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Economics as Applied Mathematics and Political Economy

-Is Economics a "Science" or a Social Thought?

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Tsuneo MORITA

Abstract

Contemporary economics is characterized by mathematical model analysis, and in the world of economics, from the 20th century to the present century, there has been a tacit understanding that economics can become a "science" from social thought by using mathematics and mathematical statistics, just as physics became a precision science by using mathematics. In line with this trend, the Nobel Prize in Economics also continues to be awarded to "mathematical models" such as laboratory models in the natural sciences. Unfortunately, the elaboration of arguments by mathematical modeling has not contributed to solving real economic problems. Why is this? What is the historical background of modern mathematical economics, what are its characteristics as a social science, and what are its limitations? This paper clarifies the pitfalls that economists tend to fall into and explains why economics cannot contribute to solving real economic problems while mathematical models are flourishing. As a case in point, I will discuss Japan's "Large-Scale Monetary Easing" policy, which has involved many economists and has continued for over a decade and examine the various hypotheses supporting the policy from a political economy perspective.

Introduction

Among the disciplines called social sciences, only economics has always tried to be "a science" like the natural sciences (physics). The foundation of human society is economic activity, and with the development of the market economy, a discipline was born that attempted to elucidate the basic mechanisms of the national economy. On the other hand, economics (its theory and analysis) has sometimes given rise to intense mutual criticism. Early classical economists who sought to understand the total economic system were also social thinkers. The attempt to analyze the economy in modern society is inseparable from the social thought and philosophy of how to view society. Since economics is not completely distinct from social thought, it is natural that the way in which economics and society are viewed is subject to criticism from those who hold different social positions. Moreover, it is difficult to establish objective evaluation criteria as in the natural sciences, and the empirical criteria for hypotheses and analysis are influenced by the ideological positions of each side, so mutual criticism often does not coincide with each other.

After the birth of economic thought, there was a long period in which "economics" was regarded as social thought (ideology). Marx's economics stands at the pinnacle of social philosophical economic analysis. The grandiose analysis of capitalism developed in Marx's *Theory of Capital* occupies a special place in human economic thought. No other work in human history has analyzed and thought about the whole economic system to such an extent. In contrast to Marx, the philosophical discussion of the whole economic system has never been a major theme in non-Marxian economics. A comparable argument could be considered the "general equilibrium theory," in which the market for the entire national economy is in harmonic equilibrium. It is a theory that proves that the capitalist economy is an economy based on market harmony (equilibrium) in response to Marx's theory that the capitalist economy is a contradictory entity. The argument on the existence of general market equilibrium has been continued intermittently, mainly among scholars of non-Marxian economics who deal with mathematical analysis.

In the 19th and 20th centuries, Marx's economic theory was regarded as the theoretical basis of the socialist movement, which necessitated an economic analysis that differed from Marx's. From this point, the main goal of non-Marxian economics was to criticize Marxian social analysis (capitalism analysis) and to construct "economics as a science" that is not an ideology. There was a growing need for an economic theory independent of social thought that could compete with Marxian economics as a social philosophy. Methodologically, formal logic, which is clearly distinguished from dialectical philosophy, was used, and the elaboration of theory backed by mathematics and statistics, following the example of physics. It came to be considered a "scientific method" that could replace economic analysis "distorted" by social thought.

In Europe at the beginning of the 20th century, various currents of economic-social theory came out and debated the validity of its social analysis and the "scientific nature" of theory. At least in the first half of the twentieth century, economists, mathematicians, and physicists engaged in cross-disciplinary debates over the criteria of science, and discussions pursued a unified understanding of science. One such theme was the debate on "making economics a mathematical science ". However, the Nazi invasion of Germany interrupted the debate in the European intellectual world, and researchers who fled the grip of fascism formed new research groups, mainly in the United States and the United Kingdom, in disarray.

In the economics world after World War II, models and theories refined by mathematics flourished mainly in the U.S., and neoclassical mathematical economics formed the mainstream of economics in the world. However, has the understanding and policy control of the real national economy progressed dramatically along with the prosperity of neoclassical economics? Looking at actual economic policy debates, it is difficult to say that the "ability to accurately grasp and analyze the real economy" of the discipline called economic science has increased.

This paper focuses on Neumann's analysis, which ignited the "mathematical science (applied

mathematics)" boom in economics after World War II, and examines the role played by Neumann. This is because Neumann is the mathematician who laid the foundation of modern mathematical economics, and by understanding the characteristics of his analysis, we can evaluate the nature of modern mathematical economics. Did the use of mathematics make economics a science? Has economics developed into a "science" free from social thought or is it still a discipline with the character of social thought or ideology (political economy)?

In Japan today, the "large-scale monetary easing" policy has been implemented for more than 10 years. What "scientific" hypotheses and analyses support this policy? What is the reality of "scientific" economics? Do the hypotheses and analyses that support this policy correctly capture the reality of the national economy? Are the "economists" who have promoted the implementation of this policy considered to be adhering to a scientific attitude, or are they merely ideological proponents of the politicians" agenda? This paper examines the hypothetical assumptions that supported the implementation of the policy and shows the limitations that the discipline of economics has yet to overcome.

I. The Neumann Revolution: Its Timeframe, Advantages, and Disadvantages

From the 1860s to the 1870s, around the same time, Marx wrote the *Theory of Capital*, the marginal utility theory was proposed in England, Austria, and Switzerland to oppose Marx's theory of the value of labor, and a non-Marxian economic theory was born. This is not an accident of history. The rise of the capitalist economy demanded a theory to support it. It is no coincidence that Marx's Theory of Capital was written in England, an advanced capitalist country. The historical period of the rise of capitalism gave birth to an economic theory with two different values. Different theories emerged depending on the standpoint from which the historical economic society was analyzed.

The examination of the concept of "general equilibrium," which Walras proposed and attempted to formulate mathematically, was passed on to the University of Vienna via Scandinavian economists (Kassel, Wissel). In Austria, which was in the historical twilight of the Habsburg Empire, there was an urgent need to construct a theory that would compete with Marx's economics to overcome the social change from an enlightened monarchy to a republic and to develop a capitalist economy. Eugen von Böhm-Bawerk (1851-1914), a theoretical supporter of Carl Menger (1840-1921), was a scholar known for his sharp criticism of Marx's labor theory of value. Austria, at a turning point in its history, produced economic thinkers such as von Mises, Schumpeter, and Hayek, who left their mark on history. The social changes that followed the collapse of the Habsburg Empire, the revitalization of the socialist movement, and the establishment of a socialist government in Hungary (1919) had a profound impact on the world

of thought in Vienna.

Some of the participants of the Mathematische Kolloquium (1928-1936)[1], organized by the mathematician Karl Menger (1902-1985), son of C. Menger, dealt with the problem of proving the existence of the Walrasian general equilibrium solution, and there the young mathematician John von Neumann (1903-1957), Hilbert assistant and then a professor at the Institute for Advanced Study at Princeton University, gave a modern mathematical solution to this problem.

In Vienna at the beginning of the 20th century, the Wiener Kreis (Vienna Circle, Vienna School of Logic and Positivism), led by Schlick (born in Berlin, 1882-1936), was very active, and mathematicians, philosophers, physicists, and others regularly exchanged ideas. Prominent philosophers, mathematicians, and social thinkers from outside of Austria were also guests at the Vienna Circle.

Menger's colloquium, which overlapped in some respects with the Vienna Circle, functioned primarily as a pure mathematics seminar where young mathematicians regularly exchanged ideas. Kurt Gödel (1906-1978) from Moravia, known for his "incompleteness theorems," was a student of Hans Hahn (1879-1937), a mathematics professor who led the Vienna Group with Schlick, and was a graduate student at the University of Vienna. In 1928, Neumann also gave a presentation on pure mathematics at the colloquium.

Menger's colloquium dealt not only with topics in pure mathematics but also with mathematical economics. Between 1933 and 1936 Wald (Abraham Wald, 1902-1950, born in Hungary), studied with Menger at the University of Vienna, Schlesinger[2] (Karl Schlesinger, 1889-1938, born in Budapest), who moved to Vienna with the establishment of the socialist government in 1919 and worked in finance, and Morgenstern (Oskar Morgenstern, 1902-1977, born in Görlitz, Germany and grew up in Vienna) gave presentations on the solution of Walras-Kassel's general equilibrium[3]. Neumann was scheduled to conclude the discussion as a guest researcher in 1936.

The Hungarian mathematician Neumann was not interested in economics in general. He had an interest in mathematical modeling in any field. One of his interests was the mathematical solution of games. The attempt to model various games, for example, card games, has long been one of the topics that fascinate mathematicians. In 1928, Neumann published a paper[4] on the equilibrium existence problem of two-player games. This later led to the generalization of game

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[1] The activities of the Mathematics Colloquium are detailed in Stadler (2015) pp. 201-223.

[2] Schlesinger never belonged to an academic institution and received private mathematics instruction from Wald and Menger; he committed suicide after the German annexation of Austria was declared in 1938.

[3] L. Punzo (1989) is a useful reference (M. Dore, S. Chakravarty, and R. Goodwin eds.:1989, pp.29-65). Note that the papers by Schlesinger, Wald, and Neumann are included in W. J. Baumol and S.M. Goldfeld eds. (1968).

[4] Neumann (1928）.

theory.

Neumann assumed that the two participants play a zero-sum game, and formulated what kind of equilibrium is achieved when each takes actions that symmetrically maximize (minimize) the gain (loss) and minimize (maximize) the loss (gain). Neumann formulated the concepts of Maxmin (Minimax theorem) and Saddle point and gave proof applying the fixed-point theorem. The mathematical formulations that summarized the duality of the forms were later used in the field of economics for linear programming and general equilibrium.

The next interest of the less than 30-year-old Neumann was "proving the existence of general equilibrium," which at the time was known as an unsolvable problem in non-Marxian mathematical economics. He learned of such a problem through a private conversation with Nicholas Kaldor[5] (1908-1986), a Hungarian economist. Neumann was interested in solving various difficult problems as mathematical models, regardless of the field of study.

During the Habsburg period, the social distance between Vienna and Budapest was much closer than it is today, and when the Hungarian Socialist Revolution took power in 1919, the Neumann family temporarily fled to Vienna. This was certainly the reason for Neumann's rejection of socialist ideology and tyrannical power[6]. In Germany, Neumann devoted himself to research in mathematics and quantum mechanics, but he had no interest in German philosophy or social thought. In economics itself, he was more interested in problems that could be pursued axiologically or in formal logic. That is why he was interested in proving the existence of general equilibrium solution. He had an intuition that the analytical methods used by classical mathematics could not solve the problem, but that topological methods could. This kind of intellectual interest always stimulated Neumann's mind.

Neumann presented his first proof idea for the existence of general equilibrium at a meeting at Princeton University in 1932. Menger then asked him to present his work at a colloquium, and in 1936 he planned to travel to Vienna, but he mailed his paper[7] to Menger from Paris and went

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[5] N. Kaldor (1989). Kaldor was five years younger than Neumann and studied at the London School of Economics (LSE) in 1927. At LSE, he met Hicks, who introduced him to the Nordic school of economics, Wicksell. Kaldor, later known as a Keynesian, was initially interested in general equilibrium theory, and in the summer of 1928 he and Neumann had lunch in Budapest on the terrace of the elegant Ritz hotel on the Danube (the site where the InterContinental Hotel now stands). This was the first encounter between Neumann and Kaldor. Neumann was 25 and Kaldor was 20. After that, they met every summer vacation in Budapest. Neumann asked Kaldor questions about problems in economics, and Kaldor introduced him to Visser's Value, Capital, and Rent, which Neumann read in a short time and questioned the approach of the marginal utility school. He wanted to see Walras's original mathematical formulation, from which Neumann learned that there existed a mathematical problem in economics called "proof of the existence of general equilibrium solutions.

[6] Neumann had lectured in Moscow during the Stalinist era and had firsthand experience with the failures of Soviet socialism. He also suggested Kyoto and other cities when deciding on the cities to drop the atomic bombs on Japan. He had a sense of rejection of tyranny, whether socialist or capitalist.

[7] Neumann (1937). This paper was to be presented at the Menger Colloquium on Mathematics after a lecture at the Institut Poincaré in Paris in 1936. The trip to Vienna was also a return trip to Budapest.

back to the USA. The mailed paper was published in the annual report of the colloquium. Neumann used “Brouwer’s fixed-point theorem” for the first time in proving the existence of a general equilibrium solution. From this point on, the use of the fixed-point theorem became the standard method for proving the existence of a general equilibrium solution.

At the time the Colloquium’s annual report was published, only a few economists had seen Neumann’s paper, and it was difficult for classical economists with no knowledge of topology to understand it. Nevertheless, Schumpeter heard of the publication of the Neumann paper and asked his disciple Goodwin to report on it.

R. Goodwin[8] (1913-1996), who had a tumultuous career that included becoming a member of the British Communist Party, returned to Harvard from Oxford University in 1937 to study under Schumpeter. According to Goodwin, around this time (1938 or 1939), he was instructed by Schumpeter to report on Neumann’s paper. He was one of the few economists who read the Neumann paper shortly after it was published. At the time, he reported to Schumpeter that it was “just a mathematical piece of work,” and afterward regretted that he could not report on the Walrasian equilibrium and the argument that the rate of profit arises from the growth of capital rather than the quantity of capital, which was of interest to Schumpeter. He recalls that he did not fully understand Neumann at the time.

This was the last time the Colloquium’s annual report was published. Hitler’s annexation of Austria (Anschluss, March 1938) forced the members of the Vienna Circle and the Mathematical Colloquium into exile, bringing an end to the intellectual circle in Vienna. Under the growing influence of Nazi Germany, tragedy struck when Schlick was assassinated by a student (1936) and Schlesinger committed suicide (1938).

However, the couple had a critical disagreement in Paris, and Mrs. Neumann returned to Hungary alone (The couple later divorced). For more information on this situation, see Macrae (1992). About 10 years after its publication, the paper was translated in the Journal of Economic Perspectives (Morgenstern translation) and attracted the attention of many mathematical economists. The English translator is George Morton, not Oskar Morgenstern because Morgenstern later changed his name. Later, he wrote *Game Theory and Economic Behavior* together with Neumann, but they never met at the Vienna Mathematical Colloquium. Morgenstern, who was born in Germany and became an Austrian citizen in 1925, had studied under von Mises and was present at the Menger Colloquium, but he and Neumann did not have the opportunity to meet at that time. After the annexation of Austria, he moved to the United States and met Neumann for the first time at Princeton University (around 1938).

F. Nikaido, a pioneer of mathematical economics in postwar Japan, studied the papers of Wald and Schlesinger in Prof. S. Yanaga's seminar (mathematics) at the University of Tokyo and later studied Neumann's papers to become a mathematical economist. My teacher T. Seki (Hitotsubashi University) was not a mathematician, but he joined the Yanaga Seminar as a research student because of the need to master mathematics and started his postwar research on mathematical economics by studying the Neumann article with Nikaido and others. After the publication of Neumann's paper, it became popular among mathematicians to use Neumann's method while giving other proofs. This led to the rise of mathematical general equilibrium theory in the 1950s and 1960s.

[8] R. Goodwin, “Swinging Along the Autostrada: Cyclical Fluctuation along the von Neumann Ray”, M. Dore, S. Chakravarty, and R. Goodwin eds. (1989), p. 125.

Later, Shizuo Kakutani[9] (1911-2004) of Osaka University, Japan, who was studying at Princeton University (Institute for Advanced Study), developed the “Kakutani’s fixed-point theorem (fixed-point of set-valued mapping),” an extension of Brouwer’s fixed point theorem (point-to-point mapping), under the advice of Neumann. At that time, Neumann’s seminars were attended by outstanding mathematicians from all over the world. After World War II, John Nash[10] (1928-2015), while still a graduate student, published an equilibrium proof of a game (1950) using Kakutani’s fixed-point theorem, which won the Nobel Prize in Economics 44 years later in 1994. This year’s Nobel Prize in Economics commemorated the 50th anniversary of the publication of *Game Theory and Economic Behavior* by Neumann-Morgenstern, and three researchers in game theory were awarded the Nobel Prize in Economics. John Harsanyi (1920-2000) also received the prize, a junior at Budapest Fasori High School (Budapest-Fasori Evangélikus Gimnázium), where Neumann graduated.

Curiously, many Japanese researchers specializing in game theory explain that the foundation of postwar mathematical economics began with Nash. They base this on the fact that “Nash equilibrium gave a more general solution” with Kakutani’s fixed-point theorem, which generalized Brouwer’s fixed-point theorem, which Neumann used. The method of using an extension theorem to give a different proof is not uncommon in mathematics. It goes without saying that it is worthwhile to be the first to use the theorem and prove it. Neumann was the first to show that the “fixed-point theorem” was the mathematical core of the proof of the existence of equilibrium solution, and subsequent research on the existence of equilibrium solution has

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[9] Samuelson, a leading figure in neoclassical synthesis, while reminiscing about Neumann, mentions an episode of Shizuo Kakutani in M. Dore, S. Chakravarty, and R. Goodwin eds. (1989), pp. 114-121. Kakutani was asked by someone, "I think you are a great mathematician," to which he replied, "No way, I am a mere nothing". He was further asked, "If you are not a great mathematician, who do you think is a better mathematician than you?" He thought for a while and answered, "John Von Neumann".

[10] Nash's paper is included in H.W. Kuhn and S. Nasar eds. (2002). When Nash showed this paper to Neumann, Neumann said, "It's trivial, you know. That's just a fixed-point theorem" (Sylvia Nasar: 1998, p. 94). Nash later recalled that "Neumann was jealous [of his talent]". However, this is Nash's innate vanity. From the mathematician Neumann's point of view, there were no new ideas or mathematical discoveries in the Nash paper. That is why he was not interested. In fact, Nash's lack of achievement as a mathematician caused him to develop schizophrenia due to the conflict and frustration of vanity and a sense of inferiority.

In 1994, the Nobel Prize Selection Committee and the General Assembly of the Swedish Academy of Sciences, the final decision-making body, were faced with a number of objections to the award being given to game theory itself, doubts about the evaluation of Nash's work, and doubts about the "scientific nature" of economics, and the decision to award the Nobel Prize to the three winners was made just in time to receive the necessary affirmative votes. The reason for this is related to a point made by Neumann in response to Nash's paper. Mathematicians are potentially frustrated by the lack of a Nobel Prize in mathematics. However, scientists from other fields questioned the awarding of a Nobel Prize for the application of an existing mathematical theorem to an economic problem, even though the mathematician had not done any work as a mathematician.

A. Lindbeck, the long-time chairman of the Nobel Committee on Economics, resigned from his post, taking responsibility for this confusion. The incident showed that there is great resistance among scientists in other fields to consider economics as a "science". For more information, see Sylvia Nassar (1998), Chapter 48, "The Prize".

changed the conditions or used extension theorems, and these are second-hand studies that provide alternative proofs to the original research.

It cannot be denied that the foundations of modern mathematical economics on the existence of equilibrium solutions were laid by the mathematical genius Neumann. However, contemporary neoclassical mathematical economists are trying hard to erase Neumann's shadow from postwar mathematical economics. They ignore Neumann and avoid comparisons with him by naming Nash, who left no mathematical achievements, as the founder of the discipline. This is because most of the postwar mathematical economists are those who couldn't make any achievements in mathematics and therefore moved from pure mathematics to mathematical economics as applied mathematics. It is hesitant for such researchers to recognize the economic model analysis initiated as a side work by the mathematical genius Neumann as the starting point of their research. However, whether contemporary mathematical economists ignore him or not, the fact remains that Neumann was a pioneer who paved the way for the rise of modern mathematical economics. Scholars who have made the transition from mathematics to economics as applied mathematics can hardly thank Neumann enough[11].

As many Nobel laureates in economics have recognized, Neumann made a significant contribution to the development of mathematical economics. At the same time, he distorted the character of economics as a social science. He spread a false perception in the economics community that modern economics is the mathematical modeling of economic analysis, like physics, and that this is the establishment of "economics as a science" that breaks away from social thought such as Marxian economics. As a result, mathematical economics has turned into applied mathematics.

Applied mathematics is undoubtedly a discipline, but the mathematization of economics has not contributed to a deeper understanding of the real national economy. The "economic behavior" of extremely abstract assumptions and economic agents is so far from reality that, compared to the sophistication of the models, there is little that contributes to a realistic understanding of the economy. To avoid the difficulty of analyzing the real economy, researchers seem to have fled to the world of abstractions that can be processed mathematically. This is a similar phenomenon in Marxian economics that has degenerated into an exegetical study of the *Theory of Capital* by

[11] Neumann's contributions to modern mathematical economics go beyond the development of game theory and the use of the fixed-point theorem in equilibrium analysis. Many of the ideas, methods, and concepts used by later mathematical economists, such as the methods and concepts of activity analysis and production aggregates, linear production functions, the description of activity forms by inequalities rather than equations, and the clarification of the concepts of optimal growth and harmonic growth, were mathematically clarified by Neumann. For a detailed discussion of Neumann's contributions to mathematical economics, see M. Dore, S. Chakravarty, and R. Goodwin eds. Mathematical economists who have turned from mathematics to obtain a regular job and fame in "economics" should not be able to forget their appreciation of Neumann, since it was by taking advantage of Neumann's innovations that they were able to win the Nobel Prize, which could not be obtained through mathematics.

Marx. Researchers who have moved from the field of mathematics to mathematical economics are rarely interested in real economic problems but rather focus exclusively on simplified abstract mathematical spaces. They rarely have anything to say about the real economy based on the results of their own research, and rarely do they speak on real economic issues. Economics, as an applied mathematics, may exist as a discipline, but it does not contribute to the analysis of economic society. This is extremely unfortunate. Neumann's innovations have distorted the character of economics as a social science. However, this is not Neumann's fault, but rather the result of the secular calculations of mathematicians who turned to economics and the peculiarities of American economics education[12].

Neumann himself was not interested in economics as a social science (philosophy or ideology). He may have thought that economics would become a "science" if it could be expressed in mathematics like physics. However, after game theory, Neumann was never involved in economic problems. Perhaps he did not think that economics was a science that could yield practical results. His interest gradually turned to the realities of the Cold War, and he devoted himself to the development of the atomic bomb and the computer.

Mathematical economics, which was inspired by Neumann, is now at its peak, and there is a widespread misconception in the economics community that creating mathematical models constitutes "science". Any economic analysis that cannot be turned into a mathematical or statistical model is regarded as a social ideology or ideology. In the early years of the Nobel Prize in Economics, the prize was awarded to the founder of a theoretical analysis of the total national economy, but after that phase, the prize has been awarded to the developer of a mathematical model of a partial economic phenomenon. Nowadays, political economy analysis has been excluded from the nomination for the Nobel Prize in Economics from the beginning.

Are mathematical economic models the "scientific economics" and political economics an ideology? It is not that simple. No matter how popular mathematical models become, they do not seem to have improved the accuracy of economic analysis. No matter how sophisticated the models become, they have not helped to solve real national economic problems. Why is this?

II. Neumann's Trap - Mathematical Models are Tautological

In general, in model analysis, a conclusion is first reached, then the logic that can reach that

[12] A. Leijonhufvud's (1973) fable, "Life among the Econ", is an ironic allegory of the American economist community. The social class hierarchy of the Econ (the economics village) consists, at the top of mathematical economists, followed by microeconomists, macroeconomists, development economists, empirical researchers, and so on down the hierarchy. This hierarchy is ranked according to the ability to create sophisticated mathematical models. Microeconomists are depicted as a group whose totem is the supply-demand curve, and macroeconomists as a group whose totem is the LM-IS curve.

conclusion is found, and the variables and preconditions that are adaptable to that conclusion are constructed. Instead of analyzing actual concrete facts, model analysis retroactively finds the logic and preconditions that generate the conclusion and reconstructs the logic from there. The success or failure of a model constructed by such a method is judged by the validity of the premises and the consistency of the logic that leads to the conclusion. Whether or not the model has a realistic basis (supported by facts) is not relevant in determining the success or failure of the model. A model is valid if it is rigorously defined and if the logic leads to the conclusion without contradiction.

A mathematical model is tautological in a sense because it is constructed so that a conclusion is reached from the beginning. In the sense that the logic that leads to the conclusion is worked out before the proof procedure is performed, it is also a tautology as an actual act of thinking.

The Neumann model is no different in this respect. At the end of his paper, Neumann wrote the following note.

"Note that these characterisations are possible only on the basis of our knowledge that solutions of our original problem exist – without themselves directly referring to this problem. Furthermore, the equality of the maximum in the first form and the minimum in the second can be proved only on the basis of the existence of this solution".[13]

This note reminds the reader that "proof of the existence of an equilibrium solution does not prove the actual existence of the solution, but shows that if an equilibrium solution exists, it is possible to prove it in this way". In short, he asserts that the argument over the existence of general equilibrium solutions is an argument that has nothing to do with whether actual equilibrium states exist or not.

Neumann's eight-page paper was described by Weintraub as "the single most important article in mathematical economics"[14]. It is littered with ideas and mathematical methods that have become the foundation of contemporary mathematical economics. Subsequent mathematical economists have established themselves as mathematical economists by deciphering Neumann's article, further developing his ideas, and providing alternative proofs. In this sense, Neumann's pioneering work is unparalleled. Of course, not all the ideas presented in the eight-page paper are original by Neumann. Neumann did not note anything about how he learned his economic ideas and from whom he learned them. It is certainly the basic ideas based on formulations by Cassel

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[13] Neumann (1945), p.9.

[14] Weintraub (1983), p.13. Weintraub relates a story he heard from A. Leijonhufvud about a seminar in Berlin attended by J. Marschak. At that time, Leo Szilard, a Hungarian physicist, was presiding over a seminar of mathematicians and physicists in Berlin, and he apparently asked Marschak to give a presentation on the topic of economics. When Marshak introduced Walras's general equilibrium theory, one of the mathematicians challenged him, saying that he should use inequalities instead of equations. The mathematician was Neumann, who is estimated to have been around 1928. For more information on Szilard and other Hungarian scientists of this period, see Georgy Marx (2001).

and Wald, but it is not known whether Neumann met Leontief, who was in Berlin at the same time.

One thing is clear, however: the use of the fixed-point theorem for equilibrium proofs was Neumann's original idea, and it must have been an idea that came to his mind instantly when he heard from Kaldor about the problem. He was a proponent of the modernization of mathematics based on axiomatic principles and excelled at constructing models and theorems based on axioms. The problem of the existence of a general equilibrium solution was another example of axiomatic model building for Neumann, demonstrating the effectiveness of his mathematical approach.

It was Neumann's idea that it was impossible to solve the existence problem of general equilibrium solutions using classical functional analysis, but that topological mathematics could be used to prove the existence of such solutions. Brouwer's fixed-point theorem shows that there exists a fixed point on a self-mapping (continuous function) on a compact convex set. If we construct a model in which this fixed point is the equilibrium point, the problem of the existence of a general equilibrium solution is solved. This is Neumann's goal. Kakutani's fixed-point theorem, which Nash used, is a natural extension of Brouwer's theorem, and Neumann also gave advice on the completion of Kakutani's theorem. Therefore, it is assumed that the reason why contemporary mathematical economists are so eager to praise Nash and ignore Neumann is that they do not want to admit that Neumann is the starting point of contemporary mathematical economics.

Be that as it may, as the Neumann model shows, the crux of the model analysis is how to use the mathematical theorem that provides the solution to the problem. Here, the economic problem is reduced to a mathematical problem. The problem is being replaced with how to use mathematical theorems. So, conversely, even if a solution to the problem is given, it does not prove the existence of equilibrium in the real economy.

The axiomatic approach is based on very strict logic (mathematics). Conclusions are drawn by applying the strictest possible formal logic to the most abstract object possible. Logical models do not require any empirical support for their conclusions. A logical model is, in this sense, a tautology. Even if it makes sense as mathematics or logic, it is not an argument of social science as an empirical science. An economic analysis that is not based on an analysis of the actual social economy cannot be that of a social science.

The study of mathematical economic models using modern mathematical methods inspired by Neumann had a revolutionary rise in the world of economics during the 1950s and 1960s. The study of equilibrium models became the sole domain of applied mathematicians who had moved from mathematics[15].

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[15] The successor to Neumann's article, which became the postwar merkmal of mathematical economics, is K. J. Arrow and G. Debreu (1954).

Naturally, there were critical arguments against the rise of deductive general equilibrium models.

One was the proposal of the "imbalance (imperfect competition)" theory in contrast to the equilibrium (perfect competition) theory. There are various imbalances in the real world. In particular, the imbalances in the capitalist economy in the 1930s gave rise to Keynesian economics. Kaldor, who had studied general equilibrium theory, became a Keynesian in the 1930s and broke away from the general equilibrium school. In 1925, Kaldor[16] spent a summer vacation with his family in Bavaria. There, he encountered the German hyperinflation after world war I. This attitude of facing real problems rather than abstract models paved the way for Keynesians to deal with macro imbalances. Keynesians also created mathematical analyses of imperfectly competitive market models and developed mathematical models of macro imbalances. However, the mathematical methods used in the mathematical modeling of imbalances are basically based on the description of imbalances in physical phenomena and lack the characteristics of socioeconomic analysis (see below).

From the 1950s to the 1960s, mathematical modeling of general equilibrium became the mainstream of mathematical economics. However, general equilibrium models gradually fell out of the mainstream of mathematical economics as economic reforms in socialist countries failed and the social turmoil caused by the Vietnam War continued. It was at this time that Kornai's *Anti-Equilibrium*[17] attracted attention. Kornai argued that the deductive method based on axioms (normative theory) was a tautology and that it was necessary to describe the economy using inductive empirical theory.

Kornai introduced the concepts of "shortage" and "surplus" as descriptive, rather than mathematical concepts of disequilibrium, and distinguished between shortage and surplus economies. Kornai's theory of socialist economies as typical shortage economies attracted attention as a theory of system transformation in the socialist bloc and became the theoretical basis for the intellectuals who led the system change. Kornai's theoretical advocacy is noteworthy in the sense that it became an intellectual force that moved the real world. Although he deserved the Nobel Prize in Economics, he was not awarded the prize because of the analytical characteristics of the political economy.

It should also be noted that Leontief warned against the abstract mathematical modeling of modern economics when Kornai published his *Anti-Equilibrium*. In his presidential address[18] at the annual meeting of the American Economic Association in December 1970, Leontief criticized the current state of economics, which has become extremely mathematical-statistical, and

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[16] Kaldor (1986).
[17] J. Kornai (1970).
[18] W. Leontief (1971) pp. 1-7.

emphasized the importance of research supported by empirical facts. The following is a list of his main points.

"I submit that the consistently indifferent performance in practical application is in fact a symptom of a fundamental imbalance in the present state of our discipline. The weak and all too slowly growing empirical foundation clearly cannot support the proliferating superstructure of pure, or should I say, speculative economic theory" (Leontief [1971], p.1)

"Uncritical enthusiasm for mathematical formulation tends often to conceal the ephemeral substantive content of the argument behind the formidable front of algebraic signs" (Leontief, ibid. p.1-2)

"In no other field of empirical inquiry has so massive and sophisticated a statistical machinery been used with such indifferent results. Nevertheless, theorists continue to turn out model after model and mathematical statisticians to devise complicated procedures one after another. Most of these are relegated to the stockpile without any practical application or after only a perfunctory demonstration exercise. Even those used for a while soon fall out of favor, not because the methods that supersede them perform better, but because they are new and different" (Leontief, ibid. p.3)

"True advance can be achieved only through an iterative process in which improved theoretical formulation raises new empirical questions and the answers to these questions, in their turn, lead to new theoretical insight. The "givens" of today become the "unknowns" that will have to be explained tomorrow. This, incidentally, makes untenable the admittedly convenient methodological position according to which a theorist does not need to directly verify the factual assumptions on which he chooses to base his deductive arguments, provided his empirical conclusions seem to be correct" (Leontief, ibid. p.5)

Both Kornai and Leontief argued that the method of economic analysis should be inductive and empirical, based on empirical facts, rather than the deductive model setting. Kurnai's work was not about the existence of equilibrium, but about how we should view the imbalances that exist in the real economy. Leijonhufvud's "Fable" written in 1973 was also published during this period. It tells us that an innovation in economics to replace the deductive equilibrium theory was the need of the era.

In the 1960s and 1970s, the United Nations Statistical Commission took the lead in developing a macroeconomic statistical system for standardization to integrate input-output tables and various economic accounts to capture the real and financial flows of a country. The international standardization of economic statistics occupies an important place in the history of economics in terms of establishing a reliable system of empirical data.

However, compared to the development of these economic statistical systems, economic theory and analysis have not evolved to the point of making the mechanisms of the national

economy controllable. No matter how much we may draw on the theorems of physics and mathematics, economic analysis cannot progress without analyzing the economy and society itself. It will be a long time before economics can become a science.

III. Equilibrium, Balance, and Growth

1. ex-ante and ex-post

As Neumann's statement above makes clear, the proof of the existence of an equilibrium solution that analyzes models in an axiomatic or deductive way is the theory of ex-ante equilibrium. Whether or not actual equilibrium exists is not the issue here. Since equilibrium is assumed to exist, it can be characterized as an ex-ante equilibrium theory.

In contrast, an argument based on an accounting balance is an ex-post equilibrium. For example, the Input-Output Table developed by Leontief is an example of the ex-post equilibrium. All national accounts tables, including the Input-Output Table, are accounting balances and describe ex-post equilibrium.

At the time of the Russian Revolution, Leontief was interested in the material balance tables developed by the USSR Bureau of Statistics and wrote articles[19] about the significance of the material balance methods in the Bureau's journal. These were written during Leontief's years as a Leningrad University student. He attempted to develop material balances into the input-output tables and their analytical methods based on them, which he devised after emigrating to the West.

The Neumann model is an ex-ante equilibrium model, and the Leontief model is an ex-post equilibrium model. All accounts in the national accounting system represent an ex-post equilibrium called "balance". Ex-post equilibrium is a balance that is recorded regardless of whether there is a surplus or a shortage and does not represent a market equilibrium in the sense that supply and demand coincide, but rather a concept that represents the ex-post balance on the accounting. In this sense, the term "ex-post equilibrium" is misleading. However, the theoretically assumed ex-ante equilibrium and ex-post balance are clearly distinguishable concepts, and as a practical matter, it is the ex-post balance that can be captured by statistics.

Leontief not only extended the material balance tables of the USSR Central Statistical Office but also developed a method of input-output analysis based on them. Assuming the input-output structure obtained from the input-output balance to be invariant and by interpreting the accounting balances as a causal relationship, the input-output analysis can be described as a functional relationship where final demand determines output. This is a method for analyzing the spillover

[19] The Balance of the Economy in the USSR in N. Spulber ed. (1964). This is an English translation of a short article published in Gosplan's journal *Плановое Хозяйство* (December 1925, pp. 254-257). Spluber's volume contains English translations of the main articles published in the journal. The full text of this volume is available in the public domain (https://doi.org/10.2979/FoundationsofSovietS).

effects of changes in final demand, assuming the production structure (input-output relationship) is unchanged.

The input-output table for year t can be described by using an input-coefficient matrix (A), output vector (x), and effective demand vector (f) as follows.

$$A^t x^t + f^t \equiv x^t$$

Although it involves the a priori operation of calculating input coefficients, the equation expresses thus far a matrix and vector representation of the input-output balance. To that extent, the above is an identical equation. By reading this equation as a function with X as a variable, it can be interpreted into a functional equation that determines the output in year t+1 from the effective demand in year t+1, assuming that the input-output structure in year t is unchanged, where I is the unit matrix and $(I-A^t)^{-1}$ is the inverse matrix of $(I-A^t)$.

$$x^{t+1} = (I-A^t)^{-1} f^{t+1}$$

Can this production decision mechanism be characterized as ex-ante equilibrium theory? Kornai recalls that he didn't feel an affinity with Leontief"s analysis because he considered this analytical method "deterministic"[20]. However, Leontief"s input-output analysis is a formula for determining the level of production in the next period based on the ex-post equilibrium of the previous period and therefore essentially differs from the ex-ante equilibrium theory. In other words, it is a determinant that assumes the ex-post equilibrium of the previous period.

In other words, in this case, by adding a causal interpretation to the accounting balance, the input-output relationship is read as a causal equation (functional relationship). The balance table itself represents the ex-post equilibrium, but by reinterpreting it as a causal relationship, it is converted into an expression for determining the output in the next period. However, input-output analysis cannot be said to be an ex-ante equilibrium theory in the sense that it is based on the ex-post equilibrium of the previous period.

2. Identical Equation and Causality

The accounting balance displays an identity relationship. Like the input-output table, gross domestic product (GDP) is also statistically defined as the balance between gross output (GDP on the production side) and gross expenditure (GDP on the expenditure side). Gross domestic product is the total domestic value-added output from the production side and is calculated from the accumulation of corporate income. On the other hand, what is produced and sold is assumed to be purchased and consumed (expenditure), and the total consumption (expenditure) of goods is assumed to be equal to the total production. From this, we obtain the following identical equation.

Gross Domestic Product (GDP) ≡ Gross Domestic Expenditure (GDE)

[20] Kornai (2006), English version p. 141.

where GDE≡ domestic consumption (C+G) + investment (I) + net exports (ΔE), C is private consumption and G is general government consumption.

In macroeconomics, this identical relationship is called the two-sided equivalence. Since there is a distributive process in the process from production to expenditure, the above identity can be further described as follows.

Gross Domestic Product ≡ Distributed Domestic Income ≡ Gross Domestic Expenditure

In Japan, this identical relationship is called the three-sided equivalence.

However, no macroeconomics textbooks accurately describe two-sided and three-sided equivalence. Most economics textbooks simply refer to these equivalences as the "principle of macroeconomics", but do not explain what exactly it means. Do the principles mean "axioms" as "self-evident truths" and "equilibria" that always hold? If so, what is the "equilibrium that always holds"? No textbook has accurately described these identical relationships, even though it is stated as if it were a natural truth. This ambiguity is the cause of the misinterpretation of GDP growth factors that we will see later.

GDP statistics are adjusted to determine the accounting balance based on the assumption that total production and total expenditure should be equal ex-post. Errors that cannot be compensated for are treated as "statistical discrepancies". In this sense, two-sided equivalence or three-sided equivalence is an expression of the accounting balances of GDP and has no further meaning. To call them as if something special like "two-sided" or "three-sided" is a tautology. Moreover, it is a double fallacy to treat it as an axiom, as in the "principles of macroeconomics".

Many economists, however, read these identical relationships as causal relationships. Theoretical economists do not make any clear criticism of this type of misunderstanding. This is the reason why the erroneous argument is left unchecked.

Not only economic commentators and economists but also politicians who take this argument seriously argue as if increasing consumer spending is a sufficient condition for GDP growth, since consumer spending accounts for more than 70% of GDP. This argument is a simple tautology. A numerical example of this is as follows.

Given a simple identity like 7+2+1 ≡10, and if you can change 7 to 8, then you can get 8+2+1≡11.

This argument is a mere arithmetic tautology that discards the analysis of GDP growth factors.

Of course, the identical equation can be read as a functional equation, as in input-output analysis. For example

GDP = F (C, G, I, ΔE),

but there is no guarantee that GDP is a simple linear function of private consumption. It is a simple tautology to assume that GDP will grow if consumer spending increases without analyzing under what social conditions consumer spending will increase or decrease. It is an elementary error of

analysis to draw causal conclusions directly from the identical equation.

3. Inorganic and Organic Equilibrium

Equilibrium treated in mathematical economics is the same as those treated in physics (inorganic world), which is incorporated into economic topics as mathematical applications. Therefore, it is important to consider the degree of closeness and similarity between the problems in economies and those in the physical world.

The equilibrium state that physics treats is not the equilibrium of the entire world, but the equilibrium of a well-defined system. It is an equilibrium in a laboratory where conditions are limited, and its reproducibility can be verified. When the system under study is in a state of inactive equilibrium, we can observe how external factors that disturb the equilibrium act, and how the results of these actions behave and converge (diverge) to the equilibrium state.

In contrast, the "market" targeted by mathematical economics does not specify what kind of real market is assumed and what kind of assumptions are made. It only discusses variants based on a simple supply-demand curve. This cannot be a theory of the real economy and is a crude argument that cannot even be compared to the study of equilibrium states in physics.

In the world of mathematical economics, the basic question of whether human economic activities can be discussed based on equilibrium conditions such as those assumed in physical phenomena has not been discussed. In all the enthusiasm for the inclusion of physical mathematics, the basic question that the analogy with physical phenomena is possible or not is missing from the discussion. The first question that needs to be asked is whether it is appropriate to talk about human economic activity as an analogy for the equilibrium state of physical phenomena.

There is no static equilibrium in human economic activity as assumed by physics and mathematics. Supply and demand are never in equilibrium, whether in individual markets or at the national economic level. There are always surpluses and shortages in the production and sale of all commodities, and surpluses are cut off (discarded) and shortages are replenished. This trial-and-error process is repeated constantly. This process of adaptation continues indefinitely, and through this process of "selection (adjustment)," a posteriori equilibrium is achieved. Neither in the short term nor in the long term is there an equilibrium as assumed by mathematical economics. There exists only an ex-post equilibrium, which is a temporary state achieved through an "infinite selection (adjustment) process" of constant disposal and replenishment. Even in economies where there is no economic growth, there is an infinite process of elimination and replenishment. The real equilibrium captured by economics exists only as an accounting balance of income and expenditure at the end of a certain period.

In this view, economic fluctuations and equilibria can learn more from biology (including biomedical science), which analyzes the organic world, than from physics, which analyzes the

inorganic world. Economists should learn more from the growth and adaptation processes in the organic world, such as biology and biomedicine, rather than being stuck in the abstract world with an inclination toward mathematics and physics.

4. Balance, Growth, and Decline in the Organic World

Is the fact that the national economy has grown without going broke proof of a balanced economy, and therefore, the meaning of discussing general equilibrium? The essential difference between equilibrium in the inorganic world and equilibrium, growth, and decline in the organic world is not considered in this assertion.

Human beings as living organisms and economic societies are in the organic world. In the inorganic world, once a state of equilibrium is achieved, it does not change unless an external force is applied. It is this kind of equilibrium in the inorganic world that is expressed in mathematics. In the organic world, such as the human body, however, the components (cells, organs, and organs in the human body) are always active and maintain a state of dynamic equilibrium. Unlike the inorganic world, where the components are in a state of inactive equilibrium, in the equilibrium state of the body, chemical actions and electrical signal transmission are always in operation, and this dynamic equilibrium state maintains the normal functions of the organism. Even if a chemical or electrical disturbance occurs for some reason, the equilibrium state of the human body is maintained if the action of restoring normal values is functional. In other words, the equilibrium state of the human body is a dynamic equilibrium state, which should be considered a state of balance as distinguished from a physical equilibrium state. This is the decisive difference from the equilibrium state of the inorganic world.

If the dynamic equilibrium state is disturbed for some reason and does not return to the normal equilibrium state, various inconveniences will occur. Drugs and surgery are used to restore the body's chemical and electrical functions to normal, but excessive drug administration or too much invasive intervention can prevent the return to equilibrium and cause various deviations from the dynamic equilibrium state. This leads to more serious problems.

From childhood to adolescence, cells proliferate, and muscles and brains grow, but this is a diminishing process, and after a certain age, the process of degeneration (shrinkage) begins. Once the process of shrinkage begins, no matter how much nutrition is provided, the musculature does not proliferate, and excess energy is stored in the body and put a strain on internal organs and organs.

Human society, like living organisms, is stabilized by maintaining a state of dynamic equilibrium. Equilibrium is not a world of inactivity, as in the inorganic world, but a world in which dynamic equilibrium is maintained through constant activity. All activities in human society, whether in growth or in decline, are carried out without interruption. The equilibrium state during

growth or decline is also a dynamic equilibrium.

Whether in growth or in decline, fiscal and monetary interventions, and measures to stimulate the real economy can be counterproductive if not properly managed. Therefore, it is necessary to determine what kind of dynamic equilibrium a country's economy and society are in, whether it is an economy that continues to grow as cells multiply or an economy that continues to decline as the population decreases and the society shrinks. Without such socioeconomic analysis, if economic policies are implemented based on the unrealistic assumption that the economy will continue to grow unilaterally, the policy measures will eventually turn into factors that impede the normal functioning of the economy and society.

If we ignore the essential difference between the equilibrium state of the inorganic world and that of the organic world, we will not be able to correctly grasp the development (growth) and stagnation (contraction) of the economy and society, and we will not be able to make appropriate policy recommendations. No matter how much we rely on mathematical modeling to mathematically elaborate the equilibria and divergences of the inorganic world, we will always be far away from grasping the real world. Rather than attempting to understand reality with existing mathematical theorems and tools, it is necessary to take a research stance that starts first and foremost with an analysis of the political, economic, and social realities. Otherwise, economics will end up being a house built on sand and an arcane spell of the Econ-tribe.

5. Restoration of the Political Economy

The desire of economists to "scientify" the discipline of economics by using mathematics is understandable, but the reduction of an economic problem to an applied mathematical problem and the finding of its solution does not "scientify" economic analysis. What is solved using mathematics is the "economic problem" that is reduced to an infinitely abstract mathematical problem. Therefore, even if an applied mathematical solution is gotten, it does not help to solve a real economic problem.

Most of the applied mathematical "economists" have no experience working in the real economic world as businesspeople. Moreover, most of them have no interest in real economic problems. No doubt that applied mathematics-oriented "economics" is also a discipline, but it is a field of study that has nothing to do with the real economy. Therefore, it is not surprising that no matter how many Nobel laureates there are in economics, there are fewer results that are useful for real economic problems than in other scientific fields.

Some mathematical economists believe that economics can become a "precision science" by utilizing the mathematical methods used in physics, taking a cue from the fact that physics has become a precision science with mathematics. However, false analogies and imitations do not produce results.

Physics is an inorganic world. It is not an organic world like the biological (human) world. It is a mistake to think that theorems and laws of the inorganic world can be applied directly to the organic world. Regardless of whether it is inorganic or organic, mathematics is a science that treats quantity as a form that discards the qualities of the world. Furthermore, the ideas and mathematical methods of physics used in economics are not systematically applied to the whole economy, but rather subjectively to partial economic phenomena (subjective facts that one considers to be phenomena) to which one considers applying mathematical theorems being available. If economic analysis is to be considered a social science, it is necessary to empirically verify the subjective facts one assumes before applying mathematical methods. Otherwise, it is just an applied mathematics.

The material capture of physics is a separate field of study in the areas of elementary particles, atoms, and molecules. Solid-state physics, geophysics, and astrophysics also form relatively independent research areas. Although physics has a systematic structure from the world of elementary particles to the universe, it is far from being able to elucidate the transient world that connects the various fields, and the current system of physics does not fully understand the entire world and universe. Therefore, the environmental (experimental) conditions are always clearly set for the problems discussed in physics. Moreover, the environmental conditions of the experiment must be reproducible no matter where the experiment is done. Anything that is not reproducible is not considered scientific proof.

In contrast, many of the problems discussed by “economists” who have become applied mathematicians do not specify any realistic environmental conditions. They are reduced to abstract mathematical problems without specifying what kind of economy, what kind of market, and what kind of economic agents they are discussing. An argument that applies to any economy is an argument that is contentless for the social sciences. Merely applying the arguments of physics and its mathematical formulations to “economic problems” does not constitute an argument for economics as a social science. No matter how many mathematical models are created, arguments without realistic support are useless for understanding the real world.

Economics as political economy or the sociology of political economy needs to clarify once again the foundation on which the discipline relies. Rushing to produce a paper and creating an applied mathematical model that lacks content is not economics research as a social science.

IV. Examining the Hypothetical Assumptions of Large-Scale Monetary Easing Policy in Japan - Discrepancy between Theory and Reality

In evaluating the “scientific nature” of contemporary economics, Japan’s policy of large-scale monetary easing, which has continued for more than a decade, is an ideal material for examination.

The 10-year period is enough time to examine the effects of the policy which is an unprecedented long-term policy experiment in normal times.

Many economists have distanced themselves from this policy to avoid political considerations and involvement, in which politicians have intervened strongly. However, those who claim to be economists, including these researchers, should clarify their own views on the hypotheses and policy effects of the policy that was vigorously promoted as a policy backed by various assumptions. Was the policy of large-scale monetary easing, touted as “Abenomics,” a policy implementation that can withstand scientific verification, or was it merely political propaganda (economic policy ideology)? If the latter is the case, then mainstream economics, which has excluded political economy and promoted mathematical modeling, has failed to have any influence on the implementation of economic policies that affect a country's economy and society over a long period of decades. The gap between theory and policy, and between theory and practice, is so great that economics itself, whether mathematical or political economy, must be called into question as a “social science” that solves the real problems of the national economy. Is economics really a “science” that can solve the problems of the national economy?

This section does not discuss the pros and cons of the policy of large-scale monetary easing but rather clarifies the author’s views on the various hypothetical assumptions that supported this policy.

1. Responsibility and Pride as a Researcher

There were several important policy (hypothetical) goals for an unusually large amount of monetary easing which was initiated by the Abe cabinet and the Bank of Japan in 2013.

(1) If price increases of around 2% can be generated, deflation can be overcome. For realizing the target, inflation targeting (price increase target) is introduced based on the assumption of rational behavior of consumers.

(2) A virtuous cycle is achieved in which consumption stimulates production, which in turn generates higher wages and further increases consumption.

(3) Gradual and long-term expansion of the money supply is not effective for achieving this goal. To accomplish this goal, the Bank of Japan should supply enough large amounts of money in a possible short period.

(4) Low-interest rates and ample supply of funds promote investment, stimulating not only production but also the stock market, while the yen's depreciation expands exports.

(5) The BOJ's underwriting of JGBs will not cause problems, because the government and the BOJ are in the relationship between parent and subsidiary companies.

The last of these hypotheses is not an easing policy hypothesis, but a hypothesis developed by some economists as an argument that downplays the problem of government debt accumulation

in a situation where the government continues to accumulate further public debt resulting from the monetary easing policy. After stepping down as prime minister, Shinzo Abe stated in a series of speeches that there would be no problem in increasing the amount of public debt because the credit of BOJ would offset the debt of the government, based on the "BOJ is a subsidiary of the government" theory. In response, opposition party lawmakers submitted a written question to the government. In its written response to the letter of inquiry, the government denied the assertion that "the Bank of Japan is a subsidiary of the government" (written response dated May 24, 2022)[21], but it is puzzling that no scholars from the standpoint of economic theory have clearly stated their opinions on this argument. In the West, such arguments are not overlooked by economists. Although theory and policy are two different things, one cannot call oneself a social scientist if one avoids policy evaluation and judgment of such a crucial policy as large-scale monetary easing.

In this section, I will provide my own evaluation of each of the hypothetical assumptions listed here in turn. Beforehand, I would like to say one thing about responsibility and attitude as a researcher or a scientist.

When a government economic policy is implemented based on hypothetical assumptions, it is fundamental for researchers and scientists to examine the effects of the policy after a certain period has elapsed. Science always requires the testing of theories and hypotheses. In fact, Kikuo Iwata (then a professor at Gakushuin University), who provided the theoretical basis for the large-scale monetary easing and was given the role of implementing the policy, was to be at the forefront of the easing policy as deputy governor of the Bank of Japan. Upon accepting the position, Prof. Iwata confidently stated that he would resign as deputy governor if the Bank of Japan failed to achieve its goals within two years[22]. This was a very honest attitude of taking responsibility as a policy advocate and a demonstration of his confidence in his policies and his pride as a researcher.

If a policy is not effective, it must be promptly reconsidered, especially if it has the potential to pose a significant risk to Japanese society in the future. It is a natural stance for a researcher (scientist) to reconsider a policy or the hypothesis that led to it if the effect cannot be confirmed through verification by facts.

However, even though the policy did not produce the desired effect in the targeted two years, deputy governor Iwata did not resign or reconsider the policy, but instead completed his five-year

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[21] This answer is a legal statement that "the Bank of Japan is not a subsidiary in the sense of the Companies Act," and does not indicate a judgment as to whether the BOJ plays a subsidiary role in terms of economic function. As will be discussed in detail later, the actual economic functional relationship between the government and the BOJ should be the issue rather than the legal relationship. The relationship between the general government and the BOJ should also be clarified from the standpoint of national accounting, and this issue should not end with the confirmation of the legal relationship.

[22] Statement of Position and Answer to Questions at the House of Representatives (House Steering Committee) held on March 5, 2013.

term of office, saying, “Although my judgment was not good enough, I will work to realize the policy without resigning”. Since then, large-scale monetary easing has continued to the present, but the original objective has not been achieved. However, not only Prof. Iwata but also other economists who have supported the policy of large-scale monetary easing have maintained their stance of supporting the policy for more than 10 years without reconsidering their original hypothesis, forcefully claiming that “partial results have been achieved”.

This is no longer the stance of a researcher, but more akin to that of politicians. Those are the researchers who did not spare any “theoretical” support for the policy, even if the policy was initiated by politicians. Although no researcher, except for Prof. Iwata who was responsible for policy implementation, can be held politically responsible, it is the proper attitude of scientists and researchers to thoroughly review the assumptions and hypotheses of policies with the pride and conscience of being a researcher. Otherwise, they are no better than politicians who do not take responsibility for their policy recommendations and are always making excuses.

If economics claims to be a “science,” it should evaluate policy implementation (experiments) as appropriate. Researchers who leave policy evaluation to bureaucrats and politicians cannot be called “scientists”. If one is not able to seriously evaluate the hypotheses he or she proposes, the policy formulation based on those hypotheses, and the implementation of the policy, his or her qualifications as a social scientist will be questioned.

2. False Hypothetical Assumptions of Price Targeting Policy

In 2013, the inflation target of around 2% per annum was announced, with large-scale monetary easing to be implemented until the target is achieved. The consequences need no explanation. However, strangely enough, no verification of “why the initial targets were not achieved” has been conducted even though 10 years have passed since the policy was implemented. In the field of natural science, prompt verification is required. However, those who are involved in the formulation of economic policies are not willing to verify them. This is because, in the case of policy implementation by politicians, if they admit that their assumptions were false, the policy has been wrong from the beginning. Admitting this would require their exit from the policy arena. It is understandable that politicians do not want to admit the fallacy of implemented policy, but if “scholars” act like politicians, they can no longer be called researchers or scientists.

In the verification of natural science, if the achievement of a goal cannot be confirmed after a certain period, it will be concluded that the hypothetical assumption itself was wrong. In the case of the large-scale monetary easing policy, the following points should be discussed first.

(1) What was the ground for believing that a shift from deflation to inflation could be achieved without fail? Was the assumption correct that consumers would rationally respond to the price target?

(2) Was the hypothesis wrong from the beginning that consumers (households) and producers (firms) would act in the same direction in response to the monetary easing policy?

The assumption that economic actors with adequate information and rational behavior can act properly in predicting future price (interest rates) increases can generally be applied to institutional investors in the financial market, because analytical methods have been developed in the financial economy, and computer programs have been developed to calculate investment returns. Markets themselves operate based on short-term and long-term forecasts. In financial markets, where money moves in large units, even a price movement of 0.1% can induce a large movement of money if a reliable forecast is made.

However, it is unrealistic to think that the average consumer will react to the annual 2% inflation forecast; a price increase of 2% will not prompt consumers to rush to purchase non-essential consumer goods. If they knew that prices would rise by 10% tomorrow, they would purchase before the price increase, but that would be panic behavior. Large-scale monetary easing is not based on the assumption of panic behavior of consumers, but rather on the assumption that consumers will behave rationally, taking future price hikes into account. Clearly, the very assumption of this argument is unrealistic.

The behavior of institutional investors in financial markets and the behavior of consumers in real economic markets are not isomorphic. International experience has shown the effectiveness of policies that set a certain price target and raise the interest rate to prevent high inflation. However, when trying to stimulate both consumers and producers to promote economic growth, as in the case of Japan's monetary easing policy, differences in the behavior patterns of each economic agent and differences in markets (financial markets or real markets) cannot be ignored.

Japan's price targeting policy does not distinguish economic agents' responses between the financial market and the real market and assumes that rational economic behavior sensitive to the rate of increase will occur both in the real market and in the financial market. However, the behavior of consumers and producers in the real economy is fundamentally different from that of economic agents in the financial economy. This is the critical point of the discussion on the monetary easing policy. While contemporary economics can successfully model the financial economy mathematically, it fails in creating effective models for the real economy. Therefore, many of the major "theorems" (common tools used in analysis) of the real economy in contemporary economics are imported from financial economic analysis. However, these are only analogies and do not capture the actual economic behavior of production and consumption. This is where contemporary economics stumbles.

However, in an economy such as the U.S., where a high percentage of consumption is through credit card loans, it can be assumed that even ordinary consumers behave similarly to financial market participants. However, Japanese consumers are not in the habit of using bank loans for

everyday purchases except for large purchases such as real estate. Moreover, if interest rates are extremely low, there is no need to rush into making purchases. Since the bank's lending rate remains low while announcing an increase in consumer prices, the effect on consumer behavior via the loan rate is almost zero. Under these circumstances, the announcement of the annual 2% price increase to general consumers should be considered to have no effect. It is not surprising that even if monetary easing continues for 10 years, there will be no significant change in the behavioral patterns of general consumers. This was fully predictable from the beginning.

Then, what was the basis for believing that Japan's price target policy would work?

There is a theoretical hypothesis that the expected inflation rate converges to a certain level because of the rational behavior of economic agents. This is the theory of rational expectation formation for price increases. To avoid complicated mathematical formulations, let us look at the formulation of the so-called adaptive expectation. The following equation assumes that the economic agent assumes the expected inflation rate for the current year, considering the price inflation rate in the preceding year.

$\Delta\pi_{t+1}=\theta(P_t - \pi_t)$ where P_t is the rate of a price increase at time t, π_t is the expected rate of increase at time t, and θ is the adjustment coefficient, $0 < \theta < 1$.

In this formulation, the adjustment coefficient is set to 1 or less, so the actual rate of price increase converges to a constant value (expected value). Assuming that the information necessary for rational judgment is available and that people act rationally, the expected rate of price increases converges to a constant value. Rational expectation theory is also a variety of adaptive expectation and is a model in which people's expectation becomes optimal forecast.

Rational expectation theory assumes that economic agents act rationally. This type of model is a normative argument that does not explain real economic phenomena. It is a mathematical model that assumes the existence of convergent values and optimal expected values from the beginning and is not a hypothesis that explains people's actual behavior in response to real price increases. Therefore, the rational expectation theory cannot be a hypothetical assumption that supports the price-targeting policy. The assumption that "since prices are expected to rise, wise consumers with perfect information and rational behavior will increase consumption to prepare for the future" is not confirmed by empirical facts and is no more than a normative hypothesis. Arguments based on such hypotheses cannot be the base for large monetary easing policy.

To analyze real economic behavior, one must distinguish between financial markets and real markets, between consumers and producers, between consumers who make financial investments and those who do not, and between firms that engage in financial investment and those that do not. Arguments that start from normative hypotheses without collecting and analyzing empirical facts are idealistic and cannot capture the actual behavior of economic actors in the real economy.

The price target argument, which was a major premise of Japan's large-scale monetary easing,

was an argument based on an imaginary economic space. This is why a political economy and sociological analysis of the real economy and society is needed.

3. Where Has the Easing Money Gone?

What about the hypothesis that because interest rates are kept at a nearly negligible level through large-scale monetary easing, firms find it easier to borrow funds for investment, new businesses (technological innovations, new products) are launched, and consumers find it easier to take out loans?

Naturally, even if interest rates are low or zero, the borrowed money must be repaid. Unless there is an investment that is sure to yield a profit, there is no such thing as a good deal. For most small businesses, investing in a new business is a matter of life or death. With a non-repayable grant, the company will not go out of business even if the new venture fails. However, a bank loan is money that must be repaid, no matter how low the interest rate on the loan. If the business started with the loan fails, the repayment of the funds will be delayed, and the company's survival will be in jeopardy. Therefore, no matter how low the interest rate is, small and medium-sized enterprises cannot easily borrow funds to launch a new business. Furthermore, Japan's population (market) is shrinking, and demand for consumer goods will surely shrink over the long term. Considering this, even if there is a temporary increase in demand, even existing businesses cannot easily expand. This is the business reality of small and medium-sized enterprises.

In contrast, large companies with retained earnings and ample funds are different. If they can borrow low-cost funds, they can use the inexpensive funds for financial investments that are not their core business. Moreover, the prospect of long-term easing, which is expected to invigorate financial and real estate markets, provides an opportunity to invest retained earnings, and the use of easing funds for financial investment will increase the company's profits. Although even large companies must be cautious about investing funds in new businesses, financial and real estate investments are far less risky and more efficient than the development of new businesses, which carry greater risks. Therefore, whether a manufacturer or a trading company, if a company can obtain inexpensive funds through monetary easing, it will first consider using the funds for financial and real estate investments. It is too naïve to assume that the borrowed funds will be used for technological innovation or new product development.

On the other hand, what about consumers (households)? Japanese consumers are not likely to rush to take out a loan to purchase durable consumer goods just because interest rates are low. Even the decision to replace existing consumer durables would not be so easy. This is different from American consumers. For the average consumer, a low-interest loan would first and foremost be used to purchase a house or a flat. Consumers with more funds to spare may also consider purchasing real estate for investment purposes.

This pattern of behavior reveals where the easing funds will be directed. One is the financial market, and the other is the real estate market.

While it is difficult to say the exact size of individual firms' financial investment without a survey, the market capitalization of the stock market has expanded by about 400 trillion yen since the large-scale monetary easing in the spring of 2013 (Table 1). The BOJ itself has been actively acquiring equity assets (approximately 40 trillion yen as of May 2023), and the GPIF (Government Pension Investment Fund) has increased its domestic equity assets (approximately 30 trillion yen) by raising its equity investment limit. Commercial bank lending has expanded by about 130 trillion yen over the 10 years of the easing policy. These loans and retained earnings of companies were used for financial investment in anticipation of higher stock prices due to the easing policy.

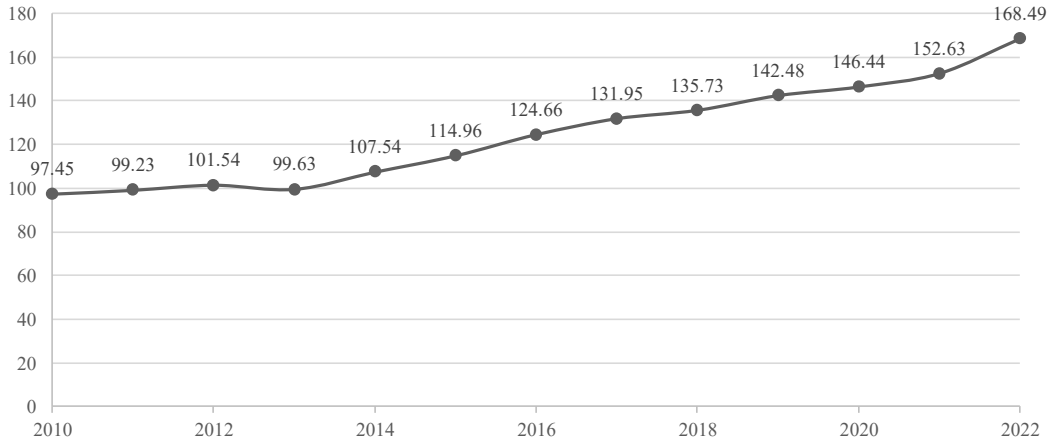
Table 1 Trends in TSE 1st Section Market Capitalization (Unit: trillion yen)

year	end of Dec.
2022	714.3
2021	728.4
2020	666.8
2019	648.2
2018	562.1
2017	674.1
2016	560.2
2015	571.8
2014	505.8
2013	458.4
2012	296.4

Source: Tokyo Stock Exchange (rounded down to the nearest 100 billion y

The real estate market has shown a similar trend. Monetary easing has led to an increase in residential real estate purchases. The real estate market in the Tokyo metropolitan area has seen a steady increase in prices since 2013, when the monetary easing policy began (Figure 1). Consumers (households) are likely to buy their own homes or condominiums as investment assets when interest rates are kept low. They will postpone the purchase of consumer durables and use the inexpensive funds for asset building.

Figure 1: Real Estate Price Index (South Kanto Region, Condominiums)



Note: Index for January of each year, with the 2010 average as 100.

Source: Real Estate Information Center, Real Estate Industry Statistics, Real Estate Distribution, p. 25 (revised September 2022).

Firms are also likely to allocate money not only to financial assets but also to real estate investments. The policy of large-scale monetary easing was envisioned as a cycle in which mitigated money would be used to finance investment in the manufacturing sector, stimulating investment and increasing the production of goods, thereby raising wages, which in turn would raise consumption among consumers. Even if the easing money revitalizes the financial and real estate markets, they do not create a virtuous circle in the national economy. If firms and individuals with ample money on hand use the easing money for financial investment, the working population in the financial and real estate sectors will increase without growth in the processing industry (expansion of the working population).

This is evident from the change in the working population (see Table 2). The reflationary camp emphasizes that the 4.3 million increase in the number of workers due to monetary easing is a result of the policy. Although the length of this article does not allow for a detailed explanation, the increase in the number of workers is attributable to a 10% increase in the employment rate of women (2 million) and a 5% increase in the employment rate of men and women aged 65 and over retiree (3 million). Most of the increase in the number of workers is due to employment to maintain the standard of living. The only real increase in the number of workers is in the finance, insurance, and real estate industries, where there is a net increase of 400,000 workers. The massive supply of funds over the past decade has brought prosperity to the finance and real estate industries, and the easing funds have only created asset bubbles.

Table 2 Number of workers by industry (Unit: ten thousand)

calendar year (end of Dec.)	number of workers (industry total)	primary industry	seandary industry	tertiary industry	Finance, Insurance and real estate
2012	6,280	241	1,539	4,500	276
2013	6,326	234	1,544	4,548	276
2014	6,371	231	1,553	4,587	268
2015	6,402	229	1,545	4,628	275
2016	6,470	223	1,544	4,703	287
2017	6,542	221	1,556	4,765	294
2018	6,682	228	1,572	4,882	294
2019	6,750	222	1,570	4,958	297
2020	6,710	213	1,547	4,952	307
2021	6,713	208	1,533	4,972	310

Note: The last column shows the figures for "Finance, insurance, and real estate" in the tertiary industry separately.

Source: Statistical Information, Japan Institute for Labour Policy and Training (updated May 8, 2023)

In this view, the use of easing money is different from what the policy envisioned. Once it became clear that the easing funds could not be used to increase investment in the manufacturing sector, the easing policy should have been revised. As long as the BOJ continues its accommodative policy, asset bubbles will continue to swell, while the BOJ's underwriting of JGBs will remain unchecked, and the BOJ's degree of freedom in monetary policy will narrow. Therefore, the BOJ should have decided to revise its accommodative policy at least five years after the policy was implemented. However, politics did not allow this, and economists were also unable to recommend a sensible decision due to the momentum of the reflationary camp.

4. Social-Economic Conditions for Consumer Spending to Grow the Economy

Economists who supported the policy of large-scale monetary easing assumed that the easing funds would increase consumer spending, which in turn would boost GDP. The tautology emphasized at this time was that "consumer spending accounts for 70% of GDP, so increasing consumer spending will increase GDP". It is still fresh in our minds that they argued against raising the consumption tax, which would limit consumer spending, relying on this tautology.

This point has been discussed in detail in section "III-2 Identical Equation and Causality", and will not be discussed again, but this argument is based on the misconception that accounting balance (identical equation) is considered a causal relationship. It is a simple tautology to draw

conclusions based solely on the accounting relationship without analyzing the social-economic conditions under which a continuous increase in consumer spending occurs.

Did the large-scale monetary easing really lead to an expansion of personal consumption? The "National Disposable Income and Spending Account" of the National Accounts show the trend of personal consumption (see Table 3).

Table 3: Real final consumption of households and government (calendar year, in billion yen)

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Household real final consumption	356,968	361,692	364,360	363,013	368,002	371,855	372,756	360,053	366,381
Government real final onsumption	39,782	40,687	41,255	41,770	41,413	41,935	42,886	44,290	45,316

Note: Real final consumption is a figure that takes into account the portion of general government final consumption that is redistributed to households.

Source: National Disposable Income and Use Accounts (National Accounts Tables for FY2021)

Despite the combined efforts of the BOJ and the government to provide huge amounts of money to the market, consumer and general government final consumption has remained at a level of almost ¥400 trillion over the past decade. Why has consumer spending failed to increase despite the massive injection of money into the market?

The Japanese economy has entered a period of stable maturity after the high growth period and has entered a historical period in which the working population is aging and shrinking. Without this historical and social awareness, it is impossible to understand the situation. The answer can be found by considering the conditions that supported the high economic growth achieved by China in recent years and by Japan in the postwar period.

For economic growth to occur, surplus labor must enter the web of the social division of labor in a market economy. As is evident from the economic growth of modern capitalism, the achievement of high growth rates coincides with the process of sustained integration of rural surplus labor into the social division of labor as the market economy expands. The new labor force increases value-added production, which increases wages paid to workers and increases consumption expenditures. The rapid emergence of a labor force temporarily tightens the supply and demand for consumer goods, but the total amount of wages paid increases, and effective demand also expands, creating a cyclical upward effect that leads to an increase in the production of consumer goods.

In fact, the number of workers in Japan increased from 40.9 million to 52.59 million during the 18-year period from 1955 to 1973, which is considered Japan's high-growth period. Nearly 650,000 new workers were brought into the Japanese economy each year. The number of workers included in the social division of labor has increased by approximately 30% during the period.

The manufacturing sector alone experienced a rapid expansion of more than 80%, from 7.57 million to 13.83 million workers, during the same period from 1955 to 1973. This supported Japan's high growth. The demand for consumption by workers that emerged in the market pushed up bottlenecks in the consumer goods market and stimulated the production of consumer goods, creating a growth cycle. The same situation can be observed in China, where the transition to a market economy has been rapidly continuing.

In contrast, looking at the period from 1990 to the present, the period known as the "lost 30 years", the number of workers in 1990 was 62.5 million, while the number of workers in 2012 was 62.8 million, almost unchanged. There has been no quantitative change in the labor force captured by the social division of labor. Subsequently, the number of workers in the tertiary industry increased by about 4,300,000 as a result of large-scale monetary easing, but the number of workers in the manufacturing industry has not increased at all, from 10.41 million in 2013 to 10.45 million in 2021. Furthermore, the number of workers in the manufacturing sector is almost the same as in 1962. In other words, the number of workers in the manufacturing industry has shrunk to the level of the early years of Japan's rapid economic growth.

Thus, it is impossible to correctly understand the current state of the Japanese economy without examining its historical structural changes of growth, maturity, stagnation, and contraction. However, those who call themselves "reflationist" ignore the historical changes in the Japanese economy and focus only on the phenomenon of deflation, arguing as if the quantity of currency determines economic growth. Moreover, even the perception of deflation is not uniform. Many economists explain deflation as "a phenomenon in which prices continue to fall". However, while prices have not risen, they have not continued to fall. They simply call the fact that prices are not rising deflation. Not only are they mistaken in their recognition of the facts, but they are blinded only by the level of prices and fail to recognize the historical problems facing the Japanese economy.

This leads to the "good inflation" or "bad inflation" argument. This argument is also a tautology, because "good inflation" is defined as "good inflation" in terms of prices. This argument is also a tautology; "good inflation" is a case in which rising prices stimulate demand and production, creating a virtuous cycle, while "bad inflation" is a case in which only prices rise without creating a virtuous cycle. This is not an analysis, but a meaningless tautology because it is the same as saying that "good inflation produces good results (a virtuous cycle)" and "bad inflation produces bad results (a vicious cycle)"[23].

[23] It is common to refer to the demand-pull type as good inflation and the cost-push type as bad inflation. However, the way to proceed with the discussion is completely different depending on whether one is discussing individual markets or the national economy, and whether one is trying to understand inflation as a short-term phenomenon or a long-term phenomenon. A discussion of the long-term national economy requires an analysis of the socioeconomic conditions that generate inflation. For this purpose, it is essential

As the historical case of high economic growth clearly shows, when new labor enters the market, consumer demand expands and the supply-demand balance of consumer goods becomes tight, which in turn induces a sustained price increase. On the other hand, the expansion of production due to the expansion of the labor force increases the total wage payment, and production also increases in response to demand because the situation in which goods can be sold if they are produced is sustained. This is the "virtuous circle" seen during periods of high economic growth. The virtuous circle is not a monetary phenomenon, but a phenomenon in which demand causes a continuous expansion of supply due to structural changes in the market, such as an expansion of the labor force. The social conditions that would induce such a cycle no longer exist in the Japanese economy. On the contrary, the Japanese economy is entering an era in which the working population is decreasing. Although the overall working population has not yet begun to decline due to a slight increase in the number of workers in the tertiary industry, the working population in the manufacturing industry is already in the process of shrinking.

Without analyzing these historical and social conditions, discussions on the quantity of money and the price level will not yield any results. Discussions that focus on quantitative economic growth as the supreme objective has lost their validity as socioeconomic analysis.

5. Government Debt Accumulation Problem - Can the Government's Debt and the BOJ's Claims be Offset

The large-scale monetary easing has been mainly implemented by the BOJ through purchasing large amounts of JGBs from the market. In the 10 years since the BOJ started its easing policy, all the JGBs issued by the government have accumulated as the government's debt. During the 10 years, an additional 300 trillion yen of JGBs have been issued, bringing the total amount of outstanding JGBs (not including 200 trillion yen of accumulated JGBs and municipal bonds) to more than 1,000 trillion yen by 2021. This is equivalent to 190% of GDP (more than 200% if municipal bonds are included), or about 20 years of tax revenues. Annual deficit financing as a percentage of general government expenditures has remained at about 45%, which is equivalent to 75% of tax revenues. Japan is the only economically advanced country with a budget deficit of this magnitude. Furthermore, Japan's fiscal deficit cannot be maintained without deficit-covering government bonds, and the accumulation of deficits cannot be stopped, and Japan's fiscal deficit will continue semi-permanent financial bottoming down for other decades. Even at this stage, politicians are irresponsible in their words and actions, covering up the problem, and the people are so blinded by the irresponsible incitement of politicians that they are unable to understand the seriousness of the problem.

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to analyze the dynamic changes in the industrial population and the quantitative and qualitative changes in the labor force market. Without this analysis, its propositions are contentless tautologies.

Table 4 JGB Issuance and its Indicators (each year, Unit: 100 million yen, %)

fiscal year	JGB Issuance (100 million yen)							dependency on JGBs (%)	outstanding amount of ordinary JGBs (100 million yen)	outstanding amount/GDP (%)
	article 4 bonds	special bonds	pension special bonds	restruction bonds	FILP bonds	refunding bonds	total			
Heisei 25	70,140	338,370	26,035	-	107,000	1,101,569	1,643,114	40.8	7,438,676	145.1
26	65,770	319,159	-	1,200	140,000	1,193,728	1,719,857	39.0	7,740,831	147.9
27	64,790	284,393	-	13,200	134,000	1,142,308	1,638,691	35.5	8,051,482	148.9
28	89,014	291,332	-	7,909	196,000	1,094,798	1,679,053	39.0	8,305,733	152.4
29	72,818	262,728	-	768	120,000	1,063,820	1,520,134	34.2	5,831,789	153.5
30	80,972	262,982	-	-	106,300	1,032,853	1,483,107	34.8	8,740,434	157.1
Reiwa 1	91,437	272,382	-	8,100	125,500	1,042,383	1,541,801	36.1	8,866,945	159.1
2	225,960	859,579	-	8,100	125,500	1,042,383	2,568,553	73.5	9,466,468	176.8
3	91,680	484,870	-	400	101,446	1,428,502	2,106,897	39.9	9,914,111	183.0
4	87,270	537,519	-	-	165,000	1,484,872	2,274,662	44.9	10,424,369	188.5

Note: JGB dependency ratio is (Article 4 bonds + special bonds)/general account expenditures.

Heisei 25 is from April 2013 to March 2014 and Reiwa 1 is from April 2019 to March 2020.

Source: Ministry of Finance, "Trends in JGB Issuance (actual basis)".

On the other hand, the Bank of Japan supports the government's issuance of deficit-covering JGBs. Immediately prior to the implementation of the large-scale monetary easing, the BOJ's holdings of JBG were about 113 trillion yen (January 15, 2013). After 10 years of the easing policy, it is approximately 587 trillion yen (May 12, 2023). The increase in JGB holdings far exceeds the amount of new JGB issuance over the 10-year period. This is the result of aggressive purchases of existing JGBs in the market. As a result, the BOJ now holds 57% of all JGBs issued by the government, which has created a de facto fiscal financing situation.

Even with this accumulation of government deficits and the deterioration of the BOJ's assets, the working population, except for the financial and real estate sectors, did not expand, nor did it increase consumer demand or stimulate the manufacturing sector. Despite this, the government and the BOJ have refused to review their policies and have only continued the large-scale monetary easing policy. It is as if the elderly with underlying diseases is being overfed and given large doses of useless drugs. Excessive nutrition leads to excess energy that accumulates in the body, resulting in unhealthy obesity, and excessive drug administration increases the severity of the underlying disease.

Even under these circumstances, economists who have supported the monetary easing policy have persisted to advocate the continuation of the policy by calling for an "end to deflation". Some economists have also joined irresponsible politicians in calling for the aggressive use of BOJ finance through further JGB issuance, on the basis that government bond issuance has not caused hyperinflation. The following two points are being argued as the basis for this argument.

One is that if the government deficit is backed by domestic savings, the government is not vulnerable to speculative investment from abroad. The second is that the government and the BOJ

are both government branches and if they are integrated into one, the government's liabilities and the BOJ's assets will be offset which results in a drastic reduction of the government's debt. These two arguments were "discovered" for proving that accumulated debt is not a problem and for explaining the reasons why hyperinflation does not occur even with this level of fiscal financing.

Since World War II, the capitalist economy has grown in basic strength through economic development, and the economic structure has become more complex. The disparities in economic development and inflation among national economies have not remained simple. Therefore, there is no longer a simple relationship between fiscal finance and immediate hyperinflation.

On the other hand, even in prewar capitalist economies, where the basic economic strength was much weaker than today, hyperinflation did not occur easily. The occurrence of hyperinflation depends on the social conditions that induce it. Historically, hyperinflation has occurred during wartime and after the end of the war. If a large amount of government bonds is issued during wartime, which is not backed by production or savings, hyperinflation will be triggered easily. Or, after a certain time lag, the shortage of goods at the end of the war makes the economic law of nullification of wartime debts without production support prevail. This is postwar hyperinflation. Many countries, including Japan, experienced postwar hyperinflation after World War II. The collapse of the socialist system at the end of the 20th century also triggered transformational inflation, which was an explosion of public debt that had accumulated under the socialist system which had not been manifested in the previous social system. The magnitude of hyperinflation is proportional to the size of each country's latent debt. The record hyperinflation that occurred in Serbia during the civil war that followed the dissolution of the Yugoslav Federation is a typical example of an explosion of wartime debt in addition to public debt hidden under the socialist system. The potential for hyperinflation is always triggered by certain social changes.

The acceptable size of accumulated public debt is related to the basic strength of the national economy. Even if the economic fundamentals are solid, massive government debt will limit the government's freedom of economic and social policy. The probability of Japan starting a war is infinitesimally small, and the probability of forced procurement of wartime supplies causing hyperinflation is close to zero. So, is the Japanese economy solid enough to continue fiscal financing? The greatest threat to Japanese society is a natural disaster (a large-scale earthquake). If an earthquake of a massive scale were to occur, resulting in the loss of large amounts of assets, a situation like that at the end of the war would be created. Even in this case, if the level of government debt is low, it is possible to control inflation caused by the expansion of fiscal spending. However, if debt accumulation is already saturated, the inflation induced by material shortages is likely to turn into hyperinflation. In the case of Japan, where the government does not have the fiscal capacity, massive additional government spending is likely to cause commodity prices to skyrocket, which in turn will cause generalized hyperinflation. Fiscal financing far more

than current levels would cause major social problems.

"The government bonds are backed by domestic savings" means, conversely, that domestic savings are used as collateral for the government debt. Deficit government bonds are collateral securities backed by "cash flows in the form of future tax revenues". However, if hyperinflation occurs, as it did immediately after the end of the war, the price of government bonds will plummet and domestic savings as collateral will depreciate without limit. Everything will break down, and the creditor-debt relationship will be reset. With the forced termination of claims and debts, the national debt will be extinguished, but the savings as collateral will also become worthless. To avoid creating such a situation, it is important to properly manage the level of government debt from normal times. This is why Europe strictly controls the government debt ceiling. In the U.S., the debt ceiling is regulated by law (although it has been revised repeatedly). In normal times, the impact of a debt ceiling crisis on the national economy is not so great. Nevertheless, controlling the debt level is meaningful because it is a pearl of wisdom to maintain the government's ability to control and protect the economy and society from the danger of collapse in the event of war, natural disasters, and other events with enormous social costs. It is a historical lesson inherited from the wars of the 20th century. Thinking only of the immediate economic boom without preparing for future crises is the thinking of the grasshopper in Aesop's Fables.

This view reveals the fragility of the argument that "there is no problem with debt accumulation as long as it is backed by domestic savings". This is the same as the argument that "there is no need for special preparations because there is no immediate risk of Tokyo Metropolitan Area Inland Earthquake at present".

What about the other argument? From the standpoint of economic substance, since the government and the BOJ have a parent-subsidiary economic relationship, can it be said that the debts and credits of both parties are offset? The issue here is not the legal relationship as stated in the government's official response, but the actual economic relationship. In the case of the BOJ's fiscal financing, the BOJ is subordinate to the government and acts like a de facto subsidiary. On the other hand, what is important is the national accounting treatment between the government and the BOJ. Therefore, the following points should be discussed here.

The government and the BOJ are not legally parent and subsidiary (legal relationship). However, since the BOJ is subordinate to the government and finances the government in real terms (substantive economic relationship), can the income and expenditure accounts of the government and the BOJ be consolidated in the national accounts (possibility of consolidated settlement)?

First, the national accounting system clearly separates the financial and non-financial sectors. This is because the financial sector is not directly involved in the production and distribution transactions of the nonfinancial sector but records the money-handling relationship resulting from

that transaction relationship. Therefore, financial, and non-financial transactions cannot be offset among the accounts of the national accounting. This is not only a formal problem of the national accounts system, but also a process that corresponds to the real economics world.

Leaving national accounting behind, we can better understand what happens to the credit-debt relationship between the parties involved in a business merger. For example, when two non-financial firms merge, their mutual claims and debts are offset, but this offset does not cause the absorbed firm's debts to disappear like air. The assets of the other company are simply reduced by the amount of the absorbed company's debt. The same is true in the case of a corporate merger between financial institutions. The extinguishment of one party's debt by setoff reduces the other party's assets by the amount of the setoff.

On the other hand, if a non-financial company and a financial company are under the same umbrella and have one owner, will the claims and obligations of the two companies disappear because of offsetting? In this case, if the debts of the non-financial company are offset against the claims of the merged financial company, the assets of the financial company will be reduced by that amount. Mergers (or consolidations) do not make claims and debts disappear like magic tricks.

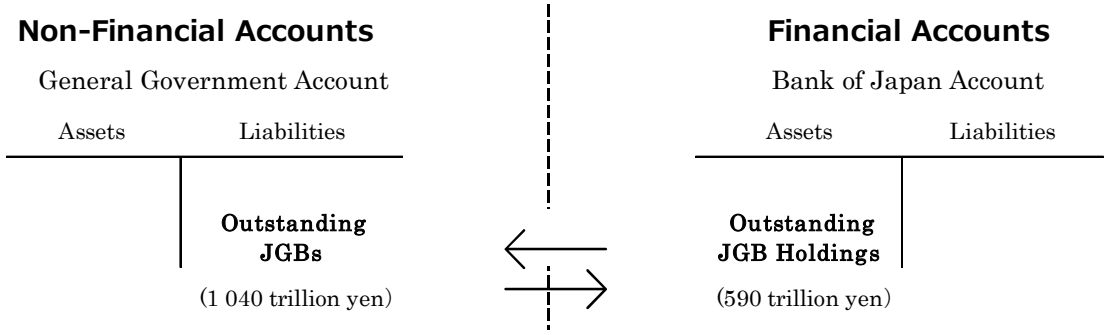
In the offsetting of parent-child loans and debts, the debt owed by the child to the parent becomes a "gift" and is not "canceled as if nothing had happened". The debt held by the child against the third party is offset in the form of a reduction of the parent's assets. Thus, the question is "To whom are the government's bonds owed?" JGBs are collateral securities backed by future tax revenues, and are a debt held by the government for the people. The BOJ's holding of JGBs does not change this character. The BOJ can only lend funds against the collateral securities called JGBs, but it cannot "cancel" the collateral securities to the public as a third party.

Let us summarize the above. As shown in Figure 2, the JGB claims-debt relationship is depicted between the government and the BOJ. "Integrating the two accounts together" is an argument that claims that the general government's JGB debt (1,040 trillion yen) is offset by the BOJ's holdings (590 trillion yen), resulting in a net government debt of 450 trillion yen. If this were possible, the government's JGB debt would be reduced to almost zero if the BOJ held more JGBs. Moreover, the government would no longer need to collect taxes. This is the alchemy of our times. This is exactly what the late Shinzo Abe insisted on in his touring lectures around Japan[24]. Nothing comes from nothing. There are only phenomena that appear to exist. To avoid

[24] For example, in a speech held in Sanjo City on July 10, 2021, he said, "The Abe administration has always been criticized for 'not passing on the bill to our children's generation', but that criticism is not correct. The reason is that the government and the Bank of Japan are working as a combined force in the Corona measures, but the BOJ buys almost all the government bonds issued by the government," he said. "Do you think the BOJ borrows money from somewhere? That's not true. The bank prints bills with paper and ink, and you can make a 10,000-yen bill for 20 yen. The Bank of Japan is a subsidiary of the government, so to speak, and in fact, it is not even a debt of the government in the consolidated financial statements. So 'don't pass the bill on to your grandchildren and children' is not correct". The audience applauded Abe's

the illusion that mirage-like phenomena are true, political economy analysis is necessary.

Figure 2: General Government Account and Bank of Japan Account



Note: The so-called "integrated government" theory assumes that the JGB debt of the general government account (1,040 trillion yen) and the JGB claims of the Bank of Japan (590 trillion yen) will be offset, resulting in a significant reduction in the government's JGB debt. The figures are approximate figures for the spring of 2024 and do not include the 200 trillion yen in municipal debt.

As mentioned above, the BOJ supplies currency using JGBs as collateral, but the BOJ cannot say, “Let’s pretend this collateral does not exist”, because this collateral is a debt held by the government against the people. JGBs are a debt held by the government against the people as a third party, so even if the BOJ were a subsidiary of the government, it is a debt instrument that cannot be erased. Therefore, they do not constitute a consolidated account in the national accounting.

Instead of just offsetting in one’s mind, one should consider the actual procedure when the BOJ’s claims are offset against the government’s liabilities. Offsetting the BOJ’s offsetting declaration means that the BOJ “forgives the government’s debt”, which means that the BOJ immediately becomes insolvent. The government’s JGB debt would be reduced by the offsetting amount, but on the other hand, the BOJ’s account would become heavily over-indebted, which would create a situation in which the very existence of the BOJ would be at stake. If the BOJ declares that it will forgive the government’s debt, the BOJ will lose its mission as a central bank, the Japanese yen and stock market will plummet, and the Japanese economy will be on the verge of collapse.

Those who believe that the government’s debt and the BOJ’s credits will be offset seem to

words and actions (https://www.youtube.com/watch?v=5sI70EEeJR8). Taro Yamamoto of the Reiwa Shinsengumi (opposition party) agrees with Abe's argument.

think that “offsetting” will “make the credits-debts disappear”, but this is a simple misunderstanding. Even if it is possible to add and subtract numbers in one’s head, it is not possible to “make something that actually exists into something that does not exist”. This is where the poverty of contemporary economic thought is truly shown. By excluding political economy, contemporary economics has become too much absorbed in the world of illusionary thinking and is unable to distinguish between reality and thought[25]. This is not the way economics can be said to be the study of economy and society.

In other words, it is only possible to offset the value of the BOJ’s JGB holdings as a thought experiment. The claim by some economists that government debt and BOJ claims can be offset by integrated thinking because the government and BOJ belong to the government sector is not possible from the standpoint of national accounting nor from the standpoint of actual procedures. It is a fanciful illusion to think that integrated “thinking” will reduce the amount of government debt.

On the other hand, as a practical matter, the BOJ should have a greater sense of urgency since it is underwriting half of the JGB debt. In Japan, where there is no legal limit or even discussion of a debt ceiling if a debt is allowed to accumulate unchecked, the Japanese economy will lose its capacity and be forced into a situation where there is no more room for growth. While the rest of the developed economies are trying to keep their debt ceilings in check, Japan is the only one that is accumulating debt without limit. It continues to accumulate like magma forming underground. The “bill” to be paid by future generations is the explosion of that magma.

It is extremely puzzling that there has been no clear criticism of this issue from scholars specializing in theoretical economics. Are they trying to distance themselves from the issue because they consider it a political debate, or are they not interested at all, or do they not have the knowledge to judge this debate? The situation in the Japanese academic community that distances itself from the evaluation of economic policies despite the seriousness of the government’s accumulated debts is extraordinary.

At some point, the accumulated debt will have to be resolved in one way or another, partially or fully. Regardless of the explanation and excuse, government bonds are collateral securities

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[25] This argument stems from a statement in a document that J. Stiglitz (Columbia University) gave at the invitation of the Japanese government at the meeting of the Council on Economic and Fiscal Policy on March 14, 2017. In just two lines on one of his prepared slides, Stiglitz wrote, 'Cancelling government debt owned by the government (BOJ) ・ Overnight reduction in gross government debt - allaying some Cancelling government debt owned by government (BOJ) '. Some economists used this as an argument that there would be no fiscal crisis because the government's and the BOJ's debt claims would be offset. Stiglitz's argument is only two lines of text and does not develop a basis or argument for offsetting, but it does not appear that Stiglitz was thinking rigorously about this issue. He makes an elementary error in his national economic accounting. Some economists take the inadvertent words of a Nobel Prize winner in economics as absolute truth and use them as arguments for "no fiscal crisis".

backed by future tax revenues, and government debt is still an anticipation of future tax revenues. If the current budget deficit continues, not only can the accumulation of government debt not be stopped, but there is no prospect that a declining labor force and the shrinking economy will be able to solve Japan's ever-accumulating debt problem. When the Nankai Trough earthquake or an earthquake directly under the Tokyo metropolitan area, which are predicted to occur in the near future, there is a strong possibility that the government (local governments), which are saddled with massive debts, will issue even more massive earthquake reconstruction bonds, triggering hyperinflation. At that time, it will be too late. Claiming that the accumulated debt can be reduced by thought experiments is no consolation. While economists are repeating abstract thought experiments on mathematical models, the economic crisis is quietly progressing.

Conclusion

Among the social sciences, only economics is eligible for the Nobel Prize. However, although the Nobel Prize was established in 1969 to commemorate the 300th anniversary of the founding of the National Bank of Sweden, it was not initiated by the Nobel Foundation. The Nobel Foundation does not recognize it as a Nobel Prize but officially refers to it simply as the "Prize in Economics. The selection of the economics prize has often been controversial, with members of the selection committee from other fields casting a critical eye on the "scientific nature" of the prize. Even if the Nobel Foundation does not recognize the prize as a Nobel Prize, the actual attendance at the ceremony and the awarding of the medal do not distinguish it from those of other fields. Only the prize money is paid by the Swedish National Bank, not by the Nobel Foundation. Thus, Prize in Economics is the "Nobel Prize, but not the true Nobel Prize".

As we have seen in this paper, there are many doubts about the science and validity of economics. Doubts are expressed at every turn about how accurately the theoretical analysis that economics captures the real economy. On the other hand, politicians with little or no background in economic theory lead the economic policies of their countries, and some economists who support them fight economic debates with simple hypotheses. We see a strange social phenomenon in which even laymen can participate in economic discussions and take the lead in the policymaking of government, while “economists” are unable to pass judgment on actual economic policies.

This situation naturally raises the question of whether "economists" are social scientists at all. Is economics a science, a social philosophy, or merely an ideology? The current state of economics is closer to the latter.

This doubt is not only held by scientists in other fields but also by scholars specializing in economics themselves. This is where the desire to “make economics more like science” comes

from. Mainstream economists (in the world of economics) believe that “mathematical modeling” is the way to make economics a science, and they try to exclude from “scientific economics” problems that cannot be modeled mathematically or economic theories that cannot be modeled mathematically.

This paper calls attention to this trend in contemporary economics. From the modern starting point of mathematical economics, the paper clarifies the nature of the theory and argues that mathematical modeling does not deepen our understanding of economic facts but is no more than a thought experiment in an abstract and simplified world. Such analysis cannot deepen our understanding of the real national economy and make policy decisions. As a concrete example, we examined the hypotheses underlying the policy of large-scale monetary easing that has been in place in Japan for more than a decade. This specific case study reveals that the analysis and hypotheses that should serve as the basis for actual economic policy formulation and development are extremely weak and that sometimes ideologies based on specific economic ideological beliefs are deployed. The fact that there has been so little examination and criticism of these weak hypotheses by theoretical economists is a clear sign of a major gap between theory and policy.

The massive monetary easing measures deployed in Japan over the past decade have created a load that will constrain the Japanese economy and society for at least the next 30 to 50 years. It will cause economic and social problems comparable to those of a coming major earthquake. The risk of a massive natural disaster triggering massive damage to the Japanese economy is a certainty. Yet most economists are indifferent to future crises, and economists do not analyze them.

Mathematical economics has lost its raison d'etre as a social science. More specialists should develop political economy and sociological analysis in all directions, to gain a firm understanding of the problems facing the national economy, and to show the way forward for Japan's economy and society. I hope for the revival and reemergence of the political economy.

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