Economics and accounting

A comparison between philosophical backgrounds of the two disciplines in view of complexity theory

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Keywords *Accounting theory, Decision making, Economic theory, Management accounting*

Abstract *Compares the philosophical backgrounds of the disciplines of economics and accounting in view of complexity theory. The relationship which has existed between the two is examined as well as the problems of such inter-disciplinary studies. Decision making, target costing and the need for future collaboration are discussed in light of the theory.*

The past relationship between economics and accounting

The French Marxist philosopher Louis Althusser once warned us of the danger of interdisciplinary research studies. They often opt for putting together dominant ideologies of different disciplines. I do not claim that this is an inevitable situation for a relationship between economics and accounting, for I believe there are many points that we can learn from each other. However, the relationship between economics and accounting in the latter half of the twentieth century seems to justify Althusser's warning.

What is symbolic for the relationship is the past one-sided attention of accounting to economics. Researchers in accounting were customarily concerned about what was achieved in economics but economists remained indifferent to the studies in accounting. As Scapens (1991) put it, the economic framework played the central role when the accounting researchers tried to construct decision making models for the development and reorganization of management accounting. Accounting researchers were therefore interested in analytical tools and theories of economics. A reciprocal interest in accounting was never observed in economics. In the 1950s and 1960s, economists were proud that their discipline came to the level of an exact science, first among the social sciences. Economics was believed to be complete by itself. So, economics did not learn from accounting, nor from other disciplines. It was believed that exploring the pure logic of economics was the only right way to pursue economic studies. On the other hand, academic researchers in accounting held a complex attitude *vis-à-vis* economics which propelled them to pursue similar theoretical success to economics. Scapens (1991) argued that this is related to accountants' desires to achieve the academic respectability of management accounting.

Plenary Address at the Second APIRA Conference, Osaka, Japan, July 1998.

Accounting Auditing & Accountability Journal, Vol. 12 No. 1, 1999, pp. 19-38.

This one-sided situation is not unique in the relationships between economics and other social sciences. Despite disciplines' apparent desire for their independence, there has always been a widespread tendency in sociology and political science to import some ideas from economics. In economics, too, there were always some people who claimed the necessity of interdisciplinary collaboration between economics and other social sciences. But they were only dissidents. Mainstream economists never imagined that there was some theoretical lacuna or deficiency which should be complemented by other social sciences. To repeat, economists believed that economics was complete in itself.

An easy explanation of this "economic imperialism" is that economics is the basic discipline among social sciences so that it is independent of other sciences while other social sciences depend upon economics. I don't think this is the only possible explanation, nor a good explanation. In fact, economics has much to learn from other disciplines but its excessively theoretical and abstract character has prevented it from incorporating knowledge and discoveries obtained by other disciplines. As long as economics continues to preserve this attitude, it is difficult to establish a mutual interaction between economics and accounting. In order to do so, economics should change. But this is not a simple question of changing the attitude of economists, for it is the theoretical structure of economics itself which prevents economists from becoming more open to other disciplines.

To be more precise, the economics with which we are concerned is mainstream neoclassical economics. It is this economics which has been occupying a dominant position in economics since the 1870s. At the core of the success of neoclassical economics lies rational choice theory. The rational choice framework made it possible to formulate human purposive action as an optimization problem. Together with the equilibrium framework, economics could take the form of a highly mathematical science. At first, argumentation was a rough imitation of mathematical reasoning. Unknowns and equations were counted and it was supposed that a solution existed with appropriate properties. Then, after a long effort in vain, there was a kind of breakthrough in the 1930s, and in the 1950s the theory was elegantly completed in the form of Arrow and Debreu's existence theorem. This success was remarkable for all social sciences. It was even the envy of some scholars of other social sciences and so they tried to adopt the rational choice framework themselves. After a long, timid imitation period, rational choice theory is now spreading its influence over various disciplines. In political science, in sociology, in decision making theory, in organization theory, and even in psychology, there are now powerful trends whose theoretical core is rational choice theory.

This facilitated each discipline to take the appearance of an exact science. At least some believed that they were successful in raising the level of argument of their discipline. In some senses, they were right. Usually the models have been specified in such a way that there are few ambiguities for

the situation under consideration. Comparison of alternatives has led to the same conclusion for all analysts. But this exportation of rational choice theory from economics to other sciences, is in fact unfortunate. It distorts the understanding of human purposive behaviors and thus misleads disciplines to what I think is a misguided research programme. This is doubly unfortunate, for economists are now considering abandoning the presumption of perfect rationality which lies at the base of all rational choice theory, and are starting to reconstruct a theory from the very basis of economic science.

As this is the situation of economics today, before embarking on the questions of co-operation between economics and accounting, it is necessary to provide a brief overview of the discussion about the necessity of theoretical reform. Why should we abandon the assumption of perfect rationality? If we introduce an alternative bounded rationality assumption, what kind of new understanding will emerge for human purposive actions?

The necessity of theory reforms in economics

The basis of neoclassical economics is general equilibrium theory. The idea was first developed by Leon Walras and mathematically perfected by Arrow and Debreu (1954). The paper on the existence of a competitive equilibrium was really seminal and I don't make any claim that there are any logical errors in their results. They are mathematically perfect. Nevertheless, as a model of how market transactions take place, the general equilibrium theory has a serious defect, and mathematical perfection cannot thereby save it from the necessity of a radical reconstruction of the theory.

The core of the general equilibrium theory is the existence of an equilibrium. The latter can be characterized as a point where the excess demand function for the economy as a whole takes all non-negative values. However in order that an excess demand function exists, it is necessary for a demand function and a supply function to be constructed, for the excess demand function is defined as the difference between these two functions. Now it is important to know that these functions have prices as independent variables and depend on no other variables. This is a very peculiar framework and it is this framework which necessitates assumptions which are too unrealistic, so that the theory which depends on it can claim no reality in terms of the working of the market economy.

Construction of the demand function

The standard theory can be explained as follows. The demand function of the economy as a whole is the sum of the demand functions of all consumers. Thus, the construction of a demand function is reduced to the case of the individual consumer. Now, a consumer is supposed to maximize his or her utility with the condition that he or she satisfies the budget constraint. This can be formulated as follows.

Utility maximization: the general case,

Maximize the value	$u(x_1, x_2, ..., x_N)$
under the conditions that	$x_1*p_1 + x_2*p_2 + ... + x_N*p_N <= B,$
and	$x_1 >= 0, x_2 >= 0, ..., x_N >= 0.$

This is just a simple mathematical problem. If the utility function u is continuous and prices p_k are positive, then there is a maximum as a simple extension of Weierstrass's theorem. However when we try to find out a solution by a concrete calculation, the problem takes on a different feature, for the calculation for a large N demands too much time, so that it is practically impossible to find a solution within a suitable lapse of time. In order to make the comparison easier, let us take a following problem which is but a special case of the above utility maximization problem.

Utility maximization: a special case,

For any numbers	$x_1, x_2, ..., x_N,$
maximize the value	$x_1*u_1 + x_2*u_2 + ... + x_N*u_N$
under the conditions that	$x_1*p_1 + x_2*p_2 + ... + x_N*p_N <= B,$
and	$x_1 = 0$ or $1, x_2 = 0$ or $1, ..., x_N = 0$ or $1.$

The new problem belongs to the category called integral programming. It is not necessarily easier than the continuous case. In particular, a linear programming problem of this type is an easy one. You have only to find out the maximum of the ratios $u_1/p_1, u_2/p_2, ..., u_N/p_N$ and then buy the good k as much as you can, if the k is the number which gives you the maximum. But, our new integral problem is much more complicated, for the unit we can buy is restricted to 1 or 0 and fractional quantities are not permitted. Thus, mathematically speaking, the restriction to an integral solution makes the problem substantially different, whereas, economically speaking, the restriction is just an approach to reality.

The problem reformulated above is in fact a famous problem in the field called the theory of computing complexity. Mathematicians call the problem the "knapsack problem", for it is equivalent to packing articles in your knapsack when you want to maximize the total value of the articles you put in, with the condition that total weight does not exceed the predetermined limit.

NP complete problem and the computing time

The knapsack problem is just a simple problem but it is also famous as a case of the NP complete problem. Conceptually, the problem is not difficult at all. It is easy to write down a program which solves the problem. The procedure is simply to find a maximum for all permissible combinations. The trouble is that the computing time is proportional to 2^N. When you try to find a numerical solution, it takes an enormous time for a problem of large size. There is little hope that another fast method will be discovered. By what is called a fundamental conjecture of the theory of computing complexity, it is believed

that there are no algorithms which give a solution in the time which is estimated by a polynomial function of the size of the problem. In our case, the size of the problem is the number of commodities N (more exactly, the number of kinds of commodities).

The computing time which is proportional to 2^N is really astonishing. You can see the effect of the exponential growth in Table I.

As a number of commodities, 80 is not large. If you walk into any convenience store, you will find as many as 3,000 items. It is thus evident that no consumers are maximizing their utility, for the calculation exceeds any consumer's capacity of calculation.

It is rather astonishing that this kind of problem (i.e. an NP complete problem) is discovered in the most common formulation of economics. We cannot assume that consumers are maximizing their utilities. We have to look for a new behavioral principle, which is different from the maximization principle.

One of the consequences of this observation is that the normal construction of demand functions has no realities that we can rely on as a basic framework of the economic theory. This is not new knowledge at all, for most of the people know that consumers are not making such a troublesome calculation as maximization when they want to decide what to buy at any moment. Economists know that utility maximization is but a theoretical construction which is necessary only to construct the demand function. They know it is unrealistic but they continue to cling to it, because once they abandon this assumption, they are obliged to abandon the whole framework of neoclassical economics.

Construction of the supply function

The construction of the supply function is also divorced from reality. The concept of the supply function includes that an enterprise has a specified volume of production and sales on which the profit is maximised. This means that in a state near the equilibrium, enterprises are facing a rise in marginal cost so that if they produce more and sell more, their profit becomes smaller. This is a really strange assumption, for a majority of enterprises are trying to sell more if it is at all possible. Just in order to increase their sales volume, they employ a number of personnel and spend a considerable amount of money in advertising and promoting their products.

Number of commodities N	10	20	30	40	50	60	70	80
Computing time	0.001 sec	1 sec	17 min	12 days	35 years	35.7 thousand years	36.6 million years	37.5 billion years

Table I.
Number of commodities in relation to computing time

The very concept of the supply function presupposes that the marginal cost of production is rising at the point where the enterprises are operating. Marginal cost and average cost are two different concepts. But, as you see by a simple calculation, we have identities:

$$a'(x) = \{ c(x)/ x \}' = \{ c'(x) - c(x)/x \} / x = \{ m(x) - a(x) \} / x$$

Here, c(x) is the total cost for the production of volume x. The function a(x) stands for the average cost and m(x) the marginal cost. If the price is equal to m(x) as the standard neoclassical theory presupposes, this is equivalent to saying that

$$a'(x) = \{ p - a(x) \} / x .$$

If in this situation enterprises are making profits (i.e. $p > a(x)$), it means that enterprises are facing an increasing average cost (i.e. $a'(x) > 0$). In other words, it means that enterprises are facing decreasing returns to scale.

As many people know, enterprises are operating in exactly the opposite situation. In other words, they are operating either at constant returns to scale (for a short term with given capacity) or at increasing returns to scale (for a long term, where an investment in plant and equipment is made). Researchers in accounting know this fact very well. This is the very basis of break even analysis. Proportionality assumed here is also the basis of cost accounting. So accounting has been long working with much more realistic assumptions than economics. Many economists know that their assumptions are unrealistic. They also know that knowledge supposed in cost accounting is contradictory to what is assumed by economics. But they cannot abandon the assumption of decreasing returns to scale. Just like the maximizing principle, the assumption of decreasing returns to scale has no empirical support. But it has been accepted by the economists for a long time, because it was necessary for the conservation of the theoretical framework of general equilibrium. As long as they cling to this framework, they cannot throw away the assumption of decreasing returns, for without this assumption, the supply function of the firm loses its meaning.

The persistence of neoclassical economics should be an object of psychoanalysis. It is only explained by the fear of losing habitual tools and accustomed frameworks.

The economics of complexity approach

A new approach to economic theory should now be proposed. This new approach has several names: institutional economics, evolutionary economics and economics of complexity. They have a common research program in the sense that they all try to reconstruct a new economic theory which does not rely on the rational choice theory. They have a common ambition of providing an alternative to the neoclassical theory of economics. As the difference between names indicates, the main focus is different for each of them. Institutional

economics focuses on the synchronic structure of various institutions, whereas evolutionary economics pays special interest to how the new behaviors and institutions come to exist and are widely adopted. The economics of complexity focuses on the consequences of complexity of the world. It wants to make clear how human actions are organized when our capacity of rational reasoning is inevitably bounded. The relation of complexity and bounded rationality is just that of opposite sides of the same paper. For the time being, let me use the term "economics of complexity" for the discussion in relation to the limits of rationality. This is the most important part of my paper.

The direction of the new approach is now almost apparent. We should reject two basic assumptions: that of unlimited rationality which underlies the maximization principle and that of decreasing returns to scale which supports the economic theory of the firm. Instead, we start from two assumptions so far neglected or rejected by the neoclassical school: that of limited or bounded rationality and that of increasing returns to scale. Basic assumptions being so posed, the framework of general equilibrium should also be abandoned. In particular, the notions like demand functions and supply functions which can be defined by a system of prices, should be abandoned as well.

The new economics must be very different from neoclassical economics, both in its topics and its method of study. As for topics, themes like institutions and evolution will occupy an important part of our concerns. As for methods of study, computer simulation of multi-agent systems and traditional narrative analysis will both be important. Narrative is the oldest and most developed analytical method ever invented by human beings. Some contents of narratives can only be analyzed by building a simulation model. In this sense, computer simulation may be a helpful tool for the detailed examination of the contents of narratives.

Now the most difficult point of the new economics is how to formulate and characterize human purposive actions. It is necessary to change our old habits of thinking that it is something similar to maximization.

Economic behavior as routines

When we abandon the long cherished idea of maximization, how can we formulate economic behavior? Some neoclassical economists think that if we abandon the maximization principle, we will be deprived of any concrete formulation of economic behavior. If formulation must be mathematical, they may be right to claim so, but it is not necessary to assume that our behavior is organized in such a way that it is easily treatable by mathematics. This is not to say that any logical treatment is impossible. Even the boundaries of mathematics move. Indeed, the world is full of phenomena, natural or social, which are not easy to formulate in traditional mathematics. But mathematics is powerful and full of possibilities. New theories like catastrophe theory, chaos theory, fuzzy theory and fractals theory show that phenomena which were once thought to be untreatable can be incorporated into the range of mathematics. There are as yet many phenomena which are not treated suitably by ready

made mathematics. The fact that some phenomena appear not to be suitable for mathematical analysis does not indicate that we should refrain from attacking those phenomena. Now there are many researchers who are interested in the theory of complexity in various fields of science. I think I can say that it is a common understanding of those people that there are no clear cut boundaries between mathematics and non mathematics and that possibility of mathematical analysis should not define the boundaries of targets for scientific research. Actually, human action is not an easy target for mathematics. Some day we may discover a mathematical theory by which we can formulate and analyze human behavior. At any rate, the fact that we do not have a ready made mathematical theory does not imply that we should abandon an ambition to tackle the problem without using mathematical formulae.

What I want to propose as a new formulation of economic behavior is to see it as routines. This is also the position of Nelson and Winter (1982), whose book on *An Evolutionary Theory of Economic Change* marked the starting point of the resurrection of the old evolutionary tradition in economics.

In my opinion, routines have a common structure. One may call them programmed behavior, for they can be decomposed into a series of actions, each of which can be seen as a CD-transformation. CD-transformation is a concept formulated by a Japanese sociologist Tamito Yoshida (1990). He thinks that human intentional actions can be seen as a transformation of a cognitive meaning (C) to a directive meaning (D) – hence the terminology CD-transformation. This understanding of human behavior is congruent with the mathematical formulation of a computer program which is but a set of quadruples qSS′q′. Here, q and q′ are internal state of the machine, whereas S and S′ are an observed state of the outer world and an action for it, respectively. It is well known that any computer program can be written as form of a set of these quadruples.

Rational choice theory under uncertainty

Neoclassical economics has been criticized in various ways. One of the important criticisms has been that it cannot incorporate uncertainty in its theoretical framework. As an answer to this criticism, neoclassical economists, in collaboration with mathematicians, developed rational choice theory under uncertainty. The standard form of this theory is called expected utility theory. Expected utility is the mean probability of utilities of all events, which are in this case assumed to have a numerical quantity and are weighted. Many economists think that expected utility theory succeeded in incorporating the case of future events which cannot be foretold with certainty. The method consists only of taking expected utility instead of raw utility in the certainty case, and as such, expected utility theory inherits all the defects of the rational choice theory of certainty.

This is really the work of a genius but as a solution it is badly conceived. All the difficulties in the theory were transferred to the subjective world, where the decision maker is supposed to give probabilities for all events in the future. It is

agreed that these probabilities should not be supposed to have any objective values. It is sufficient that they are the results of purely subjective estimates. So, such probabilities are called subjective probabilities. But even if they are purely subjective, is it possible to attribute probabilities to all events concerned? Probably not.

Even if we admit that any subject has or is able to estimate what are called subjective probabilities for all future events concerned, there remains another serious difficulty. The burden of calculations are not reduced at all. The situation is worse now, for in addition to the normal comparison of utility values, one has to calculate expected means. Then the same criticism which was made of the utility maximization problem is valid in a stronger way. Rational choice theory under uncertainty may have succeeded in incorporating future uncertainty, but it completely ignores the fact that human ability to think, reason and calculate is limited. To assume that a man or woman can maximize the expected utility is to attribute much greater rationality to the human agent. The rational choice theory under uncertainty takes the form of a difficult theory which is full of mathematics, but is only claptrap.

If we do not question the computability of expected utilities, we have another problem. Is the solution obtained sufficiently reliable as something which should be pursued as a target? Most important data, which are used in solving the problem, are subjective. Even if we obtain a solution, we cannot guarantee that the solution has any objective superiority to other alternatives. It may be better to choose an alternative, purely by inspiration or by casting lots. The positivist spirit which was apparent in the early neoclassicism is now completely lost from the rational choice theory under uncertainty.

In this way, expected utility theory has tremendous theoretical defects. Despite this, as mentioned in the first section of this paper, the influence of rational choice theory is now strong and widely spread. In this respect, the economics of information deserves to be mentioned. This is particularly important when we talk about the influence of economics on accounting. Management accounting adopted information economics as an essential part of its theoretical renovation.

Many economists believe that expected utility theory and other rational choice theories under uncertainty have succeeded in incorporating the incomplete information case. In a sense, they are right. Rational choice theory can now treat the situation where the subject has only limited knowledge of the state of the world. However seen from the complexity point of view, or in other words, when the bounded rationality is taken into consideration, it is not a solution at all. They take into consideration the cost of information gathering and monitoring, but they don't take into consideration the cost of information processing, or for the case of a human agent, the cost of thinking or reasoning.

Habitual behavior and genuine decisions

The agent assumed to exist by the neoclassical tradition is the calculating man or woman. He or she calculates every situation and decides what he or she will

do. The style is invariant, whether he or she faces a certain or uncertain situation.

The new theory proposes a totally different image. In this new image, the human agent behaves according to a routine or a ready made program. To see a human agent as someone who is repeating routines is to see them as someone who is parsimonious in thinking anew. If I use the neoclassical phraseology, this means that the most scarce resources for the agent are time. He or she is reluctant to use much time in thinking and calculating. He or she is prepared to pay only a minimal time cost. Rapidity in judgment is most welcomed and long speculation is something which should be avoided.

This image of parsimonious decision makers is confirmed by various researchers of business organizations. March (1988) argued that time and attention are scarce resources and hence the allocation of attention is one of the most important choices that managers should make. Mintzberg (1973) made it clear, after a wide survey and his own observations, that managers are spending a very short time on most of their activities – each of them being in the order of one minute to nine minutes. A shop steward is reported to have engaged in 1,073 activities in a day. The importance of quick and instantaneous judgment was also pointed out by Nakaoka (1971), when he examined the expertise of factory workers.

This is not to say that people are not thinking seriously. They should be parsimonious in thinking, judging, and decision making, because there are so many things which demand judgment and decisions. They cannot spend time in considering only one problem. In consequence they are obliged to allocate their scarce time in order to obtain a better result. Katona (1951), a rare psychological economist, explained these observations by indicating that human activities can be arranged to occupy a point on a scale whose extreme points are habitual behavior and genuine decisions.

A comment on decision theories

One may feel that neoclassical economists have paid too much attention to a situation where genuine decision is required. They are not aware of a distinction between habitual behavior and genuine decisions. The situation they wanted to explain was always that of genuine decisions. This does not mean, however, that they have succeeded in making an appropriate theory of genuine decisions.

For example, expected utility maximization is not applicable to decision making of importance to an enterprise. First of all, we do not know how to define the utility function for an enterprise. If the enterprise is of the risk averse type, how is the function bent? Second, even if we can invest a large amount of money and work time of the personnel, it is not certain that we can get a sufficient clarification of profits and losses of all alternatives so that we can draw a conclusion from the study. However for the neoclassical theory of rational choice there is no such possibility of undecidedness unless we face a choice of two alternatives of equal expected utility.

As decision making is one of the most important matters for business, various theories of decisions have been proposed. Some are empirical and some others are normative. Other people have proposed a clinical theory of decision making. It is important that we accumulate knowledge on decision making. It may bring precious information to the economic theory of complexity, or the theory of bounded rationality.

The neoclassical theory of rational choice can be included among normative theories, but as long as it continues to ignore the bounded nature of our reasoning, it will not be able to give any useful hints on decision making in a real situation. On the contrary, it may mislead decision makers into costly but unfruitful studies, for it pays little attention to the cost of decision making.

Reason for the failure

We can now understand why the rational choice theory was doomed to fail. The economic agent in the neoclassical tradition considers the world only in a prospective way. He or she calculates every future course and makes comparisons. This situation setting has an important implication. At each time when a choice is made, the alternative actions are examined only to see what will be the future results. In this *ex-ante* setting, the agent is asked to make a choice without any assumption about what he or she did in the past. In this theoretical setting, no assumption means no information. The agent has neither information nor memories inherited from the past, even though the agent is supposed to have an ability to foretell what will happen in the future as a result of present actions. The economic agent thus supposed, is a peculiar *tabula rasa* man or woman who knows the general laws of the world but has no experience nor memories. In this peculiar setting, the imagined agent is forced to make choice for the first time in his or her life. This is a very fictitious situation.

This human image is similar to a robot in the early days of artificial intelligence studies. Designers tried to equip their robot with various kinds of laws of the environment, but this program did not work well. When a robot was furnished with various laws of dynamics, it did not move at all, for it took too much time in calculation. The economic agent in the neoclassical theory is just like a robot which takes too much time in calculation and can do nothing.

What assures the usefulness of routine behavior?

It is important to know why routine behaviors are useful to us. The argument about evolution is possible, but it is necessary to acknowledge that under any evolutionary explanation, some sort of stationarity is supposed. If the world is changing without any continuity, evolution would not be efficient, for the selection would be arbitrary and ineffective. Of course, this stationarity does not require that all the variables remain constant. Just like stationary processes in probability theory, the situation changes when we can assume any constancy among the changes.

Routine behaviors generate an economic process as a whole and this total process conditions the usefulness of each routine. There is a kind of loop of mutual determination between micro behavior of agents and the macro process of the economy as a whole. This leads to an idea of the micro-macro loop.

Micro-macro loop

Although this is an important topic, I shall be brief for the sake of space. The concept of a micro-macro loop is proposed by several authors. I borrowed this expression from Imai and Kaneko (1988). Much earlier Shimizu (1978) proposed the concept of feedback loop between micro and macro. A similar concept like the micro-macro link is used in sociology in order to denote a unifying effort of two major sociological study approaches: micro theory and macro theory. They all differ from person to person. My concept is close to Shimizu's feedback loop concept. Interactions of each economic agent generate a total economic process which normally takes the form of a macro order. The important point is that agents' micro behavior will be affected by the macro order, for it will constitute conditions for the expected results of each action. Shimizu cites the example of a laser. Excited molecules are arranged to form a coherent emission of light and this coherent order conditions the behavior of each molecule.

An economic example of the micro-macro loop is given by what is normally called the Japanese management system. This consists of three major customs or institutions established in Japanese enterprises:

(1) lifelong employment;

(2) promotion by seniority; and

(3) cooperation between workers and management.

These institutions provided the very base of the quality control (QC) circles movement and the latter developed later to the total quality control (TQC) movement. Productivity increased rapidly and real wages improved substantially year after year. This in turn provided a base for the high economic growth in the 1960s and a base for the stable but steady growth in the 1980s. What is important here is that this condition of high and steady growth gave each enterprise room to maintain lifelong employment and other characteristics which comprised the Japanese management system. In the 1990s, the situation changed. Japan is now suffering an ongoing depression. Enterprises are being forced to restructure their business. So top managers are now considering the possibility of changing long established institutions. This is a very good example of the micro-macro loop. Behaviors of management and workers of individual companies and the macro performance are mutually conditioning for each other. The present depression is at risk of destroying the micro-macro loop of post war Japan.

The concept of the micro-macro loop was introduced in order to conciliate between two contradictory methodologies – one is methodological individualism and the other is methodological holism. The argument between

these two methodologies is an ontological one. A line of demarcation is drawn, in economics, somewhere between neoclassical economics and Marxian economics. A similar demarcation line exists in sociology in the form of dichotomies such as "individual versus society" and "action versus order". So, the concept of the micro-macro loop shows a new approach which is neither individualistic nor holistic. This new approach is closely related to evolutionary economics, for the loop between macro and micro provides the field in which evolution takes place.

Neoclassical economics provides an extreme case of methodological individualism. Individuals have a firm independent system of values which is not influenced by experience nor by the opinions of other people. The micro-macro loop has two directions of determination. Neoclassical economics takes only one determination into consideration. From macro to micro determination is completely ignored.

A summary view

As a summary of the above discussion, let me point out that between neoclassical economics and economics of complexity, there is a shift in the mode of economic analysis.

Neoclassical economics has paid attention to choice behavior from a very special point of view. Analysis is made only at the moment of deliberation. This reflects the fact that the equilibrium has been almost the unique framework of economics since the arrival of neoclassical economics in the 1870s. The concept of equilibrium is composed of two ideas. One is what we may call systemic equilibrium. Demand and supply for each commodity should be equal. The other is what we may call subjective equilibrium. No economic agent should have an incentive to change his or her decisions. In order to satisfy this requirement, human purposive actions are characterized as optimizations, or more precisely as maximization of profits and utilities. At this optimum point alone an agent has no incentive to change his or her previous decision. This made mathematical formulation easier but confined economic thinking to a very special moment of decision making. Human behavior was considered only from an *ex-ante* mode.

The economics of complexity emphasizes limits of rationality. As a consequence of the complexity of the situation, decision making at the pure *ex-ante* position is impossible. Normally, such deliberation takes too much time for conjecturing and the result thus obtained is unreliable. Decision making is a much more complex process in which past experience always plays an important role. It should be examined as a structured mix of *ex-ante* and *ex-post* deliberation. This shift of viewpoint is important when we talk about collaboration between economics and accounting, for in my opinion confining of economics to the *ex-ante* feature of decision making has been the main obstruction which has prevented a useful interaction between the two disciplines. It was not only an obstruction but also the cause which disfigured

our understanding of decision making and misled many arguments of management accounting. In the next section, I will illustrate this claim by citing some discussions made inside the accounting discipline.

Management accounting as a tool of decision making

I have talked at length about economics. Let me now make some comments on the possible implications of the new economic thinking to accounting. This is not to say that accounting should learn again from new economics just like it learned from neoclassical economics. If this were the case, there would be no change in the relationship between economics and accounting. It has always been accounting which has drawn on economics. My suggestion in this section is not an invitation to that kind of one-directional teaching and learning. Instead, I want to propose a relationship of mutual learning. This change is possible, because the new economics of complexity has a much wider scope in its understanding of economic behaviors. This wider scope understanding has been evident in accounting for a long time.

The nature of the management cycle

To illustrate my proposal, let me cite at first an example very familiar to accounting researchers. It is the well known management cycle. Although it is not a proper topic of academic accounting research, all researchers know it, for it is closely related to management accounting. The cycle takes the form of "plan, do, see and check". My question is – why are the last two parts, "see and check", necessary?

Accounting started as a system of records and reporting. It had in its nature an *ex-post* character. Even if accounting reports are used for management purposes, they are based on past experience and records. When management accounting started, it was exposed to a special problem which characterizes the driving force of the discipline. This was the contradiction between the *ex-post* character of accounting and the *ex-ante* requirement of decision making.

When I insist on the *ex-post* character of accounting activity, it may sound like blasphemy to accountants and researchers in accounting. I have no such intention. Instead, I want to point out that most useful knowledge is based on past experience. Even in the case of the natural sciences and technologies, the importance of experimentation shows how our knowledge is based on the past experience. Experimentation is a name given for a past experience which is well controlled. Accounting is not an experiment, but it is based on real operations. This is the crucial difference between accounting and economics. Accounting is based on real experience. Neoclassical economics is only concerned with an imaginary comparison between which alternatives to take.

If we take the management cycle into consideration, it becomes evident that neoclassical economics is composed only of the "plan" stage and does not contain the "see and check" part. One can easily understand why it does not contain the "see and check" part. Let us suppose that general equilibrium theory is valid. Then theory assures that whatever the agents' plan is, it will

always be realized in the equilibrium. As a consequence, the "see and check" part of the management cycle is useless, for everything goes as it is planned. It is not by an accident that neoclassical economics does not contain the "see and check" part and offers no explanation about it. That part does not and cannot exist in the neoclassical theory of economics.

The absence of "see and check" indicates the presence of a theoretical lacuna in neoclassical economics. In my opinion, this is the reason why management accounting could not make substantial progress under the neoclassical dominance. I will discuss this point in the next subsection.

Ex-ante *and* ex-post *features of management accounting*

If it was conceived as a contradiction or not, the difference between *ex-ante* analysis and *ex-post* analysis was sharply acknowledged from the very start of management accounting. Emerson, the advocate of efficiency engineering, contrasted standard costing with retrospective costing, claiming that retrospective cost had no relevance as a benchmark for efficiency management. Harrison, a critical successor to Emerson, mentioned the fact that entrepreneurs were shifting their attitude from a retrospective one to a more prospective one. He expressed a hope that future accountants would spend more time in forecasting than in recording past facts.

In my opinion, misfortune began from this very early phase of management accounting. Questions should be constructed in a different way. In order that management accounting becomes a self-explanatory discipline, it should answer two questions:

(1) How and why *ex-post* knowledge can be useful for *ex-ante* decision making?

(2) Why this mode of reasoning is especially important among other possibilities?

These questions are related to the *raison d'être* of management accounting. If these points are not clarified, it is difficult to argue why management accounting can be a useful tool for management. They are even related to a philosophical question (of the *Kantian* style) if management accounting as a discipline is possible at all. There are many textbooks of management accounting and I have only read a few of them, but it seems to me that these questions are not clearly posed and not yet answered in a satisfactory way. At least, I can say that these questions are not conceived by academic accounting researchers to be so important that they should be a standard topic of introductory textbooks.

For me, this is a very strange situation and I doubt if there was some negative influence of economics on accounting. I do not say that this kind of reflection is either possible or necessary in the initial phase of management accounting. It is natural that early proponents only pursue possibilities and never reflect on their own efforts, but for any discipline, the time comes when it is conceived as an independent discipline. The kinds of questions posed above

are rather natural ones for academic researchers. The fact that no such questions were posed is explained only by the fact that they were preoccupied with other academic concerns. Researchers wanted to reformulate management accounting as a science which is helpful for the *ex-ante* deliberation of decision making. Interests in operations research (OR) and information economics are but a few examples of them.

Concentration of analytical efforts upon *ex-ante* decision making gave birth to a discrepancy between practice and theory. Indeed a deep gap has been cut between real decision making practice and imaginary choice problems. When OR and other mathematical methods were introduced, their formulation was criticised as being too complicated and not useable for practical applications. In fact, it was true that management accounting based on new mathematical sciences was not practical. But the researchers believed that their analysis had some normative value. This understanding is pointed in the wrong direction. OR and other mathematical theory only address situations treatable by mathematical analysis. In contrast to real world complexity, the problems thus treated were only toy problems. As a consequence, new mathematical theories were not only impractical but also inadequate as a framework for organizing our knowledge in a useful way.

Johnson and Kaplan (1988) once declared that management accounting had lost its relevancy. Until 1925, US manufacturing had developed substantially all the tools available now. One can say that management accounting had stopped its development since then. Academic efforts to reorganize management accounting as a powerful tool of decision making resulted in failure. We should ask ourselves why.

The key to answering this question is to understand how our knowledge is organized and when it is assured to be useful. This is the same problem that economics had to face when the hypothesis of complete rationality was denied. Ex-ante choice is only a special moment of a complicated decision-making process.

Decision making consists of at least three phases:

(1) elaboration of plans;

(2) comparison of feasible alternative plans;

(3) selection of one alternative.

But management does not stop here. Execution is one of the most important parts of management. In the course of the execution, it often happens that the plan comes to face unexpected troubles and changes in direction. Managers are obliged to modify the adopted plan. Assumptions that we can foretell completely the course of the events are totally false. This is not a question of imperfect information. Even if we have all the information we want, we cannot solve the enormous equation which describes the whole course of events. Human beings confined to the limits of bounded rationality do not act as problem solvers, but behave in patterns just like programmed machines. Of

course, they have ingenuity and show that they can create new patterns. People are always able to develop a new plan, in the same way they invent a new story. Indeed, human planning is very similar to story making. When a novelist tells a story, it is invented from the fragments of our experience and arranged just as things proceed in real life. In all these considerations, past experience accumulated as knowledge, plays the essential role. So management accounting should ask about the nature of our knowledge: how is it obtained, how is it organized, how is it connected to our behavior, how and in what point is it related to the decision making, and why is it useable in a different situation than that in which the knowledge was obtained? Management accounting and the economics of complexity thus face similar problems that require solving. This is not astonishing, because accounting has been for a long time under the same influence of neoclassical thinking. Only it is now time to be liberated from its theoretical straitjacket.

Genka kikaku *or target costing*

Genka kikaku is another good example of where complexity plays an essential role. *Genka kikaku*, or target costing, is a new tool of management accounting which was invented in Japan. It is true that it is related to a specific Japanese approach to research and development activities, but this does not mean that target costing is a peculiarly Japanese method that cannot be exported to other countries. The introduction and the success of target costing were the result of the Japanese way of organization and management. Once its usefulness is acknowledged and its operating principles understood, it can be successfully transplanted to foreign countries of different cultures. In this sense, target costing has a universal value and can be analyzed as such. However this point is not my real concern.

The reason why I picked up target costing is that it gives a good example of illustration of the problems of complexity. As it is well known, *genka kikaku* started in Toyota Motor Co. as a part of *genka kanri* (cost management), which is in turn a part of total quality control (TQC) movement. *Genka kanri* includes cost targeting, cost maintenance (*genka iji*), and cost improvement (*genka kaizen*). The main tool for the target costing was value analysis (VA), but the core of target costing does not lie in analytical tools such as VA or VE. Target costing is a coordinated effort of all sections concerned with the development of new commodities. When a target cost is chosen, the design team starts to consult with suppliers and manufacturing sections. Value analysis is used in the design process, but this is not a pursuit of minimal cost combination with a given cost table.

In the field of research and development (R&D) management, a new concept called the concurrent model has now been proposed. The concurrent model replaces the linear model which presumes that research and development proceeds in a linear sequence, from basic research to applied research to development. Target costing is an effort which is only understandable when we have a concurrent model in mind. As in the case of the concurrent model of

R&D management, target costing proceeds not in a linear sequence but consultation takes place between different sections which are in charge of different phases.

The philosophy which underlies target costing is also important. In the design process, costs of components and costs of operations are examined. In the course of the design process, a search continues whether the cost of each operation is deduced or not. Designing affects the manufacturing process, so the possibility of design modifications is pursued by consultation between the two sections concerned. Claims and demands of users are crucial in deciding which functions you adopt and which you do not. So you should consult with your salesmen. These characteristics of target costing can be summarized as *gemba jushi* (emphasis on the importance of the knowledge and experience of the personnel on the spot). This is the philosophy which underlies all activities like QC circles movement, TQC and *kaizen*. *Genka kikaku* is an application of this philosophy to the design and development process. Target costing is possible only in a company where management and designers can expect voluntary collaboration from workers, engineers and salesmen on the spot, drawn from manufacturing, shipping and sales. On any setting of target cost, "shop floor" knowledge must be stressed. If workers feel that their effort to achieve the target was not sufficiently rewarded, target costing will not work well.

VA is usually understood as desk work. Target costing includes this part. But the important part lies in the consultation and coordination processes designed to ensure that the new design embodies "shopfloor" knowledge. It is not a mere choice of alternatives from among well known alternative methods. It is rather a process of discovery of a new and better method. The idea does not lie on the design table. So, if you are a design engineer, you should go and talk with people on the "shop floor" (including salespersons).

In summary, target costing is a process of deciding commodity designs and their manufacturing method. It is not *ex-ante* decision making, which is performed as desk work. Effective decision making is to be designed as a process of discovering a good solution. Neoclassical economics presents an image of decision making as being a choice among known feasible alternatives, but this image is a result of complete mystification. It is time to demystify this. The case of target costing shows how an accounting method can contribute to clarifying misunderstandings which were once created as a result of neoclassical dominance.

Call for further collaboration

The influence of neoclassical economics on accounting distorted the nature of decision making and confined management accounting to the narrow framework of *ex-ante* deliberation. Accounting should be liberated from this epistemological obstruction. The new economics of complexity will be helpful at this point.

This is not one-way collaboration. Once liberated from the yoke of neoclassical economics, accounting can be a good and helpful partner of economics. Accounting, which started as a record of past activities and thus has a different perspective from economics, can help the newly born economics of complexity in its efforts to clarify behaviors of the enterprise as an economic agent. More specifically, the two parts can collaborate on questions like "what is profit?" and "why is it important?". Economics has an experience like the reintroduction of profit concept for the management of the socialist planned economy. Accounting can contribute to this collaboration by pointing out, for example, ambiguities in the notion of profits. The economics of complexity also claims that profit maximization is not always possible except for the very simple decision case like deciding upon a volume of one specified item. If it is clarified that profit is an *ex-post* summary of the past activities and that it cannot be a target of an *ex-ante* comparison and choice, economics of complexity will gain a powerful rationale for changing the current construction of economics.

An historical survey of accounting as an institution can provide a good example for the economics of institutions. On the other hand, the theory of complexity (not specifically the economics of complexity) can provide explanations for the necessity of arbitrariness in some accounting concepts and procedures.

Thus we can say as a conclusion, that between economics and accounting, there is a promising field for interdisciplinary research and collaboration. I will be happy if this paper can provide impetus for such further collaboration in the future.

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