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METAECONOMIC THEORY OF CAPITALIST SYSTEM AND CIVILIZATION: FROM 'VALUE' TO MEASURE

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Abstract

The structure of the present global capitalist world, which is composed of various sets of capitalist systems, can be clearly explained and described with the mathematical concept of 'measure' instead of the conventional term of 'value.' The history of the commodity world is that of the irreversible order of three measures: use-measure, exchange-measure and temporal exchange-measure. According to that order, sets of capitalist systems have 'grown' up to the present day. This process of capitalist 'growth' is a transformation process from the real-economic world or space-time of use-measure to the rational space of null sets dominated by money. It may foretell the destiny of mankind's economic activities and the vicissitudes of human civilization.

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I

Following the precedent of Thomas Carlyle's *Sartor Resartus*, we may metaphorically define metaeconomics as the art of economizing the circuit of economic thinking. This is a metaeconomic attempt to enable rigorous economic thinkers to emancipate themselves from the awkward concept of 'economic value' and to reconsider economic semantics for economic history, especially that of capitalism and civilization.

As 'numerical value' is the output or codomain of morphism from a real-value space to a set of numbers and can only express a rational form of value, so 'economic value' cannot represent the real content of value. Both 'values' are the product yielded by the art of rational and metempiric approximation to reality, that is, mathematics. Therefore, 'economic value' must be translated into a mathematical term. Joseph Schumpeter considered the so-called 'theory of value' to be useless and obstructive for economic thinking[1]. Certainly it has badly hampered the

[1] Schumpeter (1908).

structural cognizance of the economic world, but he only introduced a 'theory' of animal behavior of choice in place of human 'value.' As Johan Åkerman suggested[2], 'value' is so polysemous that we cannot use the word as a fundamental tool for economic analysis. From a deeper epistemological viewpoint Gunnar Myrdal rightly alluded to the irrelevancy of a quantitative and conceptual 'value' analysis because of the 'value-loaded' character of the concepts utilized in social studies[3]. Therefore the term 'value' should be restrictedly used as a concept for reference in the domain of anthropology and sociology of culture. Through replacing 'value' by a certain mathematical ('value-free') term, we will reconstruct the historical structure of an economic system, which Karl Marx called 'capital,' that is, a capitalist system in which profit-making becomes its own end.

Generally speaking, any object for exchange may be called a *good*, but in an exchange for profit-making it becomes a commodity (hereafter, C). A mass of commodities, which share a common trait of concreteness in a set of concrete goods, appear as a commodity-set or a (mathematical) category of commodities. Originally, a set of goods and services in every primitive community can be related with each other through barter. Each of them must have a certain 'volume' in order that it can become an object for exchange. It is a *chose in possession* that is useful for human life and fostering welfare. Moreover, its quantity has to be numerically calculated on a certain common standard for exchange purposes. But it should not be called a 'value.'

Value has been primarily defined as one of the essential factors of culture, the others being language, community and technology. From the viewpoint of system, each of these factors has its own operator that is called an assignment function or mapping. A value system also has the functions of truth, goodness or sacredness and beauty. According to the terminology of Pitirim Sorokin[4], that system has originally constituted an 'ideational' or real cultural factor, but transformed itself into a 'sensate' and rational one. A representative and typical product of the latter system is a huge mass of 'economic value.' Its social settings may be formally or mathematically represented by a class of sets or 'σ-ring.' Therefore, it would be better to express *this* 'value' as a 'neutral' and formal concept, that is, a certain mathematical notion. We propose to treat it as a *measure*. We will take its concept as including measure in the narrower sense, that is, a non-negative finitely additive set function or morphism, as well as its codomain. In fact, there can be no logical inconveniences in such a treatment.

Now we will examine in more detail exchange transactions between the above primitive communities. These transactions make a market-place where various goods are transformed into commodities (C). Strictly speaking, goods are physical objects that satisfy wants in daily life (food, clothing and shelter) and express the mutual communication of people in a community. Goods have *measure in use* or *use-measure* that corresponds to real numbers in mathematics, or especially to areas in two-dimensional space. The same reasoning applies to the labor that produces goods. If we assume a two-dimensional space-time with a coordinate space-axis and a time-axis, as is often the case in the textbook explanation of physics, goods and concrete labor have a measure above zero. Time has also a certain positive measure and spreads continuously in the space-time of human life where the concept of work-hours does not exist. However,

[2] See, Åkerman (1952).
[3] See, his article entitled '"Value-Loaded" Concepts' in Hegeland (1961).
[4] See, Sorokin (1985).

goods as commodities and the *abstract* 'use-value'[5] or labor-power calculated by working hours correspond to one-dimensional segments that are regarded as *null sets* within the two-dimensional space-time of concrete goods and labor. Moreover, if we define *measure in exchange* or *exchange-measure* as a positive measure in a commodity-set, a set of prices or a codomain of exchange-measure is null because the elements of the latter set are rational points (points in a zero-dimensional space) that represent a ratio between commodities.

Then what is it that carries out the function of defining the measure of goods or concrete 'use-value'? It is a *market* that expresses a place of intercommunity that appears between primitive, closed social groups (communities). If E is defined as a set of concrete goods before entering a market transaction, the total set of goods can be represented by a union of families of sets such as

$$(\cup E_{\mu\in \mathrm{M}})\cup(\cup E_{\lambda\in\Lambda})\cup\cdots.$$

When these concrete 'use-values' are brought out on the outside of a community for some reason or other, they become commodities as elements of a market. When we denote a finite set of n-kinds of commodities, each of which have k units in the market as Eij ($i=1,...,k$, $j=1,...,n$), we suppose that a finitely additive set function μ satisfies the following condition;

$$\mu(\cup_{i=1}^{k}\cup_{j=1}^{n}E_{ij})=\sum_{i=1}^{k}\sum_{j=1}^{n}\mu(E_{ij}).$$

In mathematics μ is called a finitely additive measure, but in our analysis it can be properly named an 'exchange-value,' or more precisely a *measure in exchange* or an *exchange-measure*. In a market, physical goods are transformed into a set of abstract goods or commodities, and each of them has its own exchange-measure. Consequently, its price appears, in the first place, as a ratio between distinct exchange-measures. If, as in physics, we regard price as density, exchange-measure is defined as price×volume. When a certain commodity is abstracted from a commodity-set (C) for the sake of convenience of exchange, it becomes money (M). To put it more accurately, money is the general exchange medium for bringing about the coincidence of physical dimensions of unit-complex, which enables various real commodities (induced quantities) to be compared and exchanged with each other. The formation of commodity and market must keep pace with the appearance of money (the independent quantity), and then the typical scheme of exchange C－M－C (the general form of commodity exchange) prevails into various types of communities. In such a process the reality of goods with measurable quality will fade away.

II

Now we will analyze a scheme C－M－C more closely. If the first C equals the next in the scheme, such an exchange is economically insignificant. Some people before the Deluge ascribed a different meaning to that exchange transaction. When increasing attention is focused on the first M and the second in the chain C－M－C－M－C－$\cdots$and a certain addition to the first can be expected, this chain of exchange will be different from barter transaction within a

[5] As to the fundamental significance of abstraction in 'value' theory, see Uno (1980).

community or inner-barter. It may be formulated by the economic law called the 'comparison of comparison'[6]. In terms of mathematical analysis the measure-preserving condition for inner-barter (exchange between distinct measures in use) cannot be satisfied in the case of *intercommunal* barter or commodity exchange.

Here we clarify the meaning of the term 'comparison of comparison.' If A and B denote two sorts of commodity and the quantities of both are expressed as α and β, both of which are rational numbers, in terms of the common unit such as a certain volume of gold or silver, then the sufficient condition for profit-making exchange is $\alpha/\beta \neq \Psi(\alpha/\beta)$ where Ψ must be a non-identity function or map. As the variety of sorts of commodity increases, the original functions, for example, Ψ and Φ, become the object of comparison, and a newly induced function Ω makes the relationship $\Psi/\Phi \neq \Omega(\Psi/\Phi)$. Every merchant interprets Ψ, Φ and Ω according to temporal, spatial and other economic conditions, and continues to exchange dealing until a positive profit in the trade cannot be achieved.

We can divide the 'comparison of comparison' as a premise of exchange into the following two types:

1) spatial 'comparison of comparison'

James Steuart explained this type of comparison as a mode of transaction that makes a 'profit upon alienation' originating from barter or monetary exchange (pricing)[7]. About fifty years later David Ricardo examined international barter exchange and formulated a spatial comparison of the comparative calculation of different costs, which has been called the doctrine of 'comparative costs'[8]. The objects of exchange in his illustration have positive measures and consequently they are reduced to money and capital. As the 'profit on alienation' is calculated by the unit of certain real goods, it is really created within a null set. However, the comparison of costs may be possible in an exchange with no alienation such as money-lending, sale of labor force, leasehold transaction of land etc. These sales contracts are carried out as in the case of exchange of physical commodities. Of course, it is not money-generating exchange, but monetary exchange that enables the global extension of commodity transactions. A more extended form of comparative costs or 'advantage' can be found in the case of comparison of digital information[9].

2) temporal 'comparison of comparison'

The above type of 'comparison of comparison' does not include any temporal elements. Keynes devised a forward exchange model, or so-called 'interest parity' theory, in which he formulized the temporal relationship between outright and forward monetary transactions in two different markets[10]. However, this type of 'comparison' is, as Günter Dux pointed out, that between the present past and the present future[11]. Here we attempt a more general interpretation

[6] See, Kamitake (2009).

[7] See, Steuart (1767), Book II, Chapter IV.

[8] See, Ricardo (1951) Chapter VII.

[9] For example, a country in which most people have weak self-determination and depend on outer information and are thus more likely to agree to the construction of atomic power plants, has a comparative 'advantage' in the calculation of investment for nuclear development. But in terms of money, the potential costs of an atomic plant are not comparable to the costs of other types of generating stations, because a significant nuclear accident is uncontrollable and therefore accompanied by immense cumulative costs.

[10] See, Keynes (1971).

[11] See, Dux (2000).

of temporal 'comparison of comparison.'

Any set of time or time-set has structures of order, algebra and topology, in other words, a structure of ordered topological semigroup. This formal definition of time is based upon the concept of time as irreversibility that Ilya Prigogine suggested in his famous work[12]. As time in a narrower sense means a lapse of time or a time-period, any time-set forms a metric space with a distance. And when its algebraic structure is that of an ordered topological group, it becomes a reversible or controllable set that belongs to the codomain of a mapping from an uncountable to a countable set. In terms of the theory of information, it means that a continuous or analog information set is restricted to a set of digital messages or a digital information set.

An economically definite meaning was first assigned to the concept of time in the era of industrial revolutions[13] when an abstract notion of working hours or labor time spread over every corner of European societies of the 18th and 19th centuries. Then a measure of time acquired a certain rigid meaning. Real goods and services became composed of the periods of time for production, which can be represented by one dimensional 'length.' If a closed interval of time $[t_\iota, t_\kappa]$ is defined from a point in time ι to a point $\kappa(\iota<\kappa)$, *time-measure m* is expressed as $t_\kappa - t_\iota$. Then the exchange-measure μ, which also expresses a one-dimensional 'length' may be represented as $\mu=f(m)$ where f is a certain function. Moreover, if a function g where $g(\{p\})=m$ is given in a price-set (a set of rational numbers) $\{p\}$, $\{p\}=g^{-1}([t_\iota, t_\kappa])$ is regarded as a null set in exchange-measure space. Notably, μ has a positive measure, but it has *0*-measure in a use-measure space or a two-dimensional 'area' where a barter transaction takes place between real goods or commodities. Similarly, every time-set has *0*-measure in a set or space of real goods. On the other hand, the output of monetary exchange always has *0*-measure because any set of money is countable. Consequently, with the advent of the industrial-revolution era all the time-sets can be regarded as the commodity-sets of digital messages, which are countable, and any commodity exchange as the exchange of digital information. A detailed account on these points will be presented in Section IV.

III

Let us summarize the above arguments. The 'comparison of comparison' in exchange realizes profit making activity that is a system of the form M−C−M′ (=M+ its increment δM). This system transforms means of exchange or money into the end of exchange. Such a profit making system is generally called a *capitalist system*. It has taken various forms of development in history.

Before classifying capitalist systems, we define the relationships between functional and continuous systems. The logical content of these two systems is assumed to be well known[14]. If

[12] See, Prigogine (1997) and Kamitake (2010). Undoubtedly and realistically, irreversibility is an abstract property of 'a stretch of time,' which may be reduced to an individual 'solitary present.' See, Shackle's article entitled 'Time, Nature and Decision' in Hegeland (1961).

[13] See, Kamitake (2008).

[14] See, Kamitake (2009). In the 1950s, Åkerman and Marchal introduced and developed the concept of structure and system in economic theory and history. Åkerman's economic doctrine is, as it were, a structuralist economics, keywords of which are structure, 'primary movers' and causal analysis. Since *causality can be logically transformed into system*, causal analysis may be reduced to systems analysis. Marchal properly considered Åkerman's economics in connection

we indicate a functional system M－C－M′ by κ, then we can build the temporal structure of a continuous system $\kappa-\kappa-\kappa-\cdots$which takes three forms of development along the time-axis, that is, expanding, shrinking and copy forms.

In the days of the Italian Renaissance the first rational and calculating operator of a continuous capitalist system was introduced into the commercial accounting process in the form of double bookkeeping. Every capitalist system can obtain assurance for its formal duration as a continuous system through rational profit-loss accounting. Such rationality is a kind of system-rationality, which means that a given system is logically consistent with its model or domain-codomain mapping and able to clear up any contradictions. From the 16th and 17th centuries the continuous capitalist system transformed itself in its functional aspect and during the first industrial revolution a new type of capitalist system appeared from it. Marx called it 'industrial capital'[15]. Numerical division of working time under this capitalist system enabled 'industrial capitalists' to change human labor into a piecemeal commodity of measurable working power. For example, 8 working hours of an employee are equal to the exchange-measure of the commodities necessary for the employee's own leisure time (the remaining 16 hours). If the same 8 hours are useful for his employer's production of a commodity that is worth 16 working hours' exchange-measure, the possibility of 'exploitation' will arise. This explanation can be further generalized. Suppose that a certain wage-level (W) can be defined as $W=\phi(P)$ where ϕ is a function of a time-period (P). If ϕ is reversible, we have $P=\phi^{-1}(W)$. P may be properly called *wage-time,* which corresponds to the above time-measure. Then the condition of existence of 'exploitation' is that a laborer's wage-time per day is smaller than his daily working hours (H), that is, $P=\phi^{-1}(W)<H$. For an employee wage-time is a ' "necessary" labor-time' [16], which is a working-day for the employer. However, the arguments in this respect can be more clearly developed after the relationship between digital information and the capitalist system has been theoretically traced in the following Section IV.

Here we will examine the multivariate historical development of the capitalist system (hereinafter abbreviated to CS) . Under the condition of 'double contingency' [17], which will be theoretically examined and interpreted in IV, CS continued to develop a 'strategy' to cut off future uncertainties. In the latter half of the 19th century 'concentration' and 'centralization' [18] spread across every sphere of business activities for CS. The so-called 'monopoly capital' took the form of a joint stock company with limited liability, which can be regarded as an extended continuous CS. Another type of 'monopoly capital,' which Hilferding called 'finance capital'[19], appeared as a result of the combination of monetary and industrial CS. Between the First and Second World Wars, a new regime of capitalism was established in advanced industrialized nations. Soviet Marxist economists called it 'state-monopoly capitalism,' which is based on the amalgamation of the financial and military system of the state and the group of giant CS. After the Second World War a new type of CS began to flourish in every corner of the world in

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with List's national economics, but he did not develop any systems analysis, for he regarded a 'system' as a composed set of structures and neglected its dynamic and temporal aspect. See, Åkerman (1957) and Marchal (1959).

[15] Marx, *op,cit*., p.155.

[16] *Ibid*., p.217. 'labor-time' is supposed to mean abstract working hours.

[17] Luhman (1984),S.148ff.

[18] Marx, *op,cit*., pp.625-626.

[19] For the definition of 'finance capital,' see Hilferding (1981), p.225.

which multinationals or global enterprises based in the US began to have a great influence on the world economy. This type of CS is often organized with a divisional system, which may guarantee continuous profit-making. However, division or specialization in social systems assumes an infinite and irreversible *of-chain* such as 'systems *of* systems *of*....' Consequently a compound system of CS continues to create a mass of economic 'null sets' all over the world.

IV

Since the Second World War, human society has undergone a radical change as a result of developments in information technology, which has led to the so-called '$i-$explosion,' accompanied by an excessive and uncontrollable increase in the entropy of information. Under the increase in total population the entropy of society (σ), which is an indicator of future social uncertainty, and that of information (H) tend to increase, that is, $-\Delta(\sigma+\mathrm{H})\geqq 0$. However, towards the turn of the century another tendency became apparent in the sphere of social information. That is, information itself has tended to produce a certain residue of entropy (uncertainty), which cannot be set off. We can formulate that tendency as $\Delta\mathrm{I}<-\Delta\mathrm{H}$, where $\Delta\mathrm{I}$ denote the increase in the total quantity of information (*negentropy*). Consequently various forms of digital information have dramatically rationalized a mass of human economic activities through CS. Next, we will rebuild the above arguments from the viewpoint of the relationship between information and CS.

An exchange-measure of a commodity can be transposed into a measure of information, because every commodity is regarded as a certain amount of information. As we pointed out above, time means an irreversible order. If a period of time, that is, a distance between distinct time-points, is interpreted as expressing an amount of uncountable information for continuous human life, then it becomes a volume of measure in use, which may be called *time-of-life measure* (its codomain is 'area'). We divide our days and nights into periods of being awake and being asleep. In the former period we release mechanical or thermal energy through basal metabolism and carry on physical and mental work. At a certain time we may take a break or a nap and go to bed every night. These are parts of continuous daily life. Mapping from a set of such continuous time-of-life measures to a digital set of time-periods greatly transforms ordinary human life into an abstract working process for life. A certain volume of labor-power can be abstracted from a concrete labor and consequently it forms a social stock of 'abstract use-value,' which affords the basis for a digital system of 'labor-time.' Now work or labor does not spread over continuous daily life, but becomes an object for rational calculation of a collection of time units, that is, an *exchange-time-measure* (its codomain is 'length' or 'point'). The concept of wage as a reproduction cost for labor-power appears from the condition of living, which enables workers or laborers to reproduce their continuous life and intermittent labor. This process may be called 'commercialization of labor-power.'

With regard to the calculation of 'labor-time' we must take account of 'double contingency,' which can be defined as irreversible and asymmetric variability with the uncertainty or probability of binary operators. If, as Bertrand Russell suggests in his comments on Keynes's stochastic theory[20], probability means a *relation* laid in a partial order set of propositional

[20] See, Russell (1948), Book V, Chapter V. A similar view is shared by B. O. Koopman. He did not identify

functions, it may become an expression of human relations with 'double contingency.' From such a viewpoint the exchange transactions between employers and employees may take on several characteristics; 1) asymmetry of exchange-time-measure, that is, that the measure of a '"necessary" labor-time' of an employee is smaller than that of their employer, 2) uncertainty of employment relation, or coexistence of the union of the employee for fear of unemployment and the combination of employers for uncertain sales-competition, and 3) reversible employment relation under the irreversible conditions of employment on the side of the employee. While in profit-making on alienation, an unequal exchange may take place in the comparison of different commodity prices, in employment relations the labor-time for laborers' 'necessary' expenditure of their labor-power as the abstract 'use-value' is unequally exchanged for working hours, which are 'necessary' for employers. Michael Ende, a German writer of children's stories, intuitively expressed such unequal exchange based on asymmetry of employment as 'time-robbery'[21]. On the other hand, 'Marxist revisionist' Eduard Bernstein aimed to put an end to such 'robbery' in order that everyone can realize his or her 'liberal personality' in a socialist community[22].

Systematic extension of 'commercialization' or commodity-making activity is directed by CS (more precisely, money in CS) as an operator. If we take note of the dual aspect of CS, we can regard money in CS as an operator for transforming a thing (*chose in possession*) into a commodity. From such a point of view that money may be called a *commodity-making operator* (hereafter, CM-operator). Such a CM-operator is working almost everywhere and every time in our historical world. In the sphere of labor the 'capitalist' who is the buyer of labor-power as a commodity becomes a CM-operator in order to obtain a profit on alienation through comparison of costs. On the other hand, a 'laborer' who is the 'owner' of labor-power can only remain as its seller. Such inequality of market exchange under the condition of double contingency always creates an unequal exchange-time-measure.

A piece of land is also regarded as a commodity because of its function of commodity production. Karl Polanyi reveals an excellent insight into the 'fiction' of the market economy[23]. His arguments have a more profound meaning in the context of the national economy, for they suggest a jeopardized problem of 'commercialization of a territory,' which may infringe on the sovereignty of a nation. Through the spread of monetary exchange, land brings some of the profits on alienation to its owner, but it can also be regarded as the means of realization of exchange-time-measure in agriculturally reproduced real human life, and therefore its 'commercialization' is only a result of fictitious and empty digital calculation. As a consequence of the same calculation 'capital'—especially, a joint stock company—and cultural or religious value may form a set of commodities[24]. Further, a mass of digitized commercial information causes various types of commercialization of speculative games. They are played under the

probability with measure, but interpreted its 'intuitive' character as a 'partial ordering' system. See, Koopman (1940).

[21] See, Ende (1973).

[22] See, Bernstein (1906). See also, Schulze-Goevernitz (1909). Bernstein, a 'revisionist,' was more realistic and dispassionate than Marx. Marx showed himself as a genuine 'utopian socialist' through declaring the pursuit of an impossible dream for 'the kingdom of freedom' in the future. In fact, any prediction for the future world will necessarily lose its logical background, for 'if decision is non-illusory, non-empty and non-powerless, it is also non-predictable, and the non-predictability of decision inevitably entails that of history itself.' (See, Shackle's article, *op.cit.*)

[23] See, Polanyi (1957).

[24] For the commercialization of culture, see Benjamin (1985), Agamben (2005).

condition of 'double contingency' by means of an asymmetric binary relation that compares the present with the coming (uncertain) future. However, binary operation places the absolute limits on human knowledge and still plays the essential part of the so-called 'process logic'[25]. A stochastic binary operation in 'double contingency' may also be dissolved into an ordered set of different binary relations. In an information-intensive society people must fall into a state of chaos, which is brought by an informationally commercialized *of-chain* of speculative games and certain types of 'social uncertainty'[26].

Thus all goods, services and diverse services of services that can be replaced into an amount of information become information commodities with a certain quantity of exchange-time-measure, and they are absorbed into the global network of CS. Simultaneously the proportion of real time-measure in total human life is rapidly decreasing and the bulk of exchangeable time-measure is being transformed into a set of money according to the logic of CS. Then the world of economic 'null sets' goes forward, where the discrepancy between the real and the monetary economy has grown. For thousands of years, the total framework of CS has grown until it may accept its apoptosis. Now what a number of economists have warned since the beginning of the 19th century is gradually becoming a real possibility. For example, excessive competition under globalization will accentuate the coming of the stationary state with zero-profits, regarding which Ricardo had shown theoretical foresight[27]. From another point of view, Joseph Schumpeter made a grave prediction that the world of CS could not cultivate the power of human imagination and association, which is necessary for the creation of industrial and social technology[28]. Moreover, as Friedrich List had warned the German people in the middle of the 19th century[29], the national economy, which supports the domestic production of real goods, may tend to decline under 'unrestricted' development of CS. In other words, List's economic ideal can be paraphrased that when the monetary economy ('null set') is cut off from the planned national economy as a 'measurable cover,' the latter will become transformed into a real economic system of 'National Socialism.' On the other hand, if a socialist national economy as a 'measurable kernel' is equipped with the monetary economy, it will lose 'measurable' elements from within and then become a totally rational regime of CS. We have observed such a change since the collapse of East European 'communist' nations in the 1980's and 1990's.

Nowadays there are almost no obstacles to the globalization and computerization of CS. No one in the world can regain freedom from CS, because it is an invariant and reproducible *demon* in the ever-changing and irreversible spiral of human life. In this connection, we will examine the relationship between CS and civilization.

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[25] Dux, *op.cit*., S.167ff.

[26] See, Kamitake (2008). As the number of subsets of a certain set is increasingly larger than that of the elements of the set, so is the number of social groups comprised of men and women. In fact, a set of n persons has $2^n-(n+1)$ different subsets or *potential* social groups. This calculation is perhaps the most accelerating factor of 'social uncertainty.'

[27] Ricardo, *op.cit*., pp.120-121.

[28] See, Schumpeter (1950), Part 2.

[29] See, List (1841).

V

The historical origins of CS can be found in and around Ancient Babylonia and Assyria where there had been various types of commercial calculations of money, profits or interests, and a pecuniary speculative transaction had taken place under a customary distinction between absolute sale (C－C) and monetary exchanges (M－M). Such an established business practice was partly provided for in the famous code of *Hammurabi*[30]. A combination of C－C and M－M made possible the appearance of commission merchants and money dealers who could make a profit through temporal 'comparison of comparison.' Thus we can assign the origin of the above system M－C－M′ to the commercial and financial activities of the ancient Semites, especially the Jews and the Phoenicians.

If we define the term 'civilization' as a global and irreversible movement for making a non-blood relationship or *society* that appears as an 'intersection' of similar culture areas, its fundamental form can be set up with a compound set of CS and its content with various physical forms of exchange-measure. Civilization plays a central role in transforming a mass of use-measure created in the economic life of a closed community into a numerical fraction of exchange-measure in an open society. As is observed in the ancient and modern history of the Middle and Far Eastern culture areas, there were several potentialities of civilization outside the European mainstream.

Before considering the historical relationship between CS and civilization in detail, we must elaborate a well-defined concept of cultural system with reference to the terminology of Sorokin. He explains about 'cultural system' and 'unified system' or 'unified cultural system' as follows;

> 'The nature of the change of a spatial congeries differs from that of functionally or logically unified systems. In the congeries the change would mean mainly a mechanical addition or subtraction of elements, or their rearrangement chiefly through external forces. In the unified cultural systems the change would mean a transformation of the system as a whole or in its greater part.' [31]
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> 'A cultural system has its logic of function, change and destiny, which is a result not only (and regularly not so much) of the external conditions, but of its own nature.'[32]

Interpreting these passages with his words and the terminology of systems analysis, a cultural system will be defined as a continuous copy-system with a 'bijective' operator (in the term of set theory, *automorphism*), which reproduces fundamental elements of culture (language, community, value and technology) and their complex (nation, religion, arts and science) through the operation of 'ideational' and 'sensate' factors[33]. We can roughly identify these two factors with reality and rationality. In fact, language-creating, value-assigning, society-making and technological behaviors of mankind may form a continuous process of *rational* approximation to *reality*. At the first step, common 'ideational' operators led to a

[30] See, *Die Gesetze Hammurabis* (1903).
[31] Sorokin (1985), p.17.
[32] *Ibid*., p.18.
[33] *Ibid*., p.24ff.

'unified system,' and then 'sensate' operators gradually became so dominant that the system could transform itself significantly. There is a kernel of civilization in that drastic change. Sorokin called it a 'supersystem,' which includes an essential element of *proto-civilization*, that is, a rational community or a *society*. If we denote individual cultural systems or sets of cultural and sub-cultural elements by A, B, C⋯, then $A \cap B$ or $B \cap C$ indicates a 'unified system,' and $A \cap B \cap C$ ⋯a 'supersystem.' More generally, the former is represented by $\cap C_\lambda$ (the index λ indicates an individual cultural system), and the latter by $\cup \cap C_\lambda$. Then the content of a cultural system itself can be enriched in two ways. Taking account of the system of classification by Jacob Burckhardt[34], we may assume an extended cultural system where religion appears as a subsystem of value, state as that of technology and community, and science or arts as that of 'ideational' technology. On the other hand, using the word *oikoumenê,* which Arnold Toynbee used to express the environment of human life in the Biosphere[35], we may have a relation of inclusion: oikoumenê⊃cultural system⊃(rational) society. Naturally, CS plays a fundamental part in society where it becomes CM-operator. Thus *oikoumenê* is regarded as the domain of that operator in a kind of measure space (that is, the Biosphere) where a spatial-temporal extension of *oikoumenê* accompanies that of CS, and vice versa. We may also construe *oikoumenê* to be almost equivalent to circumstance (*Umwelt*) in Niklas Luhmann's sociological theory[36]. If we denote an input set O and an operator f, we have a system (category) $O \rightarrow f \rightarrow f(O)$. Taking its duality and regarding O as an operator, then we can obtain $f \rightarrow O \rightarrow O(f)$. And if we consider O and f to be *oikoumenê* and operator (commercialization operator) respectively, the pair $<O, f>$ may be called a *generalized element* in which domain and morphism are put together. Its concept is structurally equivalent to that of Keynes's probability or of an equivalent class of integrals. For example, the generalized element of CS, which faces the so-called 'realization of price' problem, may be reduced to a probability that is defined by Keynes[37].

Next we consider the three-phase developments of the system of civilization. In the system-relationship between civilization and culture the former passes through three phases of temporal order and becomes an extended continuous system. The first phase may be called a linear proto-civilization system. If we denote by K a set of cultural systems where 'ideational' and 'sensate' elements of culture are mixed up together, and by R rational community or society, then we have a system-schema K⇒CS⇒R. This kind of proto-civilization can be found in many places and ages of the world. For example, we can find it in the Ancient Mediterranean world, or more locally in the period of national seclusion in Japan etc. European society since the 16th century brought the second phase of civilization, that is, a bilinear civilization system where the position of operator and output are changed mutually. It can be represented by the schemata 1) K⇒CS⇒R and 2) K⇒R⇒CS. The third and final phase of civilization may be characterized by a multi-linear compound system that comprises three basic systems: 1) K⇒CS⇒R, 2) K⇒R⇒CS, and 3) {CS, R} (a set of two elements)⇒T (a set of techniques) ⇒ {CS, R} . It expresses the structure of civilization since the first industrial revolution, which has continued to expand under globalization of CS. In the world history of civilization since then to the present originally 'ideational' or real elements of culture gradually

[34] Burckhardt (1969), S.41ff.
[35] Toynbee (1976), pp.27-37.
[36] Luhmann (1984), S.22ff.
[37] See, Keynes (1920), Russell (1948).

became weakened, and various types of *pseudo-culture* suitable for CS gained influence over the whole field of real human life. From now on increasing parts of countable sets of pseudo-culture may adequately replace real culture with the aid of CS and its power of globalization.

After the Second World War a generalized element with a *niche* for human beings spread over the world. Elements of rationality switched places with those of reality and held overwhelming priority over the latter. In fact, the distinction between reality and rationality, or in a more formal expression, between real and rational numbers may assume a considerable significance for human life. For civilization has transformed a set of real goods and lives of ancient communities into a mass of tangible and intangible commodities measured by rational numbers. However, the majority of mankind may not achieve the ability to regain the reality of life, because they cannot be freed from their local 'gravitational field' of CS as the *karma* of human beings and consequently have been losing their own power to control the global circumstances of nature. Even if an extraordinary human or a sublime cultural 'hero' such as Thomas Carlyle were to muster all his power for global control, he would soon be cut off from the surface of civilized society by the principle of majority rule.

VI

In conclusion, we will summarize historical facts about the role that the US has assumed as the leader of the 'crusade' for civilization in the Post War world.

Since the Second World War, the US has developed various types of global strategy. It promptly obtained the means of mechanizing and robotizing human beings in the form of automaton studies and information technology. It has become the strongest industrial society where rationalization takes the form of nullary and unary operations to transform an ordinary man into a 'one-dimensional man' who cannot accept any binary opposition. At the same time American society has organized a potentially totalitarian 'democratic' state constituted by a majority of 'one-dimensional men' who can enjoy a happy life in mind and body. For, as Herbert Marcuse properly pointed out, 'in the realm of Happy Consciousness, guilt feeling has no place, the calculus takes care of conscience.'[38]

Consequently the rationalization of 'ideational' democracy and freedom[39] has been advanced through the principle of majority rule accompanied by the 'desublimation' of humanitarianism by which to defend minority and opposition groups. American 'one-dimensional' intellectuals made devices for practicing 'institutionalized desublimation'[40]. For example, the RAND corporation 'has transfigured the world into an interesting technological game'[41], the platform of which a few selected professionals of economic analysis contributed to provide for. They also contributed to translating genuine European conventional economic doctrines into economic analysis (applied or 'abused'[42] analytical physics) or the 'USA

[38] Marcuse (1964), p.82.

[39] For the concept of freedom and democracy in American religious communities of the 19th century, see Schulze-Gaevernitz (1926).

[40] Marcuse, *op.cit*., p.79.

[41] *Ibid*., p.81.

[42] As examples of the 'abuse' we can take the mathematical 'optimization' of the kill ratio or the calculation for a political stratagem of oppression against Anti-American peoples. Another 'abuse' was pointed out by Norbert Wiener. It

economics' which may be regarded as a sort of pseudo-paradigm-science[43].

Thus the US advocates the 'freedom' to put down all kinds of 'heresy' in the capitalist world and the 'democracy' of majority rule that enables a majority to rule over a minority with a 'sword' of conventional or atomic weapons and espionage activities. Such 'democracy' justifies warfare, because every 'holy' war that is launched by the US can weaken Anti-American forces and increase the proportion of the pro-Americans in the World. This may be confirmed by a brief history of several wars: the Korean War, the Vietnam War, the Gulf War, the Afghanistan and the Iraq Attack [44]. At the same time, the series of wars formed the strongest economic sector of the American national economy. For they have created so large a demand for consumption and investment that capitalist systems in the US can break through economic cycles, particularly economic depressions.

At present, the USA has been transfigured from that which John Dos Passos[45] symbolically depicted through his 'camera-eyes' between the Wars, into a Lilliput where a mass of 'one-dimensional men' make a happy, but merciless sphere of life, or in other words, a rational game-center at which a variety of CS and its robot converge. Now American people and Americanized nations as well as *sham-socialist* peoples continue to neglect the words of the Sphinx, which, according to Carlyle[46], can be regarded as a symbol for our civilized World. *She* might admonish us thus: 'I will kill you, humankind, if you evade the question how I can kill you.'

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is the 'abuse' of mathematics in economic analysis. He stated that economists 'have developed the habit of dressing up their imprecise ideas in the language of the infinitesimal calculus,' and suggested that the lack of quantitative uniformity of economic and social phenomenon can prohibit economists and social scientists applying mathematical tools to economic and social studies. See, Wiener (1964), pp.91-92. However, we need efficient tools for analyzing the *qualitative* uniformity of social phenomenon in social sciences. In fact, Max Weber devised a *casuistic* composition of sociological concepts that enables the compilation of an encyclopedia of conceptual instruments for comparing and classifying qualities in various communities and societies. See, Weber (1978), Book I. Regrettably, his methodological procedures are not adapted for the formalization and axiomatization of social studies. They must be performed through such terms of mathematics and mathematical logic as equivalent class, set, category, structure and model. If we suppose an assemblage of mathematical symbols to be an indicator of qualitative economic and social phenomenon, we can apply mathematical logic to the analysis of various types or qualities in social sciences. Thus the category or system of measure may be applicable in the present article.

[43] After the Second World War, American mainstream economists who deliberately conflated human and mechanical system-rationality (See, Section III) forged the 'USA economics,' which could also be called economic analysis. In the Vietnam War some of them as opportunist scholars integrated themselves with the government military and strategic authorities and tried to find wide applications of 'economics' for efficient massacres with a set of various types of bomb that have devastating effects similar to those of atomic bombs. That 'economics' is not a genuine economics that aims at humanistic control of socio-economic systems, but only a suspicious and spiritless copy of analytical physics.

[44] Especially in the case of Afghanistan, the US played a war game of OEF-A under the pretext of 'War on Terrorism,' and in the case of Iraq, it started a similar game with ambiguous reasons for war.

[45] See, John Dos Passos (1930).

[46] See, Carlyle (1843), Book I, Chapter II. He visually interpreted society, nature and universe as the Sphinx.

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