The Value Foundation of Exchange Rate

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Abstract—The theory of international value is the deepening development and application of Marx's theory of labor value, and also the basis for revealing the exploitative relationship of international capitalism in the world economic globalization. But so far the major challenges that have been faced by Marx's theory of labor value and Marxism international economics are how to quantitatively study on the fundamental principle that the international value is decided by the necessary labor time of the whole world and reasonable to explain the contemporary complex international economic problems with the theory of international value. On the basic assumptions of Marxist economics, the paper analyses the specific expressions of exchange rate in gold and silver money in circulation and in the notes in circulation, in turn, and derivates the general expression of exchange rate. Then it shows that the world labor is the value foundation of exchange rate, and the exchange rate must depend on the world labor which can creates the international value of export commodities, and change with the change of necessary world labor time.

Keywords-exchange rate; world labor; international value; labor parity; virtual labor parity

I. INTRODUCTION

The theory of international value[1] is the deepening development and application of Marx's theory of labor vale u(Marx, 2004), and also the basis for revealing the exploitative relationship of international capitalism in the world economic globalization(He Ganqiang, 2013; Liu Hang, Zhang Yuwei, 2014). But so far the major challenges that have been faced by Marx's theory of labor value and Marxism international economics are how to quantitatively study on the fundamental principle that the international value is decided by the necessary labor time of the whole world and reasonable to explain the contemporary complex international economic problems with the theory of international value(Smith ,2008;Song Shuli,2012,2013; Li Zhen,2013). [1]The labor nature and existence of the substance of international value is the basis of labor to discover the works of the capitalist of production in the world market according to the logic of labor value under the conditions of modification of the law of value. As a general

[1] The theory of international value has long been the most frequency to debate and difficult to innovate. So it is the basic to further innovate and develop the theory through clarifying the research venation and foci on international value, furthermore, summarizing the progress and the problem of the current study.

form of domestic value, the substance of international value has the basic properties of the substance of domestic value which is the broader social labor and contains two meanings of broader socially necessary labor. Further, the fundamental conditions for the existence of the substance of domestic value also are bound to change in international economic relations, but cover the international value. It concludes that the substance of international value is the application of dual natures of labor. Furthermore, Feng Jinhua(2012, 2013) developed a mathematical expression of domestic value to explain that two kinds of socially necessary labor time codetermine the value of commodities. That expression is as follows:

$$z_i = \frac{p_i}{p_a Q_a + p_b Q_b + p_2 Q_2 + L + p_n Q_n} L = \frac{p_i}{\sum_{j=a,b,2,L,n} p_j Q_j} L \quad (1)$$

Further instructions, first, the industry 1 is cogeneration mode that produces two kinds of goods, a and b; second, other industries are all single production mode that produces commodity $i(i = 2, L, n)$ and the output is $Q_i(i = 2, L, n)$; third, the industry n produces metallic money; fourth, according to the labor theory of value $L = \sum_{j=a,b,2,L,n} w_j Q_j$ represents the total amount of domestic values or labor; fifth, according to the principle of exchange of equal values, $z_i = p_i z_n$, $i = a, b, L, n$. Then he further get the values of any industry, as follows:

$$Z_i = z_i Q_i = \frac{p_i Q_i}{\sum_{j=a,b,2,L,n} p_j Q_j} L \quad (2)$$

The above expression can further be decomposed into as follows:

$$z_i = \frac{Z_i}{Q_i} \quad \text{and} \quad Z_i = \frac{p_i Q_i}{\sum_{j=a,b,2,L,n} p_j Q_j} L \quad (3)$$

On the basis of Feng Jinhua's value model, the paper explain the decision and change of exchange rate with the theory of international value from Marx.

II. THE EXCHANGE RATE OF METALLIC CURRENCY

A. The Basic Assumptions

1) International exchange of equal values

Now suppose that one country A will supply the gold and the other country B will supply the silver. The In addition, suppose the export commodity a produced by country A exchange the silver from country B at equal values and the export commodity b produced by country B exchange the gold from country A at equal values. Furthermore, and the gold exchanges the silver at equal values. The above conditions can be shown with algebraic expression:

$$w_{Aa} = p_{sa}w_s ,$$

$$w_{Bb} = p_{gb}w_g ,$$

$$w_g = p_{sg}w_s \qquad (4)$$

Further instructions, w_{Aa} , w_{Bb} , w_g , and w_s represent export commodity a and b, unite international value of international money gold and silver, respectively. p_{sa} and p_{gb} represent corresponding international price of export commodity, respectively. p_{sg} represents the international price of gold in terms of silver.

In order to facilitate the analysis, we define the direct quotation with gold as quoted currency and the indirect quotation with silver as quoted currency. So if using the direct quotation, the equation set (1) aretransformed into the forms as follows:

$$w_{Aa} = p_{sa}w_g / p_{gb} ,$$

$$w_{Bb} = p_{gb}w_g ,$$

$$w_s = w_g / p_{sg} \qquad (5)$$

While if using the indirect quotation, the equation set (4) are transformed into the forms as follows:

$$w_{Aa} = p_{sa}w_s ,$$

$$w_{Bb} = p_{gb}p_{sg}w_s ,$$

2) The amounts of international value equals to the amounts of world labor
This basic assumption can be shown with algebraic expression:

$$w_{Aa}Q_{Aa} + w_{Bb}Q_{Bb} + w_gQ_g + w_sQ_s = W = L \qquad （7）$$

In order to facilitate the analysis, let a substitute for Aa and b substitute for Bb, then the equation (4) is modified as follows:

quantities of gold and silver respectively are Q_g and Q_s .

$$w_aQ_a + w_bQ_b + w_gQ_g + w_sQ_s = W = L \qquad （8）$$

B. The International Value of Unit Money and the Form of Exchange rate

We can confirm separately the unit international value of international money gold and silver with the direct quotation method bringing the equation set (5) into (8), as follows:

$$w_g = \frac{1}{p_{sa}Q_a / p_{sg} + p_{gb}Q_b + Q_g + Q_s / p_{sg}} L ,$$

$$w_s = \frac{1}{p_{sa}Q_a / p_{sg} + p_{gb}Q_b + Q_g + Q_s / p_{sg}} \frac{1}{p_{sg}} L \qquad (9)$$

Further instructions, $i = a,b,g,s$, p_i represents the international price of gold, $\sum_{j=a,b,g,s} p_jQ_j$ represents the total international price of gold in the international exchange.

Similarly, we also confirm separately the unit international value of international money gold and silver with the indirect quotation method bringing the equation set (6) into (8), as follows:

$$w_g = \frac{p_{sg}}{p_{sa}Q_a + p_{gb}p_{sg}Q_b + p_{sg}Q_g + Q_s} L ,$$

$$w_s = \frac{1}{p_{sa}Q_a + p_{gb}p_{sg}Q_b + p_{sg}Q_g + Q_s} L \qquad (10)$$

Further instructions, $i = a,b,g,s$, $\overset{\circ}{p}_i$ represents the international price of silver, $\sum_{j=a,b,g,s} \overset{+}{p}_jQ_j$ represents the total international price of silver in the international exchange.

So the rate of gold to silver is as follows:

$$w_g / w_s = \frac{L / \sum_{j=a,b,g,s} p_jQ_j}{p_s L / \sum_{j=a,b,g,s} p_jQ_j} = \frac{\overset{+}{p}_g L / \sum_{j=a,b,g,s} \overset{+}{p}_jQ_j}{L / \sum_{j=a,b,g,s} \overset{+}{p}_jQ_j} \qquad (11)$$

Further simplify the equation (9) to get the below equation:

$$w_g / w_s = 1 / p_s = \overset{+}{p}_g = p_{sg} \qquad (12)$$

Next, according to the same deducing methods, the rate of gold to silver can be extended to general case that there are more than two nations and two export commodities in international trade. First, using the direct quotation, we can get the rate of gold to silver as follows:

$$w_n / w_{n-1} = \frac{L / p_1 \sum_{X=1}^{m} Q_{X1} + ... + p_n \sum_{X=1}^{m} Q_{Xn}}{p_{n-1} L / p_1 \sum_{X=1}^{m} Q_{X1} + ... + p_n \sum_{X=1}^{m} Q_{Xn}} = 1 / p_{n-1} \qquad (13)$$

Further instructions, the last special export commodity n is the international money gold, and the special export commodity n-1 is the international money silver.

Second, using the indirect quotation , we can also get the rate of gold to silver as follows:

$$w_n / w_{n-1} = \frac{\overset{+}{p}_n L \Big/ \overset{\circ}{p}_1 \sum_{X=1}^{m} Q_{X1} + L + \overset{+}{p}_n \sum_{X=1}^{m} Q_{Xn}}{L \Big/ \overset{\circ}{p}_1 \sum_{X=1}^{m} Q_{X1} + L + \overset{+}{p}_n \sum_{X=1}^{m} Q_{Xn}} = \overset{+}{p}_n \quad (14)$$

In addition, we can get further the rate relation as follows:

$$w_n / w_{n-1} = 1 / p_{n-1} = \overset{+}{p}_n = p_{sg} \quad (15)$$

It is worth stressing that, the exchange rate of gold to silver is not the ratio of two weights which is named mint parity, also not the ratio of two symbolic weights which is named gold parity, but the ratio of two socially necessary labor times which can be named labor parity. It shows that the international value of international money is the foundation of exchange rate, in other words, the world labor must determine the exchange rate.

III. THE EXCHANGE RATE OF PAPER CURRENCY

According to the theories of circulation of metallic currency and paper money from Marx, we can get the unit international value of any two paper money, for example, the dollar USA and pound GBP , but with one important note. The paper money has no labor value in and of itself, and only represents certain labor value.

On hand, we discuss the law of the circulation of international paper money. It is clear that the amount of international paper currency in circulation only represents the total amount of international values of necessary metallic money in international trade. In order to facilitate the analysis, w_U and w_G represent the international values of USA and GBP, respectively. Furthermore, $w_G = p_{UG} w_U$; Q_U and Q_G represent the amount of USA and GBP in circulation for international trade, respectively; v_U and v_G represent the velocity of USA and GBP in circulation; suppose that there should be a single currency gold in international trade, w_n represents the international value of gold , Q_n^d represents the currency in circulation, and v_n represents the velocity of gold in circulation. Then get the formula as follows:

$$v_U w_U Q_U + v_G w_G Q_G = v_n w_n Q_n^d \quad (16)$$

This is easy to understand: $v_U w_U Q_U + v_G w_G Q_G$ represents the total amount of international values of international paper money and $v_n w_n Q_n^d$ represents the total amount of international values of international metallic money in international exchange.

Now according to $w_G = p_{UG} w_U$, we can get the new formulas as follows:

$$(v_U Q_U + v_G p_{UG} Q_G) w_U = v_n w_n Q_n^d \quad (17)$$

$$(\frac{1}{p_{UG}} v_U Q_U + v_G Q_G) w_G = v_n w_n Q_n^d \quad (18)$$

On the other hand, we discuss the law of the circulation of metallic money. Marx showed that aggregate prices of commodities determine the amount of currency in circulation, and the two amount must be equal. So the same law in international trade is as follows:

$$Q_n^d = \frac{\sum_{i=1}^{n-1} \overset{\sqcup}{p}_i Q_i}{v_n} \quad (19)$$

Further instructions, $\overset{\sqcup}{p}_i$ represents any international price of export commodities with the dollar USA and $\sum_{i=1}^{n-1} \overset{\sqcup}{p}_i Q_i$ means the aggregate international prices of export commodities.

Combine the law of the circulation of international paper money and metallic money, and the expression of unit international value of gold, then get the expression of international value of paper money as follows:

$$w_U = \frac{w_n}{v_U Q_U + p_{UG} v_G Q_G}$$

$$= \frac{\sum_{i=1}^{n-1} \overset{\sqcup}{p}_i Q_i}{(v_U Q_U + p_{UG} v_G Q_G)(p_1 \sum_{X=1}^{m} Q_{X1} + L + p_n \sum_{X=1}^{m} Q_{Xn})} L \quad (20)$$

$$w_G = \frac{w_n \sum_{i=1}^{n-1} \overset{\circ}{p}_i Q_i}{\frac{1}{p_{UG}} v_U Q_U + v_G Q_G}$$

$$= \frac{p_{UG} \sum_{i=1}^{n-1} \overset{\circ}{p}_i Q_i}{(v_U Q_U + p_{UG} v_G Q_G)(p_1 \sum_{X=1}^{m} Q_{X1} + L + p_n \sum_{X=1}^{m} Q_{Xn})} L \quad (21)$$

Further instructions, w_U represents the unit international value of U.S. dollar, w_G represents the unit international value of pound sterling, $\sum_{i=1}^{n-1} \overset{\sqcup}{p}_i Q_i$ represents the total international price of export commodities in dollars, $\sum_{i=1}^{n-1} \overset{\circ}{p}_i Q_i$ represents the total international price of export commodities in pounds, $v_U Q_U + p_{UG} v_G Q_G$ represents the amount of paper money in circulation with dollars pricing in foreign trade, $v_U Q_U + v_G Q_G / p_{UG}$ represents the amount of paper money in circulation with pounds pricing in foreign trade, $p_1 \sum_{X=1}^{m} Q_{X1} + L + p_n \sum_{X=1}^{m} Q_{Xn}$ represents the total

international price of export commodities with gold

So the rate of pound to dollar is $w_G/w_U = p_{UG}$, and

the rate of dollar to pound is $w_U/w_G = 1/p_{UG}$. It can be

named virtual labor parity depending on labor parity.

IV. THE EXCHAGE RATE OF GENERAL INTERNATIONAL MONEYS

Based on the above analysis, we can get the general rate of one international money to the other international money as follows: $w_i/w_j = p_{ji}$, and i, j is a positive integer, and $i \neq j$. Further instructions, if i and j is metallic international currency, w_i/w_j is named labor parity, and if i and j is international credit money, w_i/w_j is named virtual labor parity. Then suppose that i is foreign currency and j is domestic currency, so p_{ji} is the international price of foreign currency under the direct quotation, and $1/p_{ji}$ is the international price of foreign currency under the indirect quotation. This is obviously a reciprocal relationship between two quotations. So that shows that the rate of any international moneys depends on international value and world labor.

Next we can discuss the change of exchange rate(Lee Chai,2004,2006). Because the above shows that the rate depends on the ratio of two international values contained in international currencies, so it must change with the change of the international values. Specifically speaking, first, under the steady international value contained in foreign currency, the rate is inversely proportional to the international value contained in domestic currency with direct quotation, and proportional with indirect quotation. Second, under the decreased international value contained in foreign currency, if the international value contained in domestic currency also decreased, but more than in foreign currency, the rate must increase with direct quotation; if the international value contained in domestic currency also decreased, but less than in foreign currency, the rate must decrease with direct quotation; if the international value contained in domestic currency can increase, the rate must decrease in any case. In other words, if the international value contained in domestic currency also decreased, and more than in foreign currency, the rate must increase with indirect quotation; if the international value contained in domestic currency also decreased, but less than in foreign currency, the rate must increase with indirect quotation. Last, under the increased international value contained in foreign currency, the change of exchange rate is contrary to the second.

pricing, L represents the amount of world labor.

V.CONCLUSIONS

The research thoughts and structure is based on Marx's labor theory of value, following the basic logic of value research and supposing that the law of value has not produced qualitative changes, and according to the distribution of the total amount of labor in proportion, apply the general equilibrium expression of international value to explain the different effects on the decision and changes of international value(Feng Jinghua,2012,2013). Then explain the decision and changes of exchange rate with the theory of international value. It shows that both the labor parity and virtual labor parity show that the exchange rate must depend on the world labor which can creates the international value of export commodities, and change with the change of necessary world labor time. Furthermore, the change of the rate is affected by both the international values of two international currencies, so is inconsistent with the international value of any international value. For China, achieve the comparative advantages of core industries to implement the mutual benefit and win-win strategy, and under national macro-control promote the national competitive advantages and stick to the policy of gradual exchange rate reform, then produce more international value.

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