ANALYSIS ON NEOCLASSIC EQUILIBRIUM THEORY OF PRICE

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Abstract: The thesis analyzes the neoclassic price theory within the framework of value and price theory based on Marx’s labor theory of value, and then illustrates the position, essence, and defects of neoclassic price theory. Moreover, it illustrates that scientific market price theory should be established on the basis of Marx’s labor theory of value, which overcomes the defects of neoclassic price theory.

Key words: theory of price; neoclassic; Marx

As far as the content is concerned, the neoclassic price theory mainly includes the product price theory and factor price theory. The former is the equilibrium theory of price; the latter is the marginal productivity theory. As far as the method is concerned, there are partial equilibrium and general equilibrium in the neoclassic price theory. The difference between the partial equilibrium and general equilibrium does not lie in the contents of theory, but in the methods to describe neoclassic price theory. The two methods have different characteristics. Partial equilibrium stresses the essence of things in which the relation of things is weakened, while the general equilibrium highlights the relation of things in which the essence of things is inundated by a mass of information.

Neoclassic price theory can not only be analyzed within the framework of original theory, but should be analyzed within the framework of advanced and more generalized theory. Only this way can the essence of neoclassic price theory be understood comprehensively. The thesis analyzes the neoclassic price theory
within the framework of value and price theory with six levels unified, which is based on Marx’s labor theory of value, and then illustrates the position, essence, and defects of neoclassic price theory. Moreover, it is illustrated that scientific market price theory should be established on the basis of Marx’s labor theory of value, which can overcome the defects of neoclassic price theory. The partial equilibrium and general equilibrium can be used in the theory too.

This paper only discusses the neoclassic equilibrium theory of price, while the marginal productivity theory can be seen in the writer’s relevant works (see Bai 2006).

1. Positioning and Defects of Neoclassic Equilibrium Theory of Price

The neoclassic equilibrium theory of price only involves a specific level of the price theory in the value category, and only involves the fourth of the six levels of the price theory—market price operation. Moreover, the neoclassic equilibrium theory of price itself has insurmountable defects.

1.1. Positioning of Neoclassic Equilibrium Theory of Price

In order to demonstrate the positioning of neoclassic equilibrium theory of price, and then to illustrate that the neoclassic equilibrium theory of price only involves a specific level of the price theory in the value category, it is necessary to first state the content of value category and the level of value theory.

1.1.1. Content of Value Category and Level of Value Theory

(1) Three Aspects of the Value Category

The value category includes three contents.

First is the inherent worth of a commodity or wealth and its measure. The “value” in expressions such as “labor is the only source of value,” “labor creates value,” or “three factors create value” essentially refers to the inherent worth.

Second is the factor of determining the center of price movement or the center of the proportion in which commodities are exchangeable. When people speak of the value laws, in expressions such as “price fluctuates around value,” “price is determined by value,” or “the proportion in which commodities are exchangeable is determined by value,” they refer to the “value” in this meaning.

It can be considered as the theory of price in value category, the function of which lies in illustrating the laws of price movement.
Third is the relation between the inherent worth of wealth or commodity and the price movement center, the function of which lies in illustrating the relation between the content (substance) of wealth and the laws of price movement.

For a long time, people have misunderstood that the inherent worth of commodity is the factor that determines the price movement center. It has been an axiom within people’s subconscious. People always hold an opinion that it is rational if the exchange of commodities happens according to the proportion determined by the inherent worth; it is irrational if it happens while violating the certain proportion.

However, “the inherent worth of commodity” and “the factor to determine the price movement center” are not unified. Thus, the relation between them should constitute special study.

(2) Six Levels of Value Theory
On the foundation of the three contents in the value category, the theory of value and price, from abstract essence to concrete superficial phenomenon and operation mechanism, should include six levels as follows.

The first level: the essence of value and price. It is the social production relation embodied in value and price. This is the most abstract and deepest level of price theory.

The second level: the substance of value and ultimate basis of price. This level focuses on the content of value, factors of value forming, and measure of value. Value constitutes the social content and substance of wealth as well as social substance of wealth distribution; consequently, value further constitutes social content and substance of commodity exchange. In this sense, value is the ultimate basis of price.

The two levels above mainly illustrate the first content of value category: the inherent worth of commodity or wealth and its measure.

The third level: exchange value (direct basis of price) and natural price. Natural price is the movement center of market price. Exchange value (direct basis of price) is the category determining the natural price directly. It is the transformation of value. Natural price is the money form of exchange value (direct basis of price).

In the commercial economy, commodity exchange and commodity price are the realization forms of social labor distribution; meanwhile, the laws of exchange and price are the representation forms of distribution laws. Moreover, the proportion in which commodities are exchangeable depends on the distribution proportion of social labor which is decided by social productivity and production relations. Social productivity and its development determine the distribution proportion of social labor in each industry; social production relations determine the distribution proportion of social labor in each social class. Therefore, the center of the
proportion in which commodities are exchangeable, or the center of market price movement, is determined by the social distribution laws, which are determined by both the social productivity and production relation. This form of value distribution determined by both social productivity and production relation is the exchange value actually. Exchange value is the direct basis of price; consequently, it constitutes an independent category.

The third level illustrates the second and third contents of value category: the second is the determinants as well as determination forms of exchange rate between commodities (or round the price movement center); the third is the relation between the inherent worth of wealth (or commodities) and determinants of price movement center.

Production price is the special form of exchange value (the direct basis of price) in freely competitive capitalist economy.

The fourth level: market value and market price operation. As mentioned before, the market price fluctuates or moves around the natural price. Market price operation refers to the movement and the realization of exchange value (direct basis of price) through this movement.

In market, market price is directly unequal to natural price. In the short term, market price fluctuates around natural price with the changes of market demands and realizes the exchange value through this fluctuation. In the long term, natural price itself changes with the market supply–demand because productive technology is a variable, though market price is equal to natural price. Further speaking, the daily market price is unequal to the price determined by the short-run market supply–demand equilibrium but fluctuates around it. Such a fluctuation depends on the combination of supply and demand elasticity of commodity. Therefore, it is necessary for economics to research the issues, including the determination of market price by market supply–demand, changes of market price led by supply–demand changes, and the law of market daily price fluctuation resulting from the combination of supply–demand elasticity.

The fifth level: absolute price and general price level.

Both the third and fourth levels research the relative price of commodity, or the exchange proportion in which commodities are exchangeable. It is not the absolute price. The absolute price refers to the commodity price represented in the money form. In the metal money system, the absolute price of a commodity is the exchange proportion between commodity and gold (money). Value of gold (money) itself does not change very often, and its change range is not large in the short term; thus, the value of money is supposed to be constant. In this assumption, the changes of absolute price and relative price of commodity are uniform. In the paper money system, value represented by paper money often changes and the range is very large, so that the value represented by paper money is variable; thus,
the changes of absolute price are not uniform with the changes of relative price. Therefore, in this system, the changes of absolute price become an independent research subject. The changes of absolute prices of commodities are expressed as the changes of general price level. Since the establishment of the paper money system, “inflation” disturbs the economy in all countries of the world.

The sixth level: regulation and control of price.

The five levels above research what value and price as well as their movement laws are to disclose the objective contents, essences, and movement laws of value and price. It is a positive study. Consequently, normative study is supposed to be carried out. That is to say, the researches on regulation and control on price, establishing price determination model, and price management policies are carried out based on positive analyses of the first five levels.

1.1.2. Positioning and Function of Neoclassic Equilibrium Theory of Price: Different Schools of Value Theory

The neoclassic equilibrium theory of price only expresses the special situation in the fourth level among the six levels of the theory of value and price, and it cannot constitute the complete theory of value and price. Furthermore, it is impossible to negate Marx’s labor theory of value by the neoclassic equilibrium theory of price.

Value theory is the oldest as well as the most modern; meanwhile, it is the most fundamental as well as the most realistic theory in economics. Whoever from Aristotle 2,000 years ago to Marx, or the famous economists in modern time, the greatest thinkers and economists have made significant efforts in this field to acquire abundant achievements. At present, three different schools have been formed due to various historical environments, class backgrounds, research perspectives and methods. The first one is Marx’s labor theory of value. The second one is the theory of value and price in Neo-Cambridge School—Sraffa system. The third one is the theory of value and price in neoclassical school—marginalist theory of value. Furious arguments and mutual negates have lasted for a long time among each school. However, in essence, each one of these schools studies only a specific level of the value theory with the unified six levels, respectively.

Marx contributed to the first-level study and revealed the essence of value. Before Marx, almost all people had held the opinion that value was the material property of commodity. Marx then revealed that value was the social property of commodity, and it was essentially the social production relations between labor distribution and labor exchange among commodity producers.

The British bourgeoisie classical economists studied the second level initially. This school was set up by William Petty, and then Adam Smith constituted a huge theoretical system. Then finally, it was accomplished by David Ricardo. However, the British bourgeoisie classical economists did not establish a scientifically
complete value substance theory because of the limitations of social classes and histories. The contribution to establishment on scientifically complete value substance theory is attributed to Marx finally.

The contents of the first and second levels constituting the core part of Marx’s labor theory of value help economists observe and analyze the social essence and content behind economic phenomenon. Meanwhile, Marx also established the surplus value theory based on the above contents and revealed the exploitation essence in capitalism.

The research on the third level proposed by classical economy was carried out by Marx initially, and was further studied by some economists belonging to Neo-Cambridge School.

In the simple commodity production, the form of direct basis of price is the value magnitude included in a commodity itself; meanwhile, the direct basis of price and ultimate basis of price are coincident. From the capitalism period, the direct basis of price is separated from the ultimate basis of price. In the free competition capitalism period, the form of direct basis of price is the production price (the price of production of commodity). Bourgeois classical economics broke up since it was unable to handle the relation between labor theory of value and production price. Marx (1998) solved this problem in Capital, vol. 3, and then verified that the production price was the transformation of value, which was the “value transformation theory” of Marx.

In 1960, Production of Commodities by Means of Commodities was published, written by Sraffa who is the famous leader of Neo-Cambridge School and established the price theory—Sraffa system. The system set up the simultaneous equations with the input, output, and general profit rate in commodity production, by which the exchange proportion or the price of commodity would be calculated and related with its distribution. This book was considered as an epochal work. And such price theory is named “theory of price determined by physical quantity” or “physical theory of price.”

However, essentially, the book only discusses the calculation on precise magnitude of the production price, which is a special case of exchange value (direct basis of price). However, the followers of Sraffa believed that what he established was a complete theory of value and price.

The book Marx after Sraffa written by Steedman (1977) further mathematized the “Sraffa system,” and partially verified based on his own understanding that Marx’s labor doctrine of value was redundant in price determination, necessarily to be abandoned.

In Chap. 10, in Capital vol. 3, Marx discusses the fourth level to some extent. He would plan to research “capital competition,” or capitalist market and price operation in his specific volumes, but he could not finish this mission within the
life span. Thus, the relative theories of market value and market price of this level were not accomplished.

The bourgeois vulgar economists named by Marx, or defined as a part of classical school by western economics, stated the function and process of market supply–demand to the price determination and change of commodities by means of equilibrium analysis. However, they rejected all the researches on the foundation of price determination and changes. Therefore, the theories they put forward had some unsolvable problems leading to the failure in the competition with Marx’s labor theory of value.

The neoclassical school, namely, the modern neoclassic equilibrium theory of price, introduced the differential calculus in mathematics into the economics, which was based on the equilibrium analysis, then, researched the function and process of market supply–demand to commodity price determination and change, and established a theory of market price operation on price level. Both the classical school and neoclassical school in vulgar economics studied the “market price operation,” the fourth level of value and price theory, lacking the first three levels as foundation. However, they admired their theory as a complete price theory to stand against Marx’s labor theory of value. The representative figure of neoclassical school was the famous professor Marshall ([1890] 1920), from Cambridge University, whose work Principles of Economics, published in 1890, laid the theoretical foundation for neoclassical school. With the development lasting for centuries, the neoclassical school has been dominating a mainstream position in western price theory.

Essentially, the neoclassic equilibrium theory of price only involves the fourth level of theory of value and price, while the advocates of this theory hold the opinion that it is the only right and comprehensive price theory.

The six levels of theory of value and price, and study content of each school are expressed in Figure 1.

According to the illustration in Figure 1, neoclassic equilibrium theory of price is only one level of the price theory in the value category, and is just the research on the fourth level among six levels of the theory of value and price.

As for analysis on the market price, it can also be divided into two levels, including value level and price level. The research on value level reveals the essence of market price operation, while the research on price level illustrates the superficial phenomenon of market price operation. What the neoclassic equilibrium theory of price involves is exactly the issue of market price operation on price value. Accordingly, the neoclassic equilibrium theory of price just describes the superficial phenomenon of market price operation.

What Marx’s labor theory of value studies is on the level of abstract essence, while what the neoclassic equilibrium theory of price involves is on the level of
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Concrete superficial phenomenon. The levels involved in both are different, so that the neoclassic equilibrium theory of price with the description of market price operation to negate Marx’s labor theory of value is completely untenable. Thus, an analogy can be made that the neoclassic equilibrium theory of price negating Marx’s labor theory of value is not different from setting up a windmill by himself and then attacking it.

The neoclassic equilibrium theory of price can only explain some issues of market price operation but cannot explain all aspects of issues of value and price comprehensively, especially the issues relevant to the wealth theory in the value category. Therefore, the market equilibrium theory can neither replace nor negate the labor theory of value essentially. Moreover, the neoclassic equilibrium theory of price has a series of theoretical defects accordingly.

1.2. Defects of Illustration on Price Essence

The neoclassic equilibrium theory of price describes superficial phenomenon but negates labor theory of value that studies essence level. Thus, it cannot illustrate issues on essence level, and this theory will never be self-perfected.

First, before illustrating the determination of price, the neoclassic equilibrium theory of price uses the concept of price directly without illustrating the essence, content, and determination of price. On one hand, in the discussion on demand, the neoclassic equilibrium theory of price directly uses the product of commodity price and commodity quantity as consumer expenditure in the budget of consumer income, and derives the consumer demand function and curve, which reflect the
relation between consumer demand and commodity price. On the other hand, in 
the discussion on supply, the neoclassic equilibrium theory of price directly uses 
the demand curve of firm product expressed by price in the firm equilibrium, 
and derives the firm supply curve, which reflects the relation between supply 
of perfectly competitive firm and commodity price. In the analysis on perfectly 
competitive market equilibrium, the neoclassic equilibrium theory of price directly 
uses the market demand curve and market supply curve derived from the consumer 
demand curve and firm supply curve expressed by price, and derives the market 
equilibrium price accordingly. Therefore, the neoclassic equilibrium theory of 
price claims that it illustrates the determination of price. However, if people further 
inquire what the content of concept of “price” adopted by neoclassic equilibrium 
theory of price at first is and what determines it, the neoclassic equilibrium theory 
of price is unable to answer the questions above. It can be seen that the neoclassic 
equilibrium theory of price just floats on the description of superficial phenomenon 
of price operation but does not delve deep into the essence of price determination.

Second, the neoclassic equilibrium theory of price directly uses all kinds of 
variables which are measured by money, but does not and cannot illustrate the 
essence, content, and determination of these variables. The neoclassic equilibrium 
theory of price directly uses the concept of consumer income expressed by money 
in the discussion on demand, while uses the concept of cost expressed by money 
in the discussion on supply. However, if people further inquire what the essence of 
these concepts is and why these concepts should and can be measured by money 
and also how their quantities are determined, the neoclassic equilibrium theory of 
price cannot answer these questions. It can be seen that the neoclassic equilibrium 
theory of price just floats on the description of superficial phenomenon of 
consumer’s and firm’s behavior but does not delve deep into the essence of the 
price determination.

Market price operation is divided into two levels, including value level and 
price level. Value level is the essence level, while price level is the phenomenon 
level. The neoclassic equilibrium theory of price is just restricted to the discussion 
on price level; thus, it does not and cannot go deeper into value level. In short, the 
neoclassic equilibrium theory of price merely describes superficial phenomenon 
but negates the labor theory of value that studies essence level. Thus, it cannot be 
self-perfected.

Why does the neoclassic equilibrium theory of price just float on the description 
of superficial phenomenon but does not go deep down into the essence? It is 
because it has to admit the correctness of labor theory of value to delve into the 
essence, which is disadvantageous to the capitalist system and the interests of 
the bourgeoisie. Thus, the neoclassic equilibrium theory of price is unwilling
to and cannot go deep into essence level, which determines it is inevitably self-unperfected.

1.3. Defects of Neoclassic Equilibrium Theory of Price: A Colossus with Feet of Clay

Since the neoclassic equilibrium theory of price is just the study on a specific level among six levels of the theory of value and price, and lacks scientific foundation, there are great theoretical defects in it. The neoclassical school derives the supply curve from neoclassical production function and the demand curve from utility function, then, on the basis of that, a huge neoclassic equilibrium theory of price system is set up, constituting the main body of modern microeconomics. Thus, the neoclassical production function and utility function are the two foundations and starting points of neoclassic equilibrium theory of price. It will separately illustrate the theoretical defects existing in neoclassical production function and utility function below. The two theoretical defects exactly make the neoclassic equilibrium theory of price a colossus with feet of clay.

1.3.1. Neoclassical Defects of Supply Curve: Measurement of Capital and Existence of Neoclassical Production Function

(1) Neoclassical Defects

The supply curve in the neoclassic equilibrium theory of price is derived from neoclassical production function. However, the Neo-Cambridge School accused the neoclassical production function as follows.

In the neoclassic equilibrium theory of price, the production function is defined as the technology relation between input and output. Thus, there are two most important inputs in the production process: one is labor $L$, the other is capital $K$ in the neoclassical production function. So the neoclassical production function can be written as follows:

$$ q = f(L,K). $$

Since the production function is the technical relation between input and output, which is equivalent to the relation between objects, both input and output should be measured with physical units. However, output $q$ and labor input $L$ have physical quantity units of their own—exclusive of capital. According to the neoclassical school, capital is defined as production elements produced; those are of variety such as plants, lathes, cutters, and lubricating oil, so that they cannot be measured with a single physical unit. Then, is it possible to measure capital by the sum of prices of these production elements? That is to say, is it possible to measure capital by the money value of these production elements? Obviously, it is impossible.
Because if the sum of the prices of these production elements is employed to measure capital, with technology unchanging, once the prices of production elements have any change, the form of production function will vary accordingly. Under this circumstance, it is divergent from the definition of production function by neoclassical school. Anyway, the neoclassical production function is not tenable until capital can be measured in a single unit (see Asimakopulos 1978, 168).

The censure was presented by Joan Robinson (1953), the leader of Neo-Cambridge School and a famous British economist, in her famous paper, *The Production Function and the Theory of Capital*. She pointed out that the production function has been a powerful instrument of mis-education. The student of economic theory is taught to write $O = f(L, C)$, where $L$ is the quantity of labor, $C$ is the quantity of capital, and $O$ is the rate of output of commodities. He is instructed to assume all workers alike, and to measure $L$ in man-hours of labor; he is told something about the index-number problem involved in choosing a unit of output; and then he is hurried on to the next question, in hope that he will forget to ask in what units $C$ is measured. Before ever he does ask, he has become a professor, and so sloppy habits of thought are handed on from one generation to the next.

The neoclassical school cannot reply the censure, basically taking the evasive attitude. For example, in the popular textbook of *Microeconomics: Theory and Application* by Edwin Mansfield (1975), at the beginning, the author discusses the production based on labor and land as two production factors, and illustrates that the unit of labor is person per year and the unit of land is mu. Then, in his geometrical figures, capital is substituted for land, and it is said that similar to the previous figure, labor and capital are assumed to be the two relative inputs in the figure, but not labor and land. However, Mansfield did not define any unit to the measure of capital in his figure. Samuelson took the same evasive attitude in his work of economics.

If the capital cannot be measured, the neoclassical production function taking capital as an independent variable is not tenable; then, if the neoclassical production function is not tenable, the supply curve derived in the starting point of neoclassical production function loses its ground as well, which is the first neoclassical defect of neoclassic equilibrium theory of price.

(2) Crux of the Problem

Output, various kinds of input, and technical relation between input and output exist, namely, the relation between objects in production. Thus, it is undoubted for the existence of production function, which reflects the technical relation between input and output, namely, the relation between objects. Furthermore, the input and output should exactly be measured by a physical unit in production function.
as well. The crux of the above-mentioned problem is not in the production function itself, which reflects the technical relation between input and output, but in the neoclassical production function using capital as an input factor in production function.

The bourgeois economics only focuses on the superficial phenomenon and covers up the capitalist exploitation relation by describing the superficial phenomenon. Thus, the capital is defined as a means of production. For example, the bourgeois vulgar economist John Stuart Mill (1848, 279) said, “Understanding by capital, the means and appliances.” Then, the neoclassic equilibrium theory of price is no exception. It defines that “the word capital is used to summarize all the factors of production that be produced out” (Asimakopuios 1978, 157). “Capital, defined as man-made aids to further production, including all machines and other production equipment” (Lipsey and Steiner 1981, 175–76).

However, in Capital, Marx has already revealed scientifically that capital is not a thing, but rather a definite social production relation, belonging to a definite historical formation of society, which is manifested in a thing and lends this thing a specific social character. Capital is not the sum of the material and produced means of production. Capital is rather the means of production transformed into capital, which in themselves are no more capital than gold or silver in itself is money. (Marx 1998, 801)

In order to illustrate this issue, Marx cited a vivid and interesting case as follows. A British capitalist named Pierre brought production material and living material worth 50,000 pounds in all and 3,000 workers to the Swan River in Australia, and tried to build a firm and make a fortune. However, it was unexpected that the workers left him and occupied the land to make a living one after another as soon as they reached Australia with vast territory and abundant resources, in which the land could be occupied freely. Even a servant who could make a bed and go to the river to get water for him did not stay. Marx said sarcastically, “Unhappy Mr. Peel who provided for everything except the export of English modes of production to Swan River!” (Marx 1996, 753). After citing this case, Marx said, “The means of production and subsistence, while they remain the property of the immediate producer, are not capital. They become capital, only under circumstances in which they serve at the same time as means of exploitation and subjection of the labourer” (753). Marx criticizes the erroneous view of bourgeois economics and points out, “But this capitalist soul of theirs is so intimately wedded, in the head of the political economist, to their material substance, that he christens them capital under all circumstances, even when they are its exact opposite” (753).
Although the neoclassic equilibrium theory of price defines capital as a means of production, it cannot get rid of the objective fact that the capital is a value magnitude and a kind of production relation. Thus, it has to take capital as a category, which is not only a means of production in the theory. If the capital is just a means of production, all kinds of material compositions of it can be put into production function directly as input, while these material compositions all have their own physical units. Thus, there is no necessity to take the capital as whole input in production function and look for measure unit for it as whole input. However, the neoclassic equilibrium theory of price must take capital as whole input to put into production function. The neoclassic equilibrium theory of price tries to establish the distribution theory on the basis of the production function taking capital as the input, and to illustrate that, in this distribution theory, the capitalists’ income is the contribution of capital, thus the capitalism is reasonable. Just for the purpose of such defense, the neoclassic equilibrium theory of price must take capital as whole input, which is not only a means of production to put into the production function reflecting the technical relation between objects.

Similarly, for the purpose of defense, the neoclassic equilibrium theory of price must also define the capital as a means of production through just describing superficial phenomenon, which leads to a contradiction. On one hand, if the capital is defined as a means of production, it will be unnecessary to put the capital into production function as a whole input; on the other hand, if the capital is taken as not just the total of means of production, it cannot be put into production function, reflecting the relation between objects as input. The neoclassic equilibrium theory of price actually puts the capital, which cannot be taken as the input, into the production function. This is the crux of the problem. The neoclassic equilibrium theory of price puts the capital which is not an object as input into the production function reflecting the technical relation between objects. However, as for the property of production function, the capital as input should have a physical unit while as for the property of capital itself, it does not have a physical unit, which constitutes the difficulty unable to be solved in production function theory of neoclassic equilibrium theory of price. In fact, the neoclassical production function taking capital as input is not tenable.

(3) Conclusion
In order to defend for the capitalist economy system and interests of bourgeoisie, the neoclassic equilibrium theory of price merely describes the superficial phenomenon, defines the capital as a means of production, and puts it into production function, which reflects the technical relation between objects as input. Similarly, for the same purpose of defense, the neoclassic equilibrium theory of
price has to take capital as a special entirety in neoclassical production function. Accordingly, in the neoclassical production function, the measure unit of capital becomes a problem, which is unable to be solved. As a result, the theory of neoclassical production function in the neoclassic equilibrium theory of price has insurmountable difficulty and is not tenable.

1.3.2. Neoclassical Defects of Demand Curve: Problem in Measurement of the Utility

The demand curve in the neoclassic equilibrium theory of price is derived from utility function. However, for the utility function in neoclassical school, the biggest theoretical difficulty is how to measure utility and marginal utility, which is still a problem now. The illustration on social structure will be touched upon by the measurement of utility. Thus, facing up to the trouble, the neoclassic equilibrium theory of price has to avoid the measure of utility; moreover, it abandons the theory of cardinal utility. The theory of cardinal utility is substituted by the theory of ordinal utility, used to explain the demand curve. Two problems are brought from transferring the theory of cardinal utility to the theory of ordinal utility. On one hand, essentially, the transferring abandons measurement of social wealth, or abandons the value theory, so that the neoclassic equilibrium theory of price merely researches the theory of price, without the element of value theory. On the other hand, “the theory of ordinal theory” is far away from being self-integrated, then, will only be perfect under some strong assumptions. This is the detour of western economics for nearly 100 years.

There is no conclusion on the measurement of utility; thus, the demand curve derived from utility function is in the absence of solid logical foundation, which is the second neoclassical defect of neoclassic equilibrium theory of price.

1.4. Conclusion

In short, the neoclassic equilibrium theory of price only involves a specific level of the price theory in the value category, and only involves the fourth level among six levels of the theory of value and price—market price operation. Moreover, the neoclassic equilibrium theory of price itself has insurmountable defects, for example, “defects of illustration on price essence” and “neoclassical defects”: problems in measurement of capital and existence of neoclassical production function and problem in measurement of the utility.

2. Market Price Analysis Based on the Labor Theory of Value

Scientific market price theory can be established on the basis of Marx’s labor theory of value, which can overcome the defects of neoclassic price theory. It
can not only explain the nature of market price but also illustrate the superficial phenomenon of market price operation.

2.1. Variable Labor Theory of Value and Supply Curve

2.1.1. Establishment of Production Function on the Basis of Marx’s Labor Theory of Value

In the following, the production function will be discussed and the correct production function theory will be established consistently from the beginning to the end on the basis of labor theory of value.

Since production function is the technical relation between input and output, the capital as the category of production relation cannot be put into the production function as input. In production, there are two kinds of inputs: the living labor and means of production. \( q \) stands for the output of certain product; \( W_h \) stands for input of living labor, and its unit of measure is the natural measure unit of labor time; \( X_1, X_2, \ldots, X_n \) represent the inputs of production means, and the measurements of them still adopt their own physical units. So the general form of production function can be written as follows:

\[
q = F(W_h, X_1, X_2, K, X_n).
\]

We call it the general production function. The first-order partial derivative of output \( q \) with respect to input is called the marginal product of the input. \( MP \) represents the marginal product, hence

\[
MP_h = \frac{\partial q}{\partial W_h},
\]

\[
MP_{Xi} = \frac{\partial q}{\partial X_i} \quad i = 1, 2, \ldots, n,
\]

where \( MP_h \) stands for the marginal product of living labor and \( MP_{Xi} \) stands for the marginal product of the means of production \( i \).

\[
MRTS_h = \left. \frac{dW_h}{dX_j} \right|_{q \text{-constant}}.
\]

\[
MRTS_{X_i} = \left. \frac{dX_i}{dX_j} \right|_{q \text{-constant}}.
\]
The formula is the marginal rate of technical substitution representing the changes of living labor and the input \( i \) caused by adding a unit of input \( j \) under the condition of output unchanged. It is assumed that the marginal rate of technological substitution is diminishing.

\( w_i \) represents the amount of labor expended upon producing a unit of the means of production \( i \) (including living labor and materialized labor), and is assumed to be constant; \( W_{X_i} \) represents the amount of labor expended upon producing \( X_i \) (including living labor and materialized labor); Hence,

\[
W_{X_i} = w_i X_i, \tag{3}
\]

The total amount of labor \( W \), expended upon producing output \( q \), is expressed as follows:

\[
W = W_h + \sum_{i=1}^{n} W_{X_i}. \tag{4}
\]

Substituting Formula (3) into Formula (4), we get

\[
W = W_h + \sum_{i=1}^{n} w_i X_i. \tag{5}
\]

Let

\[
W_w = \sum_{i=1}^{n} W_{X_i} \tag{6}
\]

represent the amount of materialized labor expended upon producing the output \( q \), then Formula (4) can be written as follows:

\[
W = W_h + W_w. \tag{7}
\]

All of the above formulas stand for the amount of labor expended upon producing the output \( q \).

We assume that all the inputs can be substituted by each other. From Formula (5), we can derive that different combinations of the inputs can correspond to the identical amount of labor expense. It is assumed that the firm selects the combination of inputs to make output \( q \) maximized under the identical amount of labor expense. That is to say, under the restrain
\[ q = F(W_h, X_1, X_2, K, X_n). \]  

(2)

make

\[ W = W_h + \sum_{i=1}^{n} w_i X_i \]

(5)

maximization. This can be solved by the method of Lagrange conditional extremum. Suppose Lagrange function is

\[ V = F(W_h, X_1, X_2, \ldots, X_n) + \lambda \left( W - W_h - \sum_{i=1}^{n} w_i X_i \right), \]

(8)

where \( \lambda \) is the Lagrange coefficient. The first-order partial derivative of \( V \) with respect to each input variable and \( \lambda \) equals 0.

\[
\begin{align*}
\frac{\partial V}{\partial W_h} &= \frac{\partial q}{\partial W_h} - \lambda = 0 \\
\frac{\partial V}{\partial X_i} &= \frac{\partial q}{\partial X_i} - \lambda w_i = 0 & \quad i = 1, 2, \ldots, n. \\
\frac{\partial V}{\partial \lambda} &= W - W_h - \sum_{i=1}^{n} w_i X_i = 0.
\end{align*}
\]

(9)

Formula (9) is the first-order condition of output maximization. The second-order condition is guaranteed by the assumption of diminishing the marginal rate of technology substitution. The assumption will not be discussed here. Assuming the labor expense \( W \) is regarded as a variable, there are \( n + 3 \) variables (one \( \lambda \), \( n \) of \( X_i \); one \( W_h \); and one \( W \)) and \( n + 2 \) formulas in Formula (9), so solutions of the inputs can be obtained by solving the formula corresponding to \( W \) to make \( q \) maximum. Then, the solutions of inputs can be substituted into Formula (2), the corresponding maximum outputs will be obtained. Corresponding relation mentioned above between the variable \( W \) and the output \( q \) constitutes the production function:

\[ q = f(W). \]

(10)

The production function shows the technological relation between the labor expense and the output. Since the input is unified into the labor expense here, the function is called the unified production function.
Thus, a perfect production function theory has been established on the basis of labor theory of value without any difficulty in the measure unit of input.

2.1.2. Labor Expense Function and Cost Function

(1) Labor Expense Function

The labor expense in commodity production is the only human payment in human process and social process of production (see Bai 2003). Such labor quantity is relevant to the quantity of product in production. Thus, the inverse function of unified production function

\[ q = f(W) \]  

is

\[ W = \phi(q). \]  

This shows the functional relation between the amount of labor expended \( W \) and the quantity of product \( q \) in a firm, called labor expense function.

Total amount of labor expended \( W \) divided by the quantity of the product produced in a firm is defined as average labor expense, namely

\[ AW = \frac{W}{q} = \frac{\phi(q)}{q}, \]  

where \( AW \) represents the average labor expense.

Marx named the average labor expense time upon producing a unit product in an industry the *socially necessary labor time* for producing the product, and pointed out that the socially necessary labor time formed the value of a unit of the product. Marx did not study the relation between quantity of product and amount of labor expended in a firm. But this issue is studied in the book. According to the verbal meaning of Marx’s definition, the average labor expense of producing products in a firm is called the socially necessary labor time (for producing the commodity) in a firm, marked as socially necessary labor time \((I)\); the materialized labor time is named the value determined by firm, marked as value \((I)\).²

The first-order derivative of the total amount of labor expended in a firm \( W \) with respect to the quantity of product is the marginal labor expense of firm:

\[ MW = \frac{dW}{dq} = \frac{d\phi(q)}{dq}, \]
where MW stands for the marginal labor expense of firm.

In Capital and traditional labor theory of value, there is no analysis on the non-linear change of labor expense with respect to quantity of the product, and no analysis on the labor expense function. Actually, they assume that the change of labor expense is linear with quantity of the product, and the marginal labor expense and the average labor expense are constant. Hence, we call it “the linear labor theory of value” or “the constant labor theory of value.” In this book, the labor expense function analyzed is non-linear; the marginal labor expense and the average labor expense are not constant, but variable. So the analysis on the value and price based on this is called “the non-linear labor theory of value” or “the variable labor theory of value.” We can say “the linear labor theory of value” or “the constant labor theory of value” is a special case of “the non-linear labor theory of value” or “the variable labor theory of value.”

It is assumed that the concrete form of labor expense function is shown in Figure 2. In the figure, the quantity of product is in the horizontal coordinate, and the amount of labor expended is in the vertical coordinate. The curve \( W = \phi(q) \) represents the labor expense function, called the labor expense curve.

![Figure 2 Labor Expense Curve](image)

Figure 2 shows the marginal labor expense curve and the average labor expense curve corresponding to the labor expense function in Figure 2. In Figure 3, the product quantity is in the horizontal coordinate, the marginal labor expense and average labor expense are in the vertical coordinate. The curve \( MW \) stands for the marginal labor expense function, called marginal labor expense curve. The curve \( AW \) stands for the average labor expense function, called the average labor expense curve. In this sense, the average labor expense curve is the curve of value determined by firm or the curve of value (I).
(2) Cost Function
The rate between the total amount of labor expense in a firm and the value of a unit of money is as follows:

\[ C = \frac{W}{w_g}. \]  \hspace{1cm} (14)

This is the labor expense presented by money in the production process of firm, or the money form of labor expense \( W \), namely, the cost. Substitute the labor expense function (11) into (14), then we get

\[ C = \frac{1}{w_g} \phi(q). \]  \hspace{1cm} (15)

From the formula, we can see that the cost is a function of the quantity of the product produced by a firm. We call it the cost function. The cost function is the money form of labor expense function.

The cost divided by the quantity of product in a firm is defined as the average cost, that is,

\[ AC = \frac{C}{q} = \frac{1}{w_g} \frac{\phi(q)}{q} = \frac{AW}{w_g}, \]  \hspace{1cm} (16)

where \( AC \) is the average cost. The function is called the average cost function. The average cost and the average cost function are money forms of the average labor expense and the average labor expense function.

The first-order derivative of the cost with respect to the quantity of product in a firm is the marginal cost:

\[ MC = \frac{dC}{dq} = \frac{1}{w_g} \frac{d\phi(q)}{dq} = \frac{MW}{w_g}, \]  \hspace{1cm} (17)

where \( MC \) is the marginal cost. The function is called the marginal cost function. The marginal cost and the marginal cost function are the money forms of the marginal labor expense and the marginal labor expense function.

It can be seen from Formula (14) that the cost equals the result that the labor expense divides the value of a unit of money. Hence, the concrete form of the labor expense function determines the concrete form of the cost function. Thus, on one hand, the cost curve can be derived by making the labor expense in Figure 2 divided by unit money value. On the other hand, it can be seen from Formulas
(16) and (17), the average cost curve and the marginal cost curve can be derived by making the average labor expense and marginal labor expense in Figure 3 divided by money value, as shown in Figure 3a.

![Figure 3 Marginal Labor Expense Curve and Average Labor Expense Curve](image1)

![Figure 3a Marginal Cost Curve and Average Cost Curve](image2)

2.1.3. Supply of Perfectly Competitive Firm

From the cost curve of firm above, the supply curve of perfectly competitive firm can be derived on the basis of the assumption that the purpose of a firm is profit maximization and the analysis on firm equilibrium (see Bai 2003).

(1) Short-Run Supply Curve of Perfectly Competitive Firm
The short-run supply curve of firm is the upward sloping part of the marginal cost curve of this firm, which is represented by $s$ in Figure 4.

It has been illustrated that the marginal cost of a firm is the money form of marginal labor expense and the upward sloping part of the marginal cost curve is the money form of the upward sloping part of marginal labor expense. Thus, the
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short-run supply curve of firm is the upward sloping part of the marginal labor expense curve of this firm on labor expense level, represented by $s$ in Figure 4a. In the figure, $w_c$ is the labor expense amount corresponding to the market price, named sale value.

(2) Long-Run Supply Curve of Perfectly Competitive Firm
The average labor expense curve of firm will shift up or down when external economy or external negative economy exists. This kind of shift can be either vertical or sloping to the right or left. Thus, the three following situations in the long-run supply curve of the perfectly competitive firm on labor expense level can be brought about, as shown in Figure 5.

In Figure 5, $S_{L1}$, $S_{L2}$, and $S_{L3}$ are three possible kinds of long-run supply curves of firm. The long-run supply curve of firm is the set of long-run equilibrium points, meaning that each point in the long-run supply curve is the equilibrium point, and also the equilibrium sale value equals the minimum average labor expense.
Therefore, each sale value corresponding to the point in the long-run supply curve is the minimum average labor expense of the firm.

It has been illustrated that the average cost is the money form of average labor expense, and the average cost curve is the money form of average labor expense curve. So, on the price level, the long-run supply curve of firm is as shown in Figure 5a.

In the figure, $S_{L1}$, $S_{L2}$, and $S_{L3}$ are the three kinds of possible long-run supply curves of firm. Thus, each price corresponding to the point in the long-run supply curve is the minimum average cost of the firm.

2.1.4. Supply of Perfectly Competitive Market

(1) Short-Run Supply Curve of Perfectly Competitive Market

The short-run market supply curve can be derived by summing up all the short-run firm supply curves. The short-run supply curve of firm is the upward sloping part of the supply curve.
of marginal labor expense curve, being upward sloping with a positive slope, so the short-run supply curve in market, as the horizontal sum of short-run supply curves of firm, is inevitably upward sloping with a positive slope as well, and the sale value still corresponds to the marginal labor expense. As shown in Figure 6, \( Q = \Sigma q \) is the supply quantity of the commodity in market.

![Figure 6](image1)

**Figure 6** Short-Run Supply Curve of Perfectly Competitive Market on Labor Expense Level

![Figure 6a](image2)

**Figure 6a** Short-Run Supply Curve of Perfectly Competitive Market on Price Level

It has been illustrated in the above that market price is the money form of the sale value. So the market supply curve on the price level is as shown in Figure 6a.

(2) Long-Run Supply Function and Curve of Perfectly Competitive Market

Until now, all the discussions share the premise of assumption that the efficiencies of firms in an industry are equal. Now, the various forms of long-run supply curve in a perfectly competitive market according to different firm efficiencies will be discussed under the assumption that no external effect exists.
When the efficiencies among firms in an industry are unequal, namely, the minimum average labor expenses are unequal, the sale value of the product equals the average labor expense of total products in the industry, that is,

\[ w_c = \frac{W'}{Q}, \]  

where \( W' \) is the total labor expense in industry and \( Q \) is the total product quantity of industry. The term on the right of the equal sign in the formula above is called the \textit{average labor expense in industry},\(^5\) which is just the socially necessary labor time mentioned by Marx in \textit{Capital} vol. 1. The average labor expense in an industry is called \textit{the socially necessary labor time for producing the product in industry, marked as the socially necessary labor time \( (II) \)},\(^6\) Such materialized labor time is called \textit{the commodity value determined by industry}, shortened as \textit{Value \( (II) \)}.

If the efficiencies among various firms producing the same commodity in an industry are equal, when the total quantity of industry \( Q \) increases, new firms who enter the industry have the same average labor expense curve, namely, they have the same average labor expense with the former firms in the industry. Thus, the average labor expense as well as the product’s sale value in the industry will not change. Therefore, the long-run market supply curve of the product is a horizontal line shown as \( S_{L1} \) in Figure 7.

If the efficiencies among various firms producing the same commodity in an industry are unequal, and with the increase of the total quantity of industry \( Q \), the new firms entering the industry will have lower efficiencies than the former firms in the industry, namely, the positions of average labor expense curves of new firms will be higher and the average labor expense amounts will be more than the former firms. Therefore, the amount of average expense in the industry will increase.

\[ wc = \frac{W'}{Q}, \]  

\[ 0 \leq Q \leq Q_f \]

\[ S_{L1}, S_{L2}, S_{L3} \]

\[ Figure 7 \quad \text{Long-Run Supply Curve of Perfectly Competitive Market on Labor Expense Level} \]
Moreover, the sale value of the product rises with the increase of the quantity of product $Q$. The long-run market supply curve of the product is upward sloping, shown as $S_{L2}$ in Figure 7.

If the efficiencies among various firms in an industry are unequal, and with the increase of the total quantity of industry $Q$, new firms entering the industry have higher efficiencies than the former firms in the industry, namely, the positions of the average labor expense curves of the new firms will be lower and the average labor expense amounts will be lesser than the former firms. Therefore, the amount of average expense in the industry will decrease and the sale value of the product will fall with the increase of the quantity of product $Q$. The long-run market supply curve of the kind of product is downward sloping, shown as $S_{L3}$ in Figure 7.

Since price is the money form of sale value, the market supply curve on price level can be derived from Figure 7, as shown in Figure 7a.

According to the discussion above, on one hand, each point in the long-run supply curve of perfectly competitive market corresponds to the average labor time in industry, namely, the socially necessary labor time said by Marx; on the other hand, the shape of the long-run supply curve of perfectly competitive market is determined by the situations whether the efficiencies of firms are equal.

### 2.2. Social Labor-Utility Equilibrium and Demand Curve

#### 2.2.1. Social Utility Labor Equilibrium

This is the unity between marginal utility of commodity and the social necessary labor time in producing commodity.

The total social utility depends on the quantities of various commodities constituting the social wealth. $Q_i$ is used to represent the quantity of commodity $i$. It is assumed that there are $n$ kinds of social products, so the function of total social utility is as follows:
\[ U = U(Q_1, Q_2, \ldots, Q_n). \] (19)

\( w_i \) represents the average labor time of industry spent on producing product \( i \), namely, the socially necessary labor time \((II)\), and then total social labor expense is as follows:

\[
W^G = \sum_{i=1}^{n} w_i Q_i
\]

\[
= w_1 Q_1 + w_2 Q_2 + \cdots + w_i Q_i + \cdots + w_n Q_n.
\] (20)

It is assumed that the society is rational, namely, to get the maximum utility under equal amount of labor. Based on the assumption, the Lagrange’s equation can be set up to work out the maximum amount of social utility under the restriction of total social labor.

Set up the Lagrange formula:

\[
V = U(Q_1, Q_2, \ldots, Q_n) + \lambda \left( W^G - \sum_{i=1}^{n} w_i Q_i \right).
\] (21)

Make the first partial derivative of \( V \) with respect to \( Q_i \) equal to 0, so

\[
\frac{\partial V}{\partial Q_i} = \frac{\partial U}{\partial Q_i} - \lambda w_i = 0. \quad i = 1, 2, \ldots, n
\] (22)

\[
\frac{\partial V}{\partial \lambda} = W^G - \sum_{i=1}^{n} w_i Q_i = 0.
\]

It is assumed that utility function satisfies the second-order condition of maximum utility; the first-order condition of maximum social utility is derived from the first \( n \) equations of the first-order condition of maximum utility:

\[
\frac{\partial U}{\partial Q_i} = \lambda w_i. \quad i = 1, 2, \ldots, n
\] (23)

Its economic meaning is that the marginal utility of each commodity is equal to its socially necessary labor time \((II)\) multiplied by a coefficient \( \lambda \). Here \( \lambda \) is the Lagrange coefficient. Consequently, marginal utility is interrelated with socially necessary labor time \((II)\), and they are united.
From the above, we can draw an important conclusion that the marginal utility of a commodity is proportional to its socially necessary labor time \((II)\). Therefore, marginal utility of a commodity can be described and measured by its socially necessary labor time \((II)\).

Formula (23) can be explained in another way that, under the hypothesis of rational society, people will adjust their production activity to make the available utility in conformity with the work they pay.\(^7\)

From (23), we can get

\[
\lambda = \frac{\partial U}{w_i \partial Q_i} = \frac{\partial U}{w_i Q_i},
\]

where \(w_i \partial Q_i\) is the amount of labor expended in producing the final unit of commodity \(i\). So \(\lambda\) can be regarded as “marginal utility of labor expense” in each product. \(\partial U/\partial Q_i\) is measured by utility/the unit of product. \(w_i\) is measured by the unit of time/the unit of product. As a result, \(\lambda\) is measured by utility/the unit of time.

### 2.2.2. Market Demand Curve

According to the illustration above, the condition of the social labor-utility equilibrium is

\[
\frac{\partial U}{\partial Q_i} = \lambda w_i, \quad i = 1, 2, \ldots, n
\]

It means that the condition of social utility-maximizing allocation is that the used quantity of every product makes the marginal utility of the product equal to the result of the average labor expense of the product in industry multiplied by a constant. Formula (23) implies the relation between the consumption quantity of various commodities and the average amount of labor expended in commodity production in the social utility-maximizing allocation under constraints of social total labor.

In the commodity economy, the average labor expense of producing a product is expressed as the value of commodity. Hence, the condition above can be shown as that the quantity of every commodity consumed makes the marginal utility of the commodity equal to the result of its value magnitude multiplied by a constant \(\lambda\). The value magnitude of a commodity faced by consumers is just the sale value of the commodity. Therefore, Formula (23) can be rewritten as follows:
\[ \frac{\partial U}{\partial Q_i} = \lambda w_i, \quad (25) \]

namely, the quantity of every commodity consumed makes the marginal utility of the commodity equal to the result of magnitude of the commodity’s sale value multiplied by a constant. Meanwhile, the marginal utility of the commodity quantity consumed is positively proportional to the sale value of the commodity. Formula (25) indicates the relation between consumed quantity of various commodities and the sale value in the social utility-maximizing allocation under constraints of social total labor.

In the social labor-utility equilibrium Formula (23), when the sale value of a commodity is higher, the corresponding marginal utility of the commodity is higher; and based on the assumption of diminishing marginal utility, the quantity of commodity consumed is less. On the contrary, if the sale value of a commodity is lower, the corresponding marginal utility of the commodity is lower, and based on the assumption of diminishing marginal utility, the quantity of the commodity consumed is less.

![Market Demand Curve on Labor Expense Level](image1.png)

**Figure 8** Market Demand Curve on Labor Expense Level

![Market Demand Curve on Price Level](image2.png)

**Figure 8a** Market Demand Curve on Price Level
consumed is more. Thus, the sale value of the commodity is negatively correlated with the quantity of the commodity consumed. The relation determined by the above is just the market demand curve, as shown in Figure 8.

Since price is the money form of sale value, the market demand curve on price level can be derived by implementing linear transformation of $p = w_c/w_g$ in the Figure 8, as shown in Figure 8a.

2.3. Determinations of Market Value, Market Price, and Market Equilibrium

2.3.1. Labor Expense Level

Since the supply curve in the perfectly competitive market is distinguished in terms of short run and long run, respectively, the corresponding supply–demand equilibrium is distinguished in terms of short run and long run as well.

(1) Equilibrium of Supply–Demand in Short Run

The supply–demand equilibrium in the perfectly competitive market is just the state of market supply equaling market demand, that is,

$$S_s = D.$$  \hfill (26)

Therefore, the state of market supply–demand balance is the state of market supply–demand equilibrium, and the short-run market equilibrium on the labor expense level is expressed in Figure 9. In this figure, the cross point $E$ is the equilibrium point and its corresponding sale value and commodity quantity are the short-run market equilibrium sale value $w_{ce}$ and equilibrium commodity quantity $Q_e$.

---

**Figure 9** Short-run Market Equilibrium in Perfectly Competitive Market on Labor Expense Level
It has been illustrated in the above that the firm short-run supply curve on labor expense level is the upward sloping part of marginal labor expense curve \( MW \), and market short-run supply curve on the labor expense level is the horizontal sum of the firm short-run supply curves. Therefore, the sale value corresponding to every point on market short-run supply curve is equal to the marginal labor expense. As a result, the short-run market equilibrium sale value of a certain kind of commodity, determined by the cross point of market demand curve and short-run market supply curve, will be always equal to the marginal labor expense for producing this commodity.

(2) Supply–Demand Equilibrium in Long Run

The long-run supply–demand equilibrium in the perfectly competitive market is the state of the market supply equaling market demand in the long run, that is,

\[
S_L = D. \tag{27}
\]

If the external effects do not exist and the efficiencies of firms are equal, the long-run equilibrium in perfectly competitive market on labor expense level can be showed as Figure 10.

![Figure 10](image)

**Figure 10**  Long-Run Market Equilibrium in Perfectly Competitive Market on Labor Expense Level

In Figure 10, \( E \) is the equilibrium point and its corresponding sale value \( w_{ce} \) and commodity quantity \( Q_e \) are the long-run equilibrium sale value and equilibrium commodity quantity of perfectly competitive market, respectively.

It has been illustrated in the above that the sale value corresponding to each point on long-run supply curve on labor expense level in a perfectly competitive market is the average labor expense in industry, named the socially necessary labor time (II) or value (II). Therefore, the long-run equilibrium sale value corresponding
to the equilibrium point is equal to the average labor time in industry as well. Moreover, the long-run equilibrium point implies the condition of market supply equaling market demand. Hence, the long-run equilibrium sale value will further be the average labor expense in industry, resulting in the market supply equaling market demand. The labor expense will be called the market socially necessary labor time, marked as the socially necessary labor time (III); and the long-run equilibrium sale value will be called the market value, named value (III). Indeed, the socially necessary labor time (III) is just the socially necessary labor time mentioned in Capital vol. 3 Chap. 10 by Marx. It is also the so-called socially necessary labor time in the second sense always referred in the academic community. Value (III) is the market value mentioned in Capital vol. 3 Chap. 10. In fact, the long-run equilibrium sale value is the unity between the socially necessary labor time (II) (the average labor expense in industry) and the socially necessary labor time (III) (the labor expense leads to supply equaling demand). Thus, the long-run equilibrium sale value is simultaneously equal to both above, being the unity between value (II) and value (III).

From the discussion above, a conclusion can be drawn: the substance of long-run equilibrium sale value is the socially necessary labor time expended upon producing a commodity. Nevertheless, the magnitude of the substance will be influenced by market demand. Whereas no matter how deep the magnitude of substance is influenced by market demand, the substance itself stays the same, still being the socially necessary labor time expended upon producing a commodity.

(3) Relation between Short-Run Equilibrium and Long-Run Equilibrium

The long-run equilibrium in the perfectly competitive market is realized through consistent change of short-run equilibrium, and their relation is explained in Figure 11.
In Figure 11, Figure (A) is the individual firm equilibrium and Figure (B) is the market equilibrium in which $S_L$ is the market long-run supply curve, $S_S$ is the market short-run supply curve, and $D$ is the market demand curve. The initial market short-run supply curve is assumed as $S_S^1$ and the market demand curve as $D^1$. Under such circumstances, the market short-run equilibrium point is $E_1$, which is also the cross point of market demand curve and supply curve, namely, the market long-run equilibrium point; thus, the short-run equilibrium is coincident with the long-run equilibrium. Consequently, the equilibrium sale value $w_{ce}$ is equal to the lowest average labor expense of firm, and the quantity of firms is $n_1 = Q_1/q_{e}$. When the growth of market demand brings the market demand curve shifting from $D_1$ to $D_2$, the market short-run equilibrium point will move to $N$ deviating from the long-run equilibrium, and the market short-run equilibrium sale value will rise to $w_{ce}^N$. Now, $w_{ce}^N$ is more than the average labor expense of the firm, the firm is in the state of positive excess profit. In the long run, the situation will lead to the firms entering the industry, thus the increase of commodity supply and the right shift of the short-run supply curve. Now, the short-run supply curve moves to $S_S^2$. Then, the quantity of firms will rise to $n_2 = Q_2/q_{e}$, the short-run equilibrium point will move to $E_2$, and the equilibrium sale value will be $w_{ce}$ again, equaling the lowest average labor expense of the firm. In this situation, firms will cease to enter the industry, and firms in the industry will be in the state of long-run equilibrium once again. Consequently, $E_2$ will be just the cross point of market demand curve $D_2$ and market long-run supply curve $S_L$, that is, the market long-run equilibrium point, and the market short-run equilibrium point will return to the long-run equilibrium point once more.

The change process caused by the decrease of market demand is just opposite. According to the discussion above, it is clear that the market short-run equilibrium point always fluctuates around the market long-run equilibrium point, and market long-run equilibrium is realized through the change of market short-run equilibrium. Figure 12 expresses this relation as follows. In the figure, $E_L$ is the collection of market long-run equilibrium points, while $E_S$ is the collection of market short-run equilibrium points.

Since the change of market short-run equilibrium requires time, the time will be introduced as a variable; then, the relations between the market equilibrium sale value in both long-run and short-run market and time are depicted in the same coordinate system, as represented in Figure 13.

In Figure 13, curve $w_{ce}$ is the curve of market long-run equilibrium sale value, and $W_{ce}$ is the curve of market short-run equilibrium sale value. Obviously, the market short-run equilibrium sale value always fluctuates around the market long-run equilibrium sale value. What should be paid more attention is that the market short-run equilibrium sale value is equal to the marginal labor expense and the market long-run equilibrium sale value is equal to the average labor expense in...
the preceding analysis. Thus, the average labor expense is three unities, including the unity between industry average labor expense and the labor expense making the equilibrium of demand–supply in the market, the unity between industry socially necessary labor time and market socially necessary labor time, and the unity between industry value and market value. As a result, in the short run, the sale value of a commodity is equal to the marginal labor expense, while the sale value of a commodity is equal to the socially necessary labor time in the long run. In other words, the sale value of commodity always fluctuates around the socially necessary labor time expended upon the commodity production.

2.3.2. Price Level

(1) Short-Run Market Equilibrium

It has been demonstrated that on one hand, both the market short-run supply function and the demand function on price level are the expressive forms of both
the market short-run supply function and the demand function on labor expense level, and determined by them. Therefore, the market short-run equilibrium on price level is the expressive form of market short-run equilibrium on labor expense level, and determined by it. Actually, the equilibrium price on price level can be derived by implementing a linear transformation $p = w/w_g$ to the equilibrium sale value on labor expense level.

On the other hand, the short-run market equilibrium on labor expense level is realized through the short-run market equilibrium on price level. In the discussion of short-run market equilibrium, it is deduced that the market equilibrium on the labor expense level is achieved through the change of sale value. However, in the real economy, what is changed directly is not the sale value of commodity but the price. Therefore, in the real economy, the short-run market equilibrium on price level is achieved through the price change. Meanwhile, the price change realizes the change of sale value. Moreover, the short-run market equilibrium on labor expense level is realized through the short-run market equilibrium on price level. The labor expense level is the essence of market operation, and the price level is the phenomenon of market operation. Although phenomenon is determined by essence, essence is realized through phenomenon.

In the discussion of market short-run equilibrium, it has been explained that the short-run equilibrium sale value of a commodity is equal to the marginal labor expense in producing the commodity on labor expense level; meanwhile, on the price level, the short-run equilibrium price of a commodity is equal to the marginal cost in producing the commodity. It has been demonstrated that the marginal cost is the money form of marginal labor expense and determined by it. Thus, from this sense, it can be said that the short-run equilibrium price in a perfectly competitive market is determined by the marginal labor expense in producing the commodity.

(2) Long-Run Market Equilibrium
The same as the short-run equilibrium, the long-run market equilibrium and equilibrium price on the price level can be derived by implementing a linear transformation of dividing $w_g$ to an equilibrium sale value on the labor expense level.

In the analysis on the long-run market equilibrium, it has been explained that on the labor expense level, the market equilibrium sale value in the long run is equal to the average labor expense in industry which brings the market supply–demand balance, namely, the long-run market equilibrium sale value is equal to the market socially necessary labor time spent on producing commodities; meanwhile, on the price level, the market equilibrium price in the long run is equal to the average cost which brings the market supply–demand balance, namely, it is equal to the market average cost. It has been explained that the average cost in industry is the money form of average labor expense in industry and determined by it. Consequently, it
can be said that the short-run market equilibrium price is determined by the average labor expense in industry which brings the market supply–demand balance or by the market socially necessary labor time spent on producing the commodity.

(3) Relation between the Short-Run Market Equilibrium and Long-Run Market Equilibrium
The market equilibrium sale value in the short run fluctuates around the market equilibrium sale value, and the market equilibrium price in the short run is the expressive form of market equilibrium sale value in the short run, while the market equilibrium price in the long run is the expressive form of market equilibrium sale value in the long run. Thus, the market equilibrium price in the short run fluctuates around the market equilibrium price in the long run, which is determined by the market socially necessary labor time for producing the commodity.

2.4. Conclusion
Generally speaking, scientific market price theory can be established on the basis of Marx’s labor theory of value. It not only explains the nature of market price but also illustrates the superficial phenomenon of market price operation. The theory overcomes the defects of neoclassic price theory.

Meanwhile, the conclusion derived from the analysis on market price operation has proved that the basic conclusion of Marx’s labor theory of value is correct. The conclusion is derived from the analysis on price operation of a perfectly competitive market, showing that the long-run market equilibrium price equals the average full cost of industry in producing the commodity, which is the expressive form of average labor expense in industry and determined by it. Moreover, the average labor expense in industry is exactly the socially necessary labor time in producing the commodity as said by Marx. Therefore, the long-run market equilibrium price is determined by the socially necessary labor time in producing the commodity as said by Marx or value magnitude. Thus, the short-run market equilibrium price fluctuates around the long-run market equilibrium price for the change of market demand, namely, the short-run market equilibrium price fluctuates around the price which is determined by socially necessary labor time in producing the commodity or value magnitude. Since all the conclusions above are the basic conclusions of Marx’s labor theory of value, the analysis on market price operation exactly proves that the Marx’s labor theory of value is correct.

The conclusion according to the discussion above shows that what Marx’s labor theory of value studies is the issue on price essence level, while what the neoclassic equilibrium theory of price describes is about the superficial phenomenon of market price operation. Since the neoclassic equilibrium theory of price lacks scientific basis, it cannot be self-perfected. However, Marx’s labor theory of value
reveals the essence of price; in addition, the market price operation theory sets up based on its illustration of the market price operation as an issue on superficial phenomenon level and has practical function of analyzing the real market price operation. Moreover, the analysis on market price operation by this theory also proves the correctness of the basic conclusion of Marx’s labor theory of value. Therefore, Marx’s labor theory of value is scientific and self-perfected.

In short, the neoclassic equilibrium theory of price only involves a specific level of the price theory in the value category, and only involves the fourth level among six levels of the theory of value and price—market price operation. Moreover, the neoclassic equilibrium theory of price itself has insurmountable defects. On the contrary, effective market price theory can be established on the basis of labor theory of value, which overcomes the defects of neoclassic price theory. The partial equilibrium and general equilibrium can be used in the theory, too.

Notes
1. In particular, natural price is the long-run market equilibrium price. Later, the issue that short-run market equilibrium price fluctuates around the long-run market equilibrium price will be discussed.
2. Here, the socially necessary labor time in a firm and the value determined by a firm are exactly the individual labor time and the individual value in Marx’s book. For the smallest unit that Marx studied is a firm, the average value in firms is named as the individual one. However, the smallest unit studied here is the individual product, therefore only the amount relevant to the individual product can be called as the individual one, but the average amount in firms cannot be called as the individual one.
3. The form of function relation between labor expense and output has borrowed from the form of neoclassical production function (see Bai 1999, Part 2: Chap. 8).
4. In the market, Marx said, “The supply is equal to the sum of sellers, or producers, of a certain kind of commodity” (Marx 1998, 192).
5. It should be paid attention that the definition of average labor expense $AW$ in previous chapters means the average labor expense in a firm.
6. It is just the so-called first definition of socially necessary labor time popular in academia for a long time. The so-called second definition of socially necessary labor time will be discussed in other articles.
7. Engels said, “The first application of value is the decision as to whether a thing ought to be produced at all; i.e., as to whether utility counterbalances production costs” (Marx 1988, 426).
8. This differential equation can be solved for the relation between the quantity consumed and the sale value, which is just the market demand function.
9. Under the assumption of diminishing marginal utility, the demand curve must be downward sloping. If this assumption is relaxed and only diminishing marginal rate of substitution is assumed, the introduction of the substitution and income effects can explain the phenomenon that the demand curve of Giffen Goods is upward sloping (when diminishing marginal utility is in, the diminishing marginal rate of substitution is certainly in; but the diminishing marginal rate of substitution does not require diminishing marginal utility necessarily). However, the issue will not be discussed here.
10. Marx said, “If commodities are sold at their market-values, supply and demand coincide.” “Although the necessary labour-time assumes a different meaning here. Only just so much of it is required for the satisfaction of social needs” (Marx 1998, 630).

11. In *Capital*, vol. 3, Chap. 10, discussing the market price and value Karl Marx said,

> So long as we dealt with individual commodities only, we could assume that there was a need for a particular commodity—its quantity already implied by its price without inquiring further into the quantity required to satisfy this want. This quantity is, however, of essential importance, as soon as the product of an entire branch of production is placed on one side, and the social need for it on the other. It then becomes necessary to consider the extent, that is, the amount of this social want. (Marx 1998, 183)

**References**


