imperfect Competition

We must admit that the assumption of the perfect competition is not realistic, particularly since it implies that firms have no powers to make changes in prices. Although it is possible to emphasize that the perfect competition is efficient and idealistic from the point of view of the normative economics, it is necessary, from the point of view of the positive economics, to drop the assumption of perfect competition and to introduce the assumption of imperfect competition to the general equilibrium model of an economy, so that firms can make, rather than have to take, prices.

Price making behavior of a firm can be described by the assumption that the firm faces a downwardly sloping demand curve, so that the price of a commodity can be raised by the firm through the reduction of its supply. The question is how to assume the

nature of such a demand curve, i.e., the relation between the price and the quantity . It is too much to assume that a firm has such a perfect information that any point on the demand curve can be actually realizable, so that the firm can tell the exact quantity of the commodity it can sell at any price it charges to its customers. A more reasonable assumption is to consider that a firm perceives a subjective demand curve from the limited data of the price it charged and the quantity it could sell at such a price.

By assuming that firms revise constantly its perceived demand curves on the basis of the newest data of the realized combination of the price and quantity, I introduced the imperfect competition into the general equilibrium theory in my article published in Review of Economic Studies (1960-61). Although it was done under very stringent assumptions, it was perhaps the first attempt to introduce the imperfect competitions into a mathematical model of Walrasian general equilibrium theory, which was followed and developed by many others in 1970's and 1980's. As will be explained below, furthermore, the idea of the perceived demand curve is very useful to consider, not only imperfect competitions, but also Keynesian problems in general equilibrium analysis.<sup>6)</sup>

### Stability of Equilibrium

It has been considered in general equilibrium theory that the adjustment process in which price of a commodity is changed by the difference between its demand and supply will eventually reach to an general equilibrium in which demand and supply are equalized for all commodities. This is the so-called stability problem of



walrasian tâtonnement process. Though Walras's own consideration of this problem was insufficient, the stability of tâtonnement is demonstrated in the late 1950's by several authors including myself under the assumption of the gross substitutability that an increase in the price of a commodity increases the difference between demand and supply of all the other commodities.<sup>7)</sup>

In Walrasian tâtonnement, however, a very stringent assumption is implicitly made so that no exchange of commodities is actually made until all the markets are cleared and all prices cease to be changed. In other words, recontract is always possible in disequilibria and commodities are exchanged only in general equilibrium. One might perhaps use this tâtonnement assumption to study highly organized markets like commodity exchanges. It is, however, too much to assume it for all the markets in an economy. It is necessary to consider the stability of a general equilibrium through the so-called non-tâtonnement processes in which contracts to exchange commodities are actually carried out at disequilibria in which prices are being changed by differences between demand and supply.

I confirmed first that a non-tâtonnement process is as stable as tâtonnement in the sense that it is also stable under the assumption of gross-substitutability. Then, F.H. Hahn and I demonstrated, in Econometrica (1962), that it is stable even without such an assumption, if exchange transactions at disequilibria follow the so-called short-side principle so that demand or supply, whichever is smaller, can be realized as planned. Although these results are obtained only in the case of pure exchange models without production, it turns out that the

role of money is very important in this non-tâtonnement process while it is very limited in tâtonnement. As will be explained below, furthermore, the study of non-tâtonnement processes gives many insights into the study of Keynesian models in which not the prices but quantities are adjusted in the face of demand supply disequilibria.<sup>8)</sup>

These studies of the theory of general equilibrium were followed by their applications, particularly the applications to the international economic problems. Perhaps my contributions to be mentioned are the problems of the infant industry protection and the customs union.<sup>9)</sup>

### The Infant Industry

The so-called infant industry dogma ( arguments for a tariff aiming at the protection of an infant industry ) has a long history and has been generally accepted by international trade theorists as the only serious exception to the arguments for free trade. It is defined by J.S. Mill as the protection of a domestic new industry for the finite period of learning by doing to catch up with foreign matured industries. Bastable argued that the discounted present value of the social gains obtainable from the industry in the future should be larger than the social cost of protection. Kemp criticized, however, the Mill-Bastable dogma which insists that the industry should be protected if it passes these two conditions, and argued that protection is not required, even if these two conditions are satisfied, unless there exists no dynamic technological externality so that only the firm that actually carries on production gains in experience and the

accumulated knowledge becomes the exclusive property of that firm. The reason insisted was that the private incentive to undertake investment in the learning period is sufficient, since losses of the unprotected firm in its learning period are more than offset by the later profit ( Bastable condition ).

In Economic Record (1968), I challenged the above argument and argued that the protection of the infant industry is necessary even if there is no technological externality, since there is dynamic internal economies due to indivisibilities. The demonstration is given in terms of general equilibrium analysis of the dynamically optimal resource allocation in welfare economics as well as in terms of a heuristic partial equilibrium analysis of consumers's surplus. Investment necessary in learning period is not marginal but lumpy, since the cost differential is not likely to be infinitesimal between domestic infant and foreign matured industries. In view of the increase in consumers' surplus caused by the reduction of the price, then, such an investment may be socially desirable, even if the profit of the industry is not sufficient to replace the cost of the investment. If the country is not small, changes in foreign consumers' surplus should also be taken into consideration, since it is possible that the protected industry becomes an export industry, as was the case of Japanese automobile industry. Subsequently, Corden (1974) extended my discussion by using the concept of the pecuniary external economies.<sup>10)</sup>

### Customs Union

Customs union can at most be the second best, since it is

merely a partial liberation of trade within an area while world-wide free trade is the condition for the optimal resource allocation from the world's point of view. The basic model in the economics of the customs union is that of two commodities and three countries -- the home country, the partner country and the foreign country ( non-member country or the rest of the world ). Pioneering attempts to study customs union were made in terms of partial equilibrium analysis of the home country, being based on the assumptions of infinite elasticity of the foreign and partner supply and the non-existence of tariffs imposed by foreign and partner countries. Under such assumptions, however, the problem itself would disappear since there is no incentive for the home country to impose any tariff on its imports from the foreign country. Vanek initiated the general equilibrium analysis of customs union, which is free from such assumptions, by extensively using geometry.

I followed him and proved some of his conjecture rigorously in terms of analysis. Despite his opinion to the contrary, it was shown that the analytical method is more useful for some problems of the customs union. Firstly, it is shown that internal free trade is Pareto optimal for the members of the union, since member countries have no incentive to impose tariff on their imports from the rest of the world, which is higher than the so-called optimal rate. Secondly, the custom union with internal free trade is shown not to be Pareto optimal from the point of view of the world, since member countries should impose import tariffs on one another for the world optimality. My approach is to emphasize the optimizing behavior of member countries to consider the optimality

of the union, rather than to ask whether a country should join the union when the rate of tariff on imports from the rest of the world is given arbitrarily. This approach was followed and extended by Kemp (1969b).<sup>11)</sup>

### Microeconomic Foundations of Keynesian Equilibrium

Though I mentioned that Walrasian general equilibrium theory is a paradigm of modern economics, Keynesian economics may perhaps be called another paradigm of modern economics. While the former theory is a micro economics which starts with the analysis of the behavior of individual consumers and firms, the latter was developed as a macro economic theory which is composed mainly by such aggregate concepts as gross national products, national incomes, etc. There is no problem if two theories differ only in this sense. There is, however, an essential inconsistency between two theories, since in Walrasian economics an equilibrium is defined as the equality of demand and supply and unemployment is always regarded as a temporal disequilibrium, while in Keynesian economics an equilibrium with unemployment is considered more general than the full employment equilibrium.

Although the appearance of Keynes's General Theory (1936) was called Keynesian revolution, it was not a thorough-going revolution, since it could not penetrate into micro economics. Subsequently Keynesian counter revolution took place, being based on such new developments in Walrasian economics as theories of expectations, uncertainty, adjustment cost, and disequilibrium, which can explain unemployment in non-Keynesian ways. The partial success of Keynesian counter revolution is, of course, due to the

fact that Keynesian economics is a macroeconomics and has not its own microeconomics. Apart from small, short-lived recessions, however, we still need Keynesian economics to explain persistent large-scale depression and unemployment. This is why my interest was turned in 1970's toward the general equilibrium theory of unemployment or micro-economic foundations of Keynesian macroeconomics.

In Walrasian general equilibrium theory, competitive suppliers can supply whatever amount they like at the market price they take as given, since demand and supply are always equalized by a quick adjustment of the price. In a non-Walrasian general (dis)equilibrium theory, however, individual suppliers cannot supply the amount they like at the given market price and have to face quantity constraints, since the price is sticky or rigid and does not change so as to equate demand and supply. In such a fixed price model, therefore, quantities traded, rather than prices, have to be adjusted so as to clear the markets. The problem is similar to that of non-tâtonnement, so far as it is concerned with how quantities traded are determined in disequilibrium of demand and supply. Usually, the quantity is determined by the short-side principle which Hahn and I used in our study of non-tâtonnement process.<sup>12)</sup>

I had no objection to the quantity constraint or adjustment theory so far as to consider that the crux of Keynesian theory is the adjustment of quantities in demand and supply disequilibrium. I was dissatisfied, however, with such a model in which price is simply given exogeneously, since we have to explain why price is sticky in the demand and supply disequilibrium rather than to

assume that it does not change in spite of disequilibrium. When the market is not cleared at the current price and it is impossible to trade the amount they like, competitive demanders or suppliers have two choices, either to admit price changes unfavorable to them, or to accept current constraints on quantities. The so-called fixed price quantity constraint theory concentrates on the second choice only and pays no attention to the first choice. Of course, we assume perfect competition in which suppliers take, rather than make, prices. But the price taking behavior of suppliers implies that they are unable to make price changes favorable to them, i.e., to raise the price above market one. Even the competitive suppliers can, therefore, reduce the price if they wish so. We have to explain, then, why they do not.

The typical situation Keynesian theory of unemployment equilibrium deals with is the one where the supply exceeds the demand and supplying firms cannot sell the amount they like. We have to explain why prices are not reduced and only quantities traded are adjusted to quantities demanded. For this purpose, I introduced perceived demand curves which I considered above in the general equilibrium theory of the imperfect competition. Unlike in the case of Walrasian market where information is perfect, an increase in demand caused by a firm's reduction of price cannot generally be expected very large, since it is not fully informed to customers of other firms which keep the price unchanged. If a firm raises the price, however, it has to expect a large reduction in demand, since its current customers leave it to search other firms which keep the price unchanged. Then, a competitive firm which cannot raise the price above the given market price

perceives its demand curve kinked at the point of the current price and demand quantity constraint. The firm does not reduce the price of its product and adjust its output to the current demand constraint, if the marginal revenue from increasing its output, which is likely to be very small, is smaller than marginal cost while that from decreasing its output, which is equal to the price, is larger than marginal cost.<sup>13)</sup>

As for the labor market, one of the most interesting explanation of unchanged wage is Azariadis's theory of implicit contracts between firms and laborers. The difference between firms and laborers with respect to risk aversion can explain why transactions in the labor market typically involve implicit long-term contracts with unchanged wage rates. Laborers are averse to risk and prefer to be employed at lower average wages with a small variance through time than at higher average wages with a larger variance. Firms are risk neutral and are willing to accommodate laborers in their interest of obtaining cheaper labor. I showed, furthermore, that implicit contracts can be with a variable level of employment, if firms are faced with demand quantity constraints and keep their product prices unchanged. In other words, the full employment is not assured and unchanged rate of wage and unemployment can coexist.<sup>14)</sup>

### III. History of Economic Theory

Economics is a science which cannot dispense with its history. The newest version of macro economics, for example, had to characterize itself as new classical, while there are many



modern "neo-" or "post-" schools in the current theory like neo-Austrian, neo-classical, neo-Ricardian, neo-institutionalism, neo-Walrasian, post-Keynesian, etc., the implications of which cannot be fully understood without the proper knowledge of the history of economics. This situation can perhaps be explained by Lakatos's theory of Scientific Research Programmes that a school in the current economic theory is merely the newest version of each SRP which keeps its hard core unchanged through many versions.<sup>15)</sup> With an ever growing emphasis on formal techniques in the mainstream economics, however, many economic theorists are now no more likely to develop their interest in history of their science than ordinary natural scientists. This is very unfortunate. To develop our science to the right direction, I do believe more theoretical resources should be put into the study of the history of economics.<sup>16)</sup> Though my own researches are rather new, already some of them are recognized by historians of economics and those who are interested in the history of our science, as will be seen below.<sup>17)</sup>

#### Adam Smith (1)

The division of labor that improves labor productivity is the key characteristic and driving force in his Wealth of Nations. Smith gave two propositions concerning the division of labor, that the division of labor is limited by the extent of the market, and that the accumulation of capital must be previous to the division of labor, so labor can be more and more subdivided in proportion only as capital is previously more and more accumulated. While the first proposition plays an important role in Book I of Wealth

of Nations, which is Smith's theory of prices and distribution, the second proposition is first introduced and emphasized in the Introduction of Book II which is his theory of capital and development. It is, then, very strange that Smith tried to explain his famous doctrine of the hierarchy or the natural order of investment, headed by agriculture, followed firstly by manufacturing, then by inland trade and finally by foreign trade, in this Book II only in terms of the creation of employment or the capital labor ratio, entirely without having recourse to the second proposition. Since the doctrine is very important as the theoretical foundation to his argument in Book III ( economic history ) and Book IV ( economic policy ), and Smith's own exposition has been regarded as admittedly confused, it is necessary to reconstruct Smith's doctrine on the foundation of the guiding principle of Book II that capital accumulation should be previous to the division of labor.

My reconstruction is as follows. The natural order of investment is concerned exactly with how the capital accumulation leads to improvement in productivity due to the division of labor, clearly the investment must start in a most unspecialized, self-sufficing single industry and then gradually proceed so that industries are more and more subdivided and specialized. Agriculture can be considered as such a most inclusive and most unspecialized single industry if we include household and coarser manufactures into agriculture. When enough capital is accumulated to support a manufacture as an independent and specialized industry other than the agriculture, investment should be and actually is made so as to develop the occasional jobs in the

neighborhood of artificers into a regular manufacture for more distant sale. As capital accumulates more, the division of labor advances to interdistrict specialization of local manufactures. Investment in home trade should be done only when the accumulation of capital has already reached the stage where the interdistrict specialization is possible. The highest stage of the division of labor is that of international trade based on the international division of labor.<sup>18)</sup>

### Ricardo

From the point of view of the standard 2 commodity 2 factor 2 country model of the neo-classical theory of international trade, the model of Ricardo's numerical example of comparative advantage has been regarded as its special case where labor is the single factor of production. Since England's labor productivity is lower than Portugal's in Ricardo's example, however, this implies strangely that the rate of wage which should be at the subsistence level is lower in the advanced country England than in the less advanced Portugal. I challenged this neo-classical interpretation of Ricardo in History of Political Economy (1982) and argued that there exist labor, capital and land in Ricardo's model. Since England has more capital and labor relative to land, the marginal labor productivity is lower even if her technology is not less advanced than Portugal's. If England's subsistence level is not lower than Portugal's, furthermore, it is the rate of profit which is lower in England than in Portugal.

At the same time I also challenged another traditional interpretation of Ricardian theory of international trade that it

cannot determine the terms of trade unless, as was suggested by J.S. Mill, the reciprocal demand of countries are taken into consideration. Since wage costs of products are determined by the subsistence wages in Ricardo's model, the terms of trade ( the relative price of exportables ) can be inferred by the ratio of rates of profit. International capital mobility is assumed implicitly in classical economics, since it duly emphasized, unlike neo-classical economics, the role of exporters and importers, whose capital replace, as Adam Smith pointed out, capitals of foreign producers as well as those of domestic ones. Capital moves from England to Portugal until the ratio of rates of profit satisfies the required risk premium for investments in foreign trade and in foreign countries. The relative price of cloth and wine is, then, determined by this risk premium which Ricardo duly emphasized and changes in reciprocal demands for them are absorbed into changes in the labor population in two countries.

The lesson from these reinterpretations of Ricardo is that the study of the classical theory from the point of view of modern theory should not be a cutting or stretching of the former theory in a Procrustean Bed of the latter theory. It should be a mirror in which the modern theory finds the importance of what it forgot to succeed from the former, in this case, the role of exporters and importers in international trade and investment.<sup>19)</sup>

### J.S. Mill

Mill's recantation of the wages fund doctrine constitutes one of the most difficult problem in the history of economics, since

he did not revise his Principles in this respect, after he recanted the doctrine in his review of a book of W. Thornton, On Labour (1869). The doctrine is a simple equilibrium theory of demand and supply that the equilibrium full employment real wage is obtained by dividing the given wages fund ( e.g., the stock of wheat ) with the given labor population. There is no role for labour unions, since they cannot raise the full employment real wage. Thornton attacked the equilibrium theory in general and the wages fund doctrine in particular, by using several examples. In his recantation, Mill interpreted one of such examples that demand cannot be increased by the reduction of the price so that there is no unique equilibrium price which equates demand with the given supply. The case suggested by Mill is conceivable in labor market, if capitalists behave speculatively against changes in wages. Since equilibrium wage is indeterminate, there is a room for labor unions' activity to raise wages without reducing employment.

The question remains is, then, why Mill left the doctrine of wages fund unchanged in his 1871 edition of his Principles, after he admitted that it is wrong in 1869. In my article appeared in History of Political Economy (1986), I tried to solve the question by referring to a hitherto unnoticed fact that, in the second edition of his On Labour (1870), Thornton denied Mill's interpretation of his example in 1869. Thornton did not assume that the demand is inelastic with respect to price in his example in 1869 and insisted not the possibility of the indeterminacy of equilibrium price but the fact that the bulk of the goods is sold at prices which do not equate demand and supply. In other words,

Thornton had in mind, not Walrasian tâtonnement process in which trade does not take place and contracts can be cancelled unless demand and supply are equalized, but the so-called non-Walrasian, non-tâtonnement process without recontract, in which goods are exchanged at disequilibrium prices. Certainly Mill recognized in 1871 that his interpretation of Thornton's example on which his recantation in 1969 was based was wrong and that Thornton insisted emphatically on the possibility of trades carried out in disequilibria. While Mill was ready in 1969 to admit the possibility of multiple equilibria and to deny the validity of the classical wages fund doctrine, Thornton insisted on denying it from the point of view of disequilibrium theory. To accept Thornton's suggestion is, however, impossible for Mill the equilibrium theorist, since it is a theory of an entirely different paradigm, which was unmaturing as was pointed out in the preface to 1871 edition of Mill's Principles. After the recent development of disequilibrium theory, are we ready to write Principles of Disequilibrium Economics?<sup>20)</sup>

### **Böhm-Bawerk**

Böhm-Bawerk adduced three causes for the existence of interest in a stationary economy, (1) better provision for wants expected in the future than in the present, (2) undervaluation of future wants, and (3) the superiority of more roundabout methods of production. As for the last cause which is concerned with the demand for capital, Böhm-Bawerk had two different models, i.e., the model of circulating capital and the period of production, which he explained numerical examples, and the model of fixed

capital and the capital-labor ratio, for which he gave some parables, such as a boat and net in fishing and a sewing machine in tailoring. Wicksell formulated a mathematical model based on numerical examples of the first model, and found that one equation is missing to determine the rate of interest. The missing equation should, of course, be supplied by the consideration of Böhm-Bawerk's first two causes which are concerned with the supply of capital, though this fact has not been unanimously recognized until very recent times. To introduce the second cause, the time preference, is to assume that people are myopic and not rational. While the second cause is an independent assumption to be added to the already assumed third cause, furthermore, the first cause is considered to be generated by the third cause, since the latter can create the relative abundance of future goods compared with the present ones.

My own reconstruction of Böhm-Bawerk's theory is, therefore, to use the first cause to explain the supply of capital and the third cause, to explain the demand for capital. After some trial and error, I decided to follow Böhm-Bawerk's model of fixed capital and the capital-labor ratio rather than his model of circulating capital and the period of production, since the first is more convenient to dispense with the second cause and the roundaboutness of production in terms of capital-labor ratio is more comfortable to neo-classical economists than that in terms of the period of production. We have to consider a life cycle overlapping generations model of individuals considered by Samuelson, in which people live for finite periods, having rising consumptions, and consume their life-time incomes, to apply Böhm-

Bawerk's first cause in a stationary state where an economy as a whole should be equally provided for in the future as well as in the present. Such a model is not alien, however, to Böhm-Bawerk himself. People do not save too much so that the rate of interest remains positive, not because they are myopic but because their life span is limited. Only after Samuelson, thus, we can formulate consistently what Böhm-Bawerk had in mind and see clearly the implications of the celebrated Böhm-Bawerk versus Schumpeter controversy on the rate of interest in a stationary economy.<sup>21)</sup>

Though they are not yet recognized by others, I would like to use this occasion for insisting following points on Smith and Marx. The reason why I am concerned with them is perhaps many of my colleagues in Tokyo are Marxian.

#### Adam Smith (2)

The traditional interpretation of his value theory is that commodities exchange in proportion to embodied labor, which equals to commandable labor, in pre-capitalist society while they do not exchange in proportion to the former labor, which is now smaller than the latter, in modern capitalistic society. If we read him with a growth economy in mind, however, we found that embodied and commandable labors are identical in a stationary state, whether it is a pre-capitalist society with no capital or an economy with capital where, however, the rate of profit is zero, while commandable labor is larger than embodied one in a growing economy



where the rate of profit is positive. Smith argues that in such an economy the surplus appears not only as profit in a sector where a commodity is produced from the input of labor but also in the higher natural ( equilibrium ) wage in a sector where labor is produced from the input of commodities. This latter surplus, which is also due to the difference between commandable and embodied labors, cannot be explained by the Ricardo-Marx theory of embodied labor value in which the natural price ( value ) of labor is defined so as to just reproduce labor expended in production. In other words, the embodied labor theory of value can be applied only in a stationary state.

My Smithian growth model is a von-Neumann model of the production of commodities by means of commodities where commodities include labor. In the von-Neumann model, all the commodity stock expands at the common constant growth rate, relative prices remain constant, and the rate of interest equals the rate of growth. In the terminology of Smith, this implies that the natural price of commodities and the natural rate of wages and profit prevail and the natural rate of wages exceeds the subsistence level by the natural rate of profit. As Smith insisted for the case of new colonies, a high natural rate of wages and that of profit coexist in an economy with as high rate of growth. If we introduce saving into this model, furthermore, we can demonstrate the Malthusian regulating principle of profit that the rate of profit is determined by the demand and supply of capital, which defends Smith's theory of the falling rate of profit against Ricardo's criticism. A higher rate of saving implies the higher rate of growth but the lower rate of profit,

i.e., the less incentive for capitalists to produce, which was the problem of Malthus.<sup>22)</sup>

#### K. Marx

Studies of Marx's economics from the point of view of modern economic theory has been recently very much developed by the application of linear economic theory. It centers, however, on the theory of value and the problem of transformation of values into prices of production. According to Marx's plan of economics, furthermore, Das Kapital he left us covers only a small part of the first part of the plan, and many important problems including that of international trade are located in the second part of the plan and left to be done by his successors. In Das Kapital, however, Marx left some fragmentary discussions and suggestions on such problems from which we can start our own studies. In view of the north-south economic relations of the present world, what is most interesting to us may perhaps be the problem of international value, which is the foundation of Marxian theory of international trade and international exploitation.

The crux of Marxian economics is to explore the social relation between those who exploit and those who are exploited. Marx's theory does not, however, make sense so far as it is concerned with the exploitation of labor by capital, since, as was pointed out by Böhm-Bawerk, it is based on an unwarranted supposition that the labor value of an output can be compared with that of an input without any discounting, even though they are located at different times. Unless labor is mobile through time, larger value of output in terms of labor in the future compared

with smaller labor value of wages paid in the past does not necessarily imply that those who advanced wage costs exploit wage earners. Marx also argued that a rich country exploits a poor one through the exchange of one day's labor of the former and three days' labor of the latter. As I argued in my presidential address of Japan Association of Economics and Econometrics in 1985, this argument of Marx does make sense, even if labor is not mobile internationally, since in Marxian economics labor is an intermediate good produced by the consumption of consumers' goods, which are, directly or indirectly, mobile internationally, so that we can compare labors of different countries.<sup>23)</sup>

Finally, it is perhaps my duty to emphasize that the accumulation of past studies on history of economics is very large in Japan, though they are unknown to other countries, and to develop them further in the form accessible from economists who do not understand Japanese language. The following is an example.

#### Von Thünen

Studies of von Thünen in Japan have a long history. While Yasuo Kondo insisted in 1928 that Thünen's natural wage should be the competitive equilibrium wage in a long-run stationary economy, Yuzo Yamada argued in 1934 that the natural wage and the interest rate should be determined by the macroeconomic equilibrium condition of saving and investment. These studies suggest an interpretation of Thünen's theory, which is different from those of recent studies of von Thünen in English speaking world. A simple model of a stationary economy is constructed on the basis

of such an interpretation, in which workers are assumed to be free to save in their life-cycles, though the level of consumption of working families is kept at the subsistence level. Von Thünen's famous formula of the natural wage that it is the geometric mean of the marginal productivity of labor and the subsistence wage is derived from our model, which is free from the criticisms given to von Thünen's original model.<sup>24)</sup>

1) This is, of course, the story of an economist who belongs to the last generation of those who were educated before the recent rapid growth of Japanese economy. Nowadays Japanese economists are convinced that their economy is as matured as those of western advanced countries. Now Japanese students are taught by standard text books of micro and macro economics. Young generation of Japanese economists are trying to develop Japanese theory based on Japanese economy.

2) Other problem I studied in 1970's is that of public economics. See Negishi (1979), pp.167-203.

3) Since I was elected to the dean of the faculty of economics in 1990, further research activity has to be suspended.

4) See Arrow and Hahn(1971), respectively p.127 for [1], pp. 167-168 for [2], and pp.322 and 346 for [3].

5) See Negishi(1960), Negishi(1972), pp.11-27, Hahn(1990), Diewert(1970) and Ginsburgh and Waelbroeck(1976).

6) See Negishi(1960-61), Negishi(1972), pp.103-115, Hart(1984) and Hahn(1977).

7) See Negishi(1962), Negishi(1972), pp.191-206. I was much

influenced by Allais(1943), vol.2, pp.486-489.

8) See Negishi(1962), Negishi(1972), pp.207-227, Hahn and Negishi(1962), and Negishi(1979), pp.9-25. Subsequently, non-tâtonnement models with production are extensively studied by Fisher(1983).

9) Other contributions in international economics are problems of gains from trade ( see Kemp(1969a), pp.274, 281, 288, Kemp and Negishi(1970), Negishi(1972), pp.73-89, Corden(1984), and Helpman(1984) ), domestic distortions ( see Kemp and Negishi(1969), Negishi(1972), pp. 158-178, Bhagwati(1969), pp.295-308 and Smith(1977) ), and imperfect competition ( see Negishi(1972), pp.116-127, Krugman(1979), and Gandolfo(1986), pp. 54, 75 ).

10) Negishi(1968), Negishi(1972), pp. 90-99, and Corden(1974), pp.256-257.

11) Negishi(1969), Negishi(1972), pp.179-188, and Kemp(1969b), pp.8, 125-139, 148.

12) For quantity constraint models, see Benassy(1978), (1982), pp.28-40, 61-70, and Malinvaud(1985), pp.1-80.

13) Negishi(1974), (1979), pp.87-98, 247-257, Itoh and Negishi(1987), pp.89-93, Cuddington, Johansson and Löfgren(1984), pp.40-44, Malinvaud(1985), p.ix, and Reid(1981), pp.65-66.

14) Negishi(1979), pp.227-235.

15) For SRP, see, for example, Boland(1987).

16) It is interesting to see that more than half of graduate students in U.S. elite schools are moderately interested in history of economics, though only less than twenty per cent of them have great interest. See Klammer and Colander(1990), p.17.

- 17) Besides those which follow, see Negishi(1982b), Negishi(1989a), pp.319-344, 363-375, Ekelund and Shieh(1989), and Groenewegen(1990) for my studies on Jevons and Marshall.
- 18) Negishi(1985), pp.23-34, Negishi(1990), 95-103, Blaug(1985), p.61, and Baranzini and Scazzieri(1990).
- 19) Negishi(1982a), Negishi(1985), pp.123-126, Negishi(1989a), pp.131-138, and Gandolfo(1986), I, pp.24, 28-31.
- 20) Negishi(1986b), Negishi(1989a), pp.162-170, 181-189, Ekelund and Thommesen(1989), Negishi(1989b) and de Marchi(1988).
- 21) Negishi(1985), pp.103-108, 197, Negishi(1989), pp.297-317, Blaug(1985), p.569, and Faber(1986).
- 22) Negishi(1989a), pp.83-89.
- 23) Negishi(1986a), Negishi(1989a), pp.206-213.
- 24) Negishi(1990).

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