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Okishio Theory Revisited in the Light of ‘Axiomatic Externality’

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Abstract

It is well known that Nobuo Okishio played a central role in the world of mathematical Marxian economics. In this paper, we examine Okishio theory from a methodological perspective. Our focus is the “theoretical boundary” that separates the economic model from conditions “given from outside”. We demonstrate that Okishio’s theory could be “an open” system, but, actually, it only shows the Achilles heel of a capitalist economy. Nevertheless, bearing in mind that the accumulation of capital is at the heart of the workings of a capitalist system, and even if modern capitalism were to be financialised, Okishio’s theory should still provide us with a starting from which to think about this system, because it demonstrates capitalism’s essentially unstable character.

Keywords: Okishio theory, Externality, Capitalist system, Accumulation, Profit, Wage

JEL Classification: E11, E12, E32

1. Introduction

Those who aim to build an alternative economics for the mainstream should know the status quo of the mapping of a variety of theories. It is indispensable for theorists to order many strands of thought. We have to confirm our theoretical standpoint in order to discern a new direction. In the West, there are political economists such as Marxian, Post-Keynesians, Regulation Theorists, Radical Economists, and Institutional Economists, who have always had to be constantly aware of their relationship to neo-classical orthodoxy.¹ However, Marxian economists in Japan lack this rivalry with neo-classical economics. They may be said to have been preoccupied with internal academic disputes inside Marxist economics. Two reasons are that they could not handle the mathematical techniques used in neo-classical economics or that critics would think that they had denied themselves if they applied mathematical methods. Under these circumstances, Nobuo Okishio (1927-2003) is unique. He tried to demonstrate various propositions of Marx’s economics by using strict mathematical methods.² Known as the pioneer of mathematical Marxian economics, Okishio published twenty-five books, including his masterpiece *Accumulation Theory*, and he left more than two hundred and fifty articles.

Okishio’s argument, in general, has been called *Okishian theory* and/or *Okishio economics*,

¹ See the reminiscence by D. Gordon, one of the main members of URPE (Union for Radical Political Economics), in an interview with Klammer (1983).

² As for the academic career of Okishio, see Arestis and Sawyer (1992).

though he did not complete his own *Principles of Economics*. It is our challenge to construct a theoretical system from his many writings. The goal of political economists is to reveal the economic law of motion of modern society, which is from a frequently cited passage from *Capital*, as everyone knows. What is needed to analyze the working of a society is the power of "abstraction". Collecting all the data concerning the economic behavior of individual citizens cannot be a base for the analysis of a national economy. A consistent economic theory, aiming to establish itself as *the system*, in order to guarantee the independence of the theory, should place "contaminants" outside the theory by applying immediate assumptions.

What and why does Okishian theory locate the theoretical boundary separating the internal from the external? Re-reading the theory from this perspective is the task of this paper.

2. Main Task of Okishio Economics

How do those who decide on an academic career select their area of research? Needless to say, no one can escape the constraints of time when they select any area in the natural or social sciences. Okishio graduated from the Kobe University of Economics (Faculty of Economics, Kobe University) in 1950. Okishio spent his student life across the war. He worked on Hicks' *Value and Capital*, and Keynes' *General Theory* on the recommendation of his academic advisors. These two texts surely satisfied his intellectual curiosity, but he could not acquire a deep understanding of capitalist history. He noted, "... I felt uneasy about their works. At that time, Japanese capitalism was being shaken fundamentally."³ In this remark, we can find the motivation to develop an interest in Marxian economics, but he has also written,

*I attended no lecture on Marxist economics in college at all. Though I read through Capital by myself, I was not impressed by it as a principle of economics.*⁴

Fortunately, after graduation, he found employment as a research assistant. He started to seek a fundamental theory to analyze the movement of an entire society. He selected Marx's theory as a referential framework, but this did not mean he dismissed all so-called modern economics. Even if a theory is full of historical ideologies, we must see how consistent it is and to what extent it reflects reality. Okishio stuck to this position. Here we cite a passage from his first book, *Theory of Reproduction*.

*Having occurred in human history, the phenomenon of "employment" seems self-evident, but it is based on a misunderstanding. This is unusual and strange, and requires a truly scientific analysis. I am convinced that one would qualify as a social scientist just on the question of whether or not one feels this is strange.*⁵

In later years, Okishio was termed the pioneer of mathematical Marxist economics. His fundamental motif appears here. It is nothing other than his passion as an orthodox Marxist economist. As is well known, there are two aspects to economic phenomena: qualitative and quantitative. A relevant mathematical method is essential in analyzing a quantitative relationship. For example, the interdependence of many markets cannot be expressed in words alone. However, it was not his

³ See Kruger and Flaschel (1993: vii)

⁴ Okishio (2004:121).

⁵ Okishio (1957:2).

only purpose to rewrite various propositions in *Capital* in a mathematical fashion. Rather he was cautious about excessive mathematical reasoning, and we have to keep this in mind.

Despite the deepening in structure in Okishio's theory, his standpoint is simple and straightforward in analyzing a given society, for example the capitalist economy. He felt the need to theorize and identify the following seven issues based on historical fact.⁶

- (1) What level of human ability is necessary to control the nature of the relations of production in question so that they can become established and work? What kinds of relations of production are necessary for a capitalist economy?
- (2) How do people engage in economic activity with regard to the relevant relations of production?
- (3) What economic phenomena (exchange, money, wages, profits, business cycles, employment, and so on) appear as a result of the composite consequence of people's actions?
- (4) How are these economic phenomena mutually interrelated?
- (5) How do these economic phenomena function to maintain and reproduce the relations of production, which characterize a society?
- (6) How do these economic phenomena change man's ability to control nature?
- (7) How do economic phenomena develop the factors that discard existing relations of production, or how do they create the conditions for the fostering of new relations?

Of the above-mentioned questions, (1) constitutes the basis of a society, (2), (3), (4), and (5) constitute the mechanism of social reproduction, and (6) and (7) constitute a mechanism by which social form is replaced with another form. In short, we must analyze the structure and working of society from three viewpoints: the viewpoint of existence, the viewpoint of reproduction, and the viewpoint of transformation.⁷

Looking back at Okishio's academic career in the light of these challenges, his focus can be summarized in the following four points.⁸

- #1 Instability of the capitalist economy
- #2 The labor theory of value: mathematical formulation
- #3 The essence of Socialism: ownership and decisions
- #4 Technical change and the capitalist economy

At the end of this paper, we will assess the value of these points. Here, we aim to re-read the work

⁶ Okishio (1989). Here we can easily see that Okishio's standpoint is similar to Marx's historical materialism.

⁷ This problematic reminds us of the methodology of such radical economists as Bowles, Edwards and Roosevelt. Their three-dimensional approach consists of (a) Competition, or the horizontal dimension, (b) Command, or the vertical dimension, and (c) Change, or the time dimension. See Bowles, Edwards and Roosevelt (2005).

⁸ Okishio (1993: 5-11).

of Okishio from our previous perspective, although this might appear to be very narrow.

3. Three boundaries

As discussed above, Okishio argued that we should analyze human society from three viewpoints (existence, reproduction and transition). The essence of his approach is expressed by “the viability of humankind”. To construct a coherent economic theory for a theoretical analysis of the capitalist economy, we must cut out a certain part of human society as a requirement of the theory. The boundary is never fixed, but at this point, three boundaries may be considered.

We know ‘a happy daydreamer’ might think it possible to create a general theory describing the whole of human history from the primordial to the future. Unfortunately, we cannot be such a dreamer. Needless to say, we must select the capitalist economy as our subject of study. For our theory, what is excluded by the boundary that is set to distinguish capitalist society from another society can be called “External I”. Referring to Okishian economics, the level of ability to control nature fulfills this role. It is the upper and lower limits of the human ability to control nature for a capitalist economy to be able to exist.

A capitalist economy can stay cropped inside and be reproduced as a system, if some conditions are satisfied. For example, the real wage rate cannot continue to rise and/or decline. The upper and lower limits of the real wage rate are settled. This provides the basis of “External II”. Moreover, a theoretical simplification is required to analyze the working of the “Inside”. The contents pushed out of the theory by this procedure are “External III”. The relationship between Boundaries, and the External can be shown as in the following Figure.

In the following, we re-read the Okishian theory from the viewpoint of Boundary and/or Externality, and we choose such topics as the so-called Fundamental Marxian Theorem⁹, the accumulation model, and the Okishio theorem on the falling rate of profit. The focal point of this re-reading might be the movement of the real wage rate. Speaking in accordance with the challenges set by Okishio, we will always keep in mind the three dimensions (existence, reproduction and transition).

4. People responsible for labor

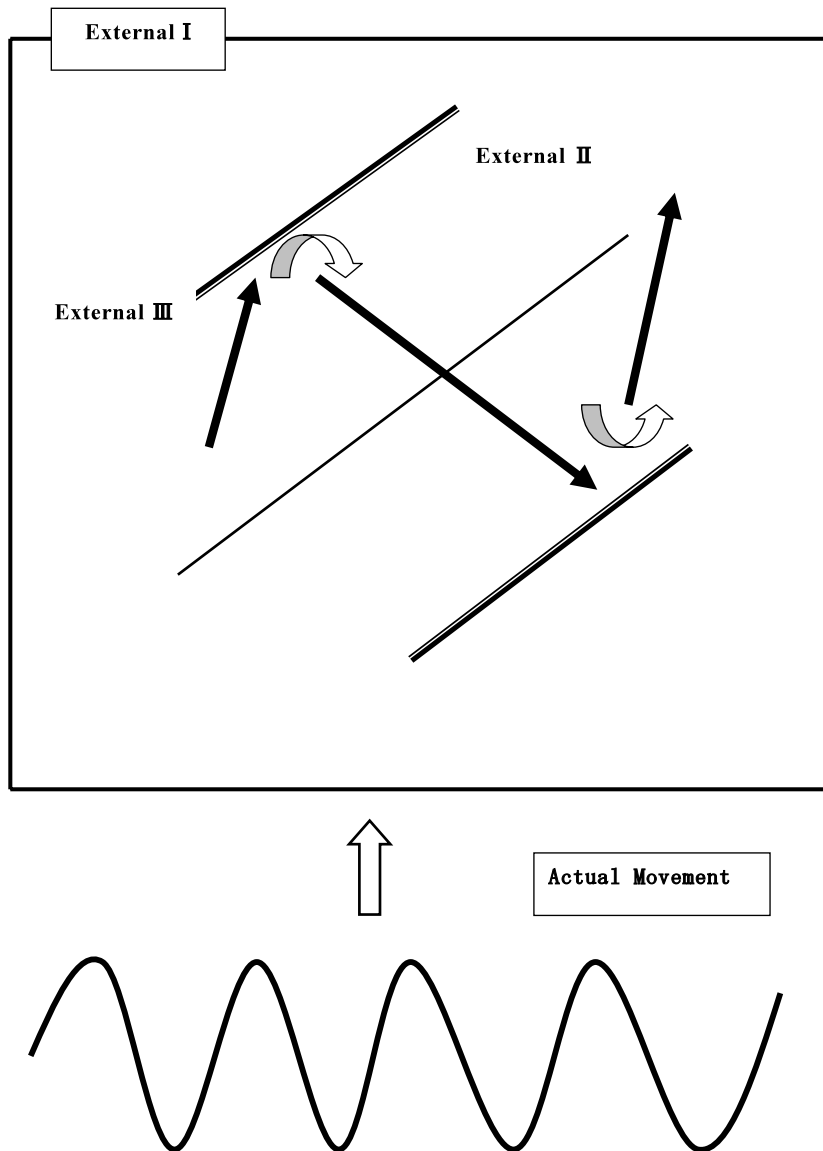
A minimal definition of a capitalist economy might be “a class society dominated by commodity production”. As profit ensures the survival of the capitalist, the Fundamental Marxian Theorem (FMT) has great significance. It demonstrates that the source of profits is based on the exploitation of the worker. Prior to the reading of this “fundamental theorem”, the reason why labour is chosen as a starting point for economic analysis must be confirmed. In this regard, Okishio stated,

If we try to analyze some phenomenon in a specific society based on a general law, which governs human society, it becomes apparent that the basic units of measurement in economics are the physical units of various products and the working hours. On this point, I find the basis of the labor theory of value.¹⁰

⁹ The Fundamental Marxian Theorem (FMT) asserts that the exploitation of surplus labor is the necessary condition for the rate of profit to be positive. Okishio proved this theorem mathematically in the 1950s. Later, Morishima (1973) named it FMT. See Kruger and Flaschel (1993).

¹⁰ See Okishio (1957:3).

Figure : External I,II and III



Thus, labour is selected when we start a historical analysis of an economic society. Then, another point to distinguish a capitalist economy from that of other societies is the commodification of all sorts of goods and services, including labour. The critical point is the exploitation of labor through this system.

When we discuss the existence of profits, we must assume both commodity production and wage labor. We cannot discuss this problem without these two conditions. We assume a two-sector economy, which is the smallest model and reflects the social division of labor. The first sector produces production goods the other consumer goods.¹¹

¹¹ See Okishio (1976:43)

The following assumptions in the FMT, which state that the source of profit is based on the existence of surplus labor, are easy to identify.

(A1) Commodity production is dominant: the products are measured in money, and therefore have the form of a price (production goods prices p_1 , and consumer goods prices p_2)

(A2) The commodification of the labor force: the price of labor (money wage rate w)

(A2 ') Because of the unequal distribution of the means of production, the "have-nots" are forced to sell their laborpower

(A3) The real wage rate is defined in the context of socio-cultural history, and for now will be given as $R(= \frac{w}{p_2})$

(A4) Production techniques: the amount of production goods required to produce one unit of production goods and consumption goods a_1 (a_2), the amount of direct labor required to produce one unit of production and one unit of consumption goods, respectively τ_1 (τ_2)

In order for profit to exist in both sectors, the following system of inequalities must have positive solutions (prices $p_1 > 0$, $p_2 > 0$ and the money wage $w > 0$).

$$p_1 > a_1 p_1 + \tau_1 w$$

$$p_2 > a_2 p_1 + \tau_2 w$$

$$w = p_2 R$$

The necessary conditions for positive solutions are:

$$1 - a_1 > 0 \quad [\text{Net output possibility condition}]$$

$$1 - R t_2 > 0 \quad [\text{Surplus condition}]$$

The total amount of labor required to produce one unit of production goods and consumer goods is determined by the following equations using the production technique stated above.

$$t_1 = a_1 t_1 + \tau_1$$

$$t_2 = a_2 t_1 + \tau_2$$

The surplus condition states that the amount of labor required to produce consumer goods, which wageworkers buy back with their wages ($R t_2$) is smaller than one unit of labor. Therefore, there must exist surplus labor.

This model assumes (A1) and (A2), by which it characterizes the capitalist economy. In other words, it pushed outside both the so-called process of the primitive accumulation of capital and the process of the introduction of a new technique, which is constantly developed from the economic and social point of view. In so doing, "the simplest possible model" has been configured, which might disclose the secret of the exploitation in capitalist production, but as long as the real wage rate is assumed as a given, this model is incomplete. Indeed the proof of the existence of exploitation has not been finished, because it is unclear whether the real wage rate moves in the region which satisfies the surplus condition or not. Okishio wrote on this point as follows.

The critical problem for the survival of the capitalist economy is whether the real wage rate will stay in the permissible region with the result that there is a cyclical movement of the rate of capital accumulation and its trend through cycles.

In my opinion, the proof of Marx's theory of exploitation is complete in Chapter 23 of Capital Vol.1, which deals with the process of capital accumulation.¹²

One key point remains. When re-reading the FMT from the point of view of “Externality”, the existence of exploitation can be demonstrated in the chain of mathematical equivalence, if a specific model economy can be formulated. However, the question remains as to whether or not with the theory of exploitation, we can say that a capitalist economy is ‘unjust’ so that we can then proceed to develop the idea that the capitalist society must be replaced with a new one.¹³ Certainly the FMT asserts that the capitalist economy has been established on the exploitation of the *have-nots*. However, it is not certain that the unequal distribution of assets has been formed because of the unfair process of primitive accumulation and therefore this injustice must be remedied.

Transactions between the capitalist and labor seem to be “free” and “equal”. But is this true? What we should discuss is not the legal issue of the relationship, but the de facto relationship.

...

The relationship between the capitalist and wageworker cannot be equal. The capitalist owns the means of production and also owns a stock of goods for consumption. On the other hand, the worker does not own the means of production and has no stock of consumer goods. As a result, workers are forced to sell their labor to capital.

...

Hunger compels them to do so.¹⁴

“Equality” and “freedom” in the passage above have not been explored deeply. As long as an economic transaction is carried out based on formal freedom and voluntary contract, there are no elements to be criticized in a capitalist economy. Such an understanding might allow the power to continue with their exploitation. This would constitute the ideology of modern economic theory. On the other hand, if you say that a capitalist economy is unjust, a shift to a more equitable economic system is required. As people constitute society, they have a responsibility to transform the society. How are subjects of change formed? How can they be formed? These issues will emerge. We have to examine whether and how the boundaries of economics and political science should be drawn. We can say that Okishio is quite naive in his evaluation of both the formation of the subject of change and the competence of the working class.¹⁵

¹² See Okishio (1976:57, 89)

¹³ If “Steel (an example of a commodity)” is selected instead of “labor” as *nemeraire*, steel-value can be obtained in the value equations. We can formulate the fundamental Marxian theorem in steel-value terms. This is called the Generalized Commodity Exploitation Theorem. Cf. Bowles and Gintis (1981).

¹⁴ Okishio (1976:53)

¹⁵ Indeed the downward cumulative process of disequilibrium forces workers to lose jobs, and in some cases, they almost lose their lives. But this does not mean the immediate formation of the subject of change. Okishio understood this but we can say that he was very optimistic about this situation. See Okishio (1980:40).

5. Life in an unstable world: Okishio's Accumulation Model

As has already been confirmed, the movement of the real wage rate must be clarified in order to complete the exploitation theory (FMT). It is also necessary to talk about the character of the antagonism between capital and labor. This would become a central issue of Okishio's theory of capital accumulation.¹⁶

The theoretical framework, which is "External I" in this paper, consists of the following items: the labor productivity sufficient to produce a surplus, the role of production goods, the scale of cooperation, the minimum necessary amount of money, and information processing capabilities. However, putting these aside for a while, we will summarize how Okishio's accumulation model is formulated. The criteria used to classify models can be listed as follows:

- (B1) Open systems / Closed systems
- (B2) Nation state¹⁷
- (B3) One-sector/ Two-Sector/ Multi-sector
- (B4) Real system and monetary system
- (B5) "Closed (and complete) model"
- (B6) Exogenous / endogenous technical change¹⁸
- (B7) Exogenous / endogenous labor supply

The assumptions of the model explored in Okishio's *Theory of Accumulation* are:

- (B1) Closed systems
- (B2) The nation state is abstracted
- (B3) One-sector and/or Two-Sector
- (B4) Real system
- (B5) "Closed (and complete) model"
- (B6) The production technique is a given
- (B7) Exogenous labor supply¹⁹

Then, in analyzing the accumulation process, three kinds of trajectories are postulated: "a smooth extended reproduction trajectory," "an equilibrium accumulation trajectory," and "an actual accumulation trajectory". The growth path, which satisfies both the equilibrium of the goods market and the normal utilization of production equipment, defines "a smooth extended reproduction trajectory". The Equilibrium Accumulation Trajectory is persistent. "Persistence" means that a situation, which jeopardizes the survival of the system, cannot arise when the economy takes this path. Specifically, the initial point is that there is unemployment, and then the rate in the growth of labor demand is equal to that of labor supply, which is to say, the rate of unemployment is kept constant.

Needless to say, it is uncertain whether the actual path of accumulation always moves along the equilibrium accumulation trajectory. If the actual rate of accumulation diverges from equilibri-

¹⁶ Okishio (1976).

¹⁷ Okishio's view of the state is that of a traditional Marxist. For example, he affirmed, "The state presides over the ideological, legal and violent apparatus, equipment, legal and institutional devices to summarize the violence, which is essential for the superstructure to maintain specific relations of production." Okishio (1980:146).

¹⁸ Okishio wrote, "The character of new production techniques cannot be neutral or independent from the relations of production." Okishio and Ito (1987:173).

¹⁹ Okishio (1976:315-17).

um, disequilibrium arises, and the extent of the disequilibrium will increase. The path never smoothly returns to equilibrium.

The one-sector model, which can describe the movement of the rate of capital accumulation (g_t) and the real wage rate (R_t), is summarized by two equations.²⁰

$$g_{t+1} = g_t + \beta(\delta_t(g_t) - 1)$$

$$R_t = \frac{\delta(g_t)\sigma - g_t}{l\delta(g_t)\sigma}$$

Where

δ = Rate of utilization of equipment

σ = Normal capital coefficient

l = Labor coefficient.

The rate of capital accumulation diverges from the equilibrium value (g^*). The extent of disequilibrium increases upwards or downwards. Under conditions in which the profit rate elasticity of the rate of utilization is less than unity, the real wage rate moves with capital accumulation in the opposite direction. That is, when the trend in the rise of the rate of capital accumulation increases, the real wage rate continues to decline. Even if the model does not satisfy the elasticity condition above, the real wage necessarily declines after the capacity utilization rate has reached its limit. The rate of capital accumulation and the real wage rate can move in the same direction, but such a movement cannot last.²¹

The accumulation rate, the rate of profit, the growth rate of labor demand, and the real wage rate continue to increase or decrease in one direction. Why does the disequilibrium increase? What is the reason for this process?

- (i) A capitalist economy is a commodity society based on exploitation
- (ii) Workers are exploited, and their demand for consumption is limited.
- (iii) Capitalists produce goods in pursuit of profit anarchically

This result in a basic contradiction in the capitalist economy.²² However, there is the historical fact that capitalist society has survived for a long time even though inevitably the disequilibrium gets worse, so we have to clarify why a capitalist economy can reproduce itself theoretically and consistently. This is the theoretical challenge we face.

*We cannot accept the view that the accumulation of capital is not possible without the external complement of a capitalist society. Accumulation is possible under a capitalist economy, and inevitably so.*²³

Here we return to the analysis of the real wage rate, which plays a critical role in this paper. The real wage rate will continue to decline in the upward cumulative process of disequilibrium, and it will eventually reach a level under which workers cannot maintain their livelihoods. If the

²⁰ See Okishio (1976) Mathematical appendix.

²¹ See Okishio (1976: 315-17). Sato (2004) examined the mathematical structure of Okishio's accumulation model.

²² Op.cit. 199-200.

²³ Op.cit. 129.

real wage declines to such a low level, workers cannot appear in the labor market. Accordingly, a capitalist economy as an economic system cannot maintain itself in this situation because no one can find workers to exploit.

In other words, the capitalist economy, through its internal system, establishes a mechanism that rejects itself. If we don't admit the "existence of an external complement", we must proceed with the following logic. The upward cumulative process of disequilibrium must be reversed as long as we assume that a capitalist economy can survive.

We assert Okishio's accumulation model to be "(B5) closed". Certainly the model itself is complete since the number of equations and unknowns are equal. However, it is *in*-complete as a model to describe the actual cyclical behavior of a capitalist economy. Therefore, to ensure the survival of the capitalist, a variety of momenta must be added from outside. If we do this, Okishio's theory of accumulation can be closed. In this respect, this is different from models such as the Goodwin model, which produce regular cyclical movements inside the system.²⁴ Speaking only from the point of view of formal similarity, it resembles Hicks' trade cycle model²⁵ or Harrod's instability principle.²⁶

The point of this argument, the character of regular cycles, is connected to the evaluation of Uno's Theory when compared with Okishio theory.²⁷ Okishio objected to Uno, saying "he understands a capitalist economy as being constantly repeated. His theory seems to be ahistorical in that it does not pursue the momentum of the irreversible movement of capital."²⁸ On the other hand, Makoto Ito has responded as follows.²⁹ Okishio's point is confined to "an area called the principle."

Finally, we will take the issue of (B4) the real system and the financial system. Causality in the Okishio model moves from the goods market towards the labor market. The financial market does not play an active role. Okishio brought in "the exhaustion of money funds" as a momentum, which could reverse the upward cumulative process of disequilibrium. The leading factor is not monetary but real. Okishio departs from Uno on this point.³⁰

*General overproduction cannot occur unless the rate of capital accumulation declines. Such a rise in interest as is enough to cause further declines in rates of capital accumulation cannot be the cause of a decline in capital accumulation, but the result.*³¹

6. Return to the "Basic"

The existence of a profit is essential to a capitalist economy. The "Fundamental Marxian Theorem" revealed a temporary existence condition, and the accumulation model analyzed the existence of profit through cycles. When the economy moves along the limit cycle where the period and amplitude are constant, regular cycles are repeated constantly. If this is not the case, we must discuss the trend through the cycles themselves. Here, we are trying to re-read Okishio's theory. A re-examination of the "Okishio theorem" will be helpful at this point. A proposition has been presented through the study of the law of the falling rate of profit. The name of Okishio is

²⁴ Goodwin (1967). Sato (1985) explored the Goodwin-type movement in a two-sector economy.

²⁵ Hicks (1950).

²⁶ Harrod (1948).

²⁷ Uno (1953).

²⁸ Okishio (1980:10).

²⁹ Okishio and Ito (1986).

³⁰ On the classification of many macro models, see for example, T. I. Palley (1999).

³¹ Okishio (1976:232).

often chosen as a disputant who denied Marx's argument on the falling rate of profit. Clearly, this is a misunderstanding. Okishio argued the law in two different ways. The first concerns the type of technological progress; the second is the so-called "Okishio theorem". Regarding the rate of profit, the following relation holds.

$$r = \frac{M}{C + V} < \frac{V + M}{C} = \frac{N}{C}$$

Where

- r = Rate of profit
- C = Constant capital
- V = Variable capital
- M = Surplus value
- N = Living labor ($=V + M$)

The actual rate of profit moves upwards and/or downward, that is, it experiences a cyclical movement, but the rate of profit necessarily declines as long as the ratio N/C declines. Okishio called C/N "the organic composition of production", so the reciprocal of the organic composition of capital results in the decline of the rate of profit in the long run.

Marx characterized technical change in a capitalist economy as the increase of the organic composition of capital (i.e. the rise of C/V) and claimed a falling rate of profit. However, the rate of profit is determined by two factors: the rate of surplus value (M/V) and the organic composition of capital (C/V). The movement of the average rate of profit cannot be defined by only one factor. What Okishio did is correct this point. He did not deny the law itself. In other words, he raised the importance of the type of technical progress. This determines the trend of a capitalist economy.³²

Now we move on to the "Okishio theorem":

Assume that the real wage rate measured by consumer goods remains constant and a new technique of production is introduced if the unit cost of output at the prevailing price is less than the pre-change unit cost.

- (i) If the industry where the new technique is introduced is a non-basic industry, then the general rate of profit is not influenced at all.
- (ii) If the industry introducing the new technique is a basic industry, then the general rate of profit *necessarily* rises.³³

Thus, the Okishio theorem is demonstrated under the following assumptions: (a) the real wage rate remains constant, and (b) a new equilibrium rate of profit prevails after the introduction of a new production technique. The comparison lies then between the equilibrium established before and after the introduction of new technologies; it is the result of comparative statics. The law of the falling rate of profit concerns the actual movement in the accumulation process, which is not static but dynamic. So there is a big gap between the arena the Okishio Theorem operates in and the

³² In a simple case, the organic composition of production equals the capital coefficient in modern economics. The situation in which the organic composition of production does not increase, or remains constant entails a constant capital coefficient. It suggests the 'Harrod neutral' type of technical progress in growth theory.

³³ Okishio (1961).

argument Marx developed. Okishio's theorem is static in character.

Okishio was captivated by the image that the market equilibrium could be smoothly established through competition. He was influenced by Hicks' writings, which he studied intensively in his young days. The basic ideas in his *Basic Theory of Capitalist Economy* were formed in the 1950s. He was under the influence of general equilibrium theory, though he had already decided to analyze the economy using Marx's framework. Later, he constructed his own theory of accumulation through a critical examination of the writings of Keynes, Harrod, Kaldor, and neoclassical growth theory. After he completed the theory of the cumulative process of disequilibrium, he began to assert that the equilibrium state cannot be realized even temporarily and that it is only established on average in the long run through cycles. In his Preface to *Basic Theory of Capitalist Economy* (enlarged and revised edition), Okishio described this as follows.

In the later stage of Chapter 3 Section 1 ("Existence of the average rate of profit and its establishment") of the first edition, it was shown that the profit rate was equalized in every sector under the assumption of a free flow of capital to each sector. But here I confirm that this was incorrect. Even if the flow of capital is free, the flow into the sector itself affects new investment demand. Then aggregate demand may increase, which may accelerate differences among sectors. Equalization of the rate of profit is established through cycles: an upward cumulative process of disequilibrium → reverse → downward cumulative process of disequilibrium → reverse →³⁴

It might be reasonable to conclude that equalization of the rate of profit will be established through business cycles on average in the long run. However, the question remains. Does competition within capital lead to a situation where a uniform rate of profit is established? As discussed above, the Okishio Theorem rests on two assumptions: (1) that the real wage rate is constant, and (2) that a new equilibrium rate of profit prevails (in other words, new production prices are established). What situation will emerge when we remove these assumptions? This was the problem Okishio tackled in his later years.

Okishio analyzed this problem in several papers.³⁵ The paper published in the *Cambridge Journal of Economics* was his last. His conclusion was negative for the theorem. "Competition among capitalists, when there is no technical change, does not establish production prices with a positive profit rate. Instead, it destroys surplus value itself."³⁶

The implication of this conclusion has a critical importance for a political economy that asserts capitalist society is based on the exploitation of workers. In FMT, the real wage rate is shown as given from "outside". Then, the movement of the real wage rate appeared to have been demonstrated in "a closed model", but, in order to complete the model as a cycle theory, some moments to reverse the cumulative process had to be added from "outside", so the logical structure was not changed. Moreover, the Okishio Theorem has shortcomings. The proof rests on a questionable assumption: that the real wage is constant and is given from "outside". We admit that the wage rate will fluctuate due to the forces of supply and demand. If we assume that (a) the supply of labor remains constant, and (b) that there is no technical change, the proposition that completion among capitalists establishes production prices with a positive uniform rate of profit is denied. "Though the increase in the supply of labour is a way of keeping the surplus value positive, it is an

³⁴ Okishio (1978:7).

³⁵ Okishio (1996, 1997a, 1997b).

³⁶ Okishio (2001: 500).

exogenous factor.”³⁷ After all, in order for profits to be positive, the development and introduction of new techniques of production are indispensable. As long as technical change can be clarified “inside”, Okishio’s theory is burdened with a “theoretical hole”.

7. Conclusion

Reproductive mechanisms can be analyzed on the basis of mathematical modeling, but it is impossible to describe the process of “full maturity and transformation” in a mathematical fashion. Okishio’s standpoint that a specific society must be understood from three connected points of view, i.e. existence, reproduction and transformation, is the same as the idea of examining society based on the basis of a materialistic interpretation of history. Even when formulating economic phenomena and then examining them, he kept this standpoint, so he was a Marxist economist all his life. In this paper, we have re-read Okishio’s theory to focus on the role, which is played by the real wage rate. We compared the three dimensions of existence, reproduction and transformation to the three topics of FMT, the accumulation model, and the Okishio Theorem.

Economics, which is only one social science to understand society, cannot describe it totally. It is essentially impossible for a single theory to describe everything, and no one dreams of doing such a thing. What we should pursue is how to make “connections” between the sciences. Here we raise our consciousness of the boundaries that can limit a theory. Here is the significance of reflecting on the premises of an economic model. Referring to the existence, reproduction, and transformation of a society, we have settled on “three boundaries.” These are never solid and permanent in character. The investigation of economics cannot proceed in an orderly, irreversible fashion on the basis of axioms. We tried to describe the dynamics of a capitalist economy, the rate of capital accumulation and the real wage rate, moving cyclically in “an internal closed-system” which is bounded, but this system cannot be complete. In this sense, this attempt is unsuccessful.

Looking at the reality of the capitalist economy, new technologies have been invented and the labor supply increased. However, not only Okishio’s theory but also any other economic theory has not succeeded in building a complete system that captures these factors “inside”. For example, even the theory of endogenous technical change and the theory of induced technical progress could not do everything. Rather, we must recognize the existence of “joints” from economics to related sciences at this point. Okishio listed four that he had completed as a political economist. We may grasp the remaining challenges we must tackle from re-reading Okishio’s writings.³⁸

We live in a financialised global economy, whose technical foundation is its advanced information technology. What should we adapt from Okishio theory? How can *Okishio Theory* survive? The basic question, the origin of market instability, has been posed.

Marx emphasized the antagonistic character inherent in a capitalist economy and developed his crisis theory on this basis. Faced with the reality of the Great Depression in the 1930s, Keynes clarified that the capitalist economy has not been autonomous by pointing out the importance of investment demand. Harrod demonstrated the knife-edge character of investment. Okishio was in this tradition of economic thought. The essence of the theory, such as the following, is not and should not be dismissed. The root cause of instability is the fundamental contradiction of capital. Labour is the basis for the reproduction of human society. If capitalists do not change production technology, the capitalist economy cannot survive. Survival without technical change and so forth

³⁷ Okishio (2001:500).

³⁸ The problems around ownership and decision-making in the production process have not been mentioned so far.

is not rejected. "Having a hole" is not a drawback to a theory, it is only a reflection of the Achilles heel of the capitalist economy.

Despite a severe financial collapse, many people believe that market mechanisms still operate smoothly. We can never forget that the capitalist economy is organized through *Capital*. At the heart of the workings of this system is an accumulation of capital. By this light, even if modern capitalism can be financialised, Okishio Theory will continue to qualify as a candidate to help start our thinking about it.

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