Exploring the sinicization of Marx's social capital reproduction theory: review and reflection

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Abstract

Purpose – Karl Marx's social capital reproduction theory is his significant contribution to economics. The purpose of this paper is to review the contributions of the exploration of Chinese economists (especially Professor Liu Guoguang) in the concretization of Marx's social capital reproduction theory combined with socialist construction since 1949.

Design/methodology/approach – During this process, Professor Liu Guoguang, a famous Chinese Marxist economist, has made an outstanding contribution by creating a Marxist social capital reproduction model with Chinese characteristics and a distinctive Marxist economic growth model. Professor Liu's exploration is still of crucial practical significance to building a socialist market economy today.

Findings – The process and achievements in the sinicization exploration of Marx's social capital reproduction theory were reviewed. With the reform and opening up, fundamental changes have occurred in China's economic system – the centralized planned economic system has been transformed into a socialist market economic system.

Originality/value – The planned management of the national economy is replaced by a macro-regulation system characterized by gross control gradually, and the concepts of agriculture, light industry, and heavy industry, and their intercorrelation are no longer applied in theory and policy. However, the sinicization exploration of Marx's social capital reproduction theory in the older generation of Marxist economists represented by Liu is not only of historical significance but also of important practical significance.

Keywords Social capital reproduction theory, Sinicization exploration, Practical significance

Paper type Translated paper

As an integral part of Marxist economics, the social capital reproduction theory is also Marx's great contribution to economics, which has revealed the objective conditions to be observed for the regular progress of capitalist reproduction. If categories that represent capitalist economic relations, such as C, V, and W, [1] are transformed into socialist ones, the principles revealed by Marx's social capital reproduction theory also apply to the socialist economy; as Lenin (1990, p. 275) has stated, the relationship and accumulation of I$v + m$ and IIc also exist in pure communism. However, as Marx's social capital reproduction theory is developed at a highly abstract level, the theoretical principles therein obtained cannot be applied to the concrete level of economic operation directly. Meanwhile, from the perspective of the concrete logic system reproduced in *Das Kapital*, the social capital reproduction theory should also rise from the abstract to the concrete with theoretical logic. Hence, applying Marx's social capital reproduction theory to the guidance of the socialist economic construction requires exploration from the abstract to the concrete, which means combining theory with the

practice of socialist economic construction. Such an exploration is known as the concretization of social capital reproduction theory. During this process, famous Chinese Marxist economist Professor Liu Guoguang has made an outstanding contribution by creating a Marxist social capital reproduction model with Chinese characteristics, achieving the transformation from concretization to sinicization of social capital reproduction theory to some extent.

This paper is structured as follows: Part I is a brief review of the historical background of exploring the sinicization of Marx's social capital reproduction theory, which contains the response to the two views about the denial of China's socialist industrialization; Part II is a review of the process of exploring the sinicization of Marx's social capital reproduction theory, highlighting the contribution of Professor Liu Guoguang, which is the core content of this paper; Part III is about several reflections on the review.

1. Historical and theoretical background

In the early period of the foundation, China was a large country with a fragile economic foundation, a vast gap between the rich and the poor, a deformed economy, widespread poverty, and backwardness, and a large agricultural population, which was also economically impoverished and technologically blank. In 1949, the modern industry only accounted for about 10–17% of the gross output value of the national economy, and the rest were scattered individual agriculture and handicrafts (Xu, 1959; Cao *et al.*, 1992). After three years of economic recovery, China's per capita gross national product was only US $50 by 1952, with modern industry accounting for merely 26.7% of the gross output value (Liu, 2000). China started a planned socialist construction process on a large scale from 1953 and executed the "First Five-year Plan" for the development of the national economy in 1953 to turn around the extreme backwardness radically, establish a complete industrial system, realize socialist industrialization and lay a solid foundation for the socialist system. The "First Five-Year Plan" centered on 156 key projects aided by the Soviet Union and 68 projects supported by the socialist countries in Eastern Europe featured intensive investment in the heavy industry. On the one hand, it was the requirement for a fundamental change to China's economic backwardness; on the other hand, it also had a theoretical basis and objective conditions. With the implementation of the "First Five-Year Plan", China established a highly centralized planned management system. The implementation of the Plan changed the backward economic structure and productivity level fundamentally, laid a foundation for socialist industrialization, and formed a relatively complete modern industrial system, thus providing an essential material and technical basis for China's socialist construction in the future.

It is necessary to make a brief response to two popular views regarding China's socialist industrialization construction:

One of the views is that China is not qualified for developing socialism because of no experience in large-scale socialist construction. Without the qualification, implementing socialism is nothing but exceeding the stages of development [2]. This view is an inflexible and dogmatic interpretation of the principles of historical materialism. Firstly, since modern times, the prospect of European and American capitalism has no longer been an option for China. There is only peripheral and dependent capitalism left for China, which cannot develop national social productivity. To release and develop social productivity, it is necessary to thoroughly change such relations of production and establish a socialist economic system. The practice of socialist construction in China has demonstrated that it is possible to build socialism under backward economic conditions. Secondly, the conditions of productivity under which social modes or relations of production are established are different from those under which they are consolidated. For example, the productivity on which capitalism relies during its emergence and early development stages is not different from the feudal guild – both are established based on hand tools (Marx, 2004, p. 374). The productivity that

consolidates capitalism is the machine system, which, however, is a product of capitalist relations of production created by the competition of individual capital in pursuit of excess surplus value in the capitalist system instead of the feudal system. Hence, although the proportion of the capitalist economy in old China was very low, it still offered the material conditions for establishing a socialist system, and the material and technological foundation required to consolidate the socialist system can be totally created under socialist relations of production.

Another view is that China's strategy of realizing socialist industrialization by giving priority to the development of the heavy industry violates the principle of comparative advantage and that China's achievements since the reform and opening up are the result of following the principle of comparative advantage (Lin *et al.*, 1995). This view is divorced from reality and is difficult to hold. The reasons are as follows:

Firstly, China's socialist construction was carried out under the imperialist blockade without any condition or possibility to participate in the international trade and labor division system dominated by major capitalist countries. Even if China were equipped to participate, China could only serve as a raw material source and cheap labor market for developed countries, and it was impossible to solve China's industrialization problems by the so-called comparative advantage. Without an independent and complete industrial system and strong manufacturing capabilities, the nation cannot have true independence. This is an objective truth proven again by the recent US–China trade war initiated by the USA. It is puzzling that this view, on the one hand, admits that China was not equipped with the conditions to adopt the so-called comparative advantage strategy under imperialist hostility and blockade and could only choose a catch-up strategy relying on its own strength; on the other hand, it asserts that the catch-up strategy is a failure because of not adopting the comparative advantage strategy. Also, the holders of this view never found any case of success in selecting a comparative advantage strategy on the premise of adhering to the socialist system at that time; nor did they propose any theoretical idea of adopting a comparative advantage strategy under the same conditions. This self-contradictory and inapplicable view is totally against history and divorced from reality.

Secondly, the industrialized construction based on a weak economic foundation is indeed in the face of financial and technological challenges, which, however, can be overcome by the state itself with some aid from socialist countries. The talent requirement for industrialization can also be met by supporting science education and the initiative of learning by doing, which has been supported by successful cases.

Thirdly, various comparative advantage theories derived from Ricardo's 2×2 physical model are essentially thought experiments. In policy practice, the theory of comparative advantage was neither adopted by the UK back then nor by the USA later on. Contrary to Ricardo's physical model, his 2×2 monetary model is a standard absolute advantage model of intradepartmental competition based on labor productivity determined by technologies, machinery and equipment (Ricardo, 1976, pp. 115–158; Emanuel, 1988, pp. 250–253). This theoretical model of Ricardo complies with the actual international trade and division of labor. It suggests that Ricardo essentially advocated the absolute intradepartmental competitive advantage, which is highly consistent with the practice in the UK, the USA and other countries. In fact, it was because China established an independent and complete industrial system through socialist industrialization, developed processing and manufacturing capabilities, and had absolute advantages in this aspect that it could export manufactured goods massively after the reform and opening up, and participate in the intra-product specialization through processing trade and assembly production, leading to the so-called comparative advantage.

Finally, even based on the neoclassical growth theory, to have a higher consumption level in the future, the saving rate or the rate of capital accumulation must be increased. Hence,

implementing socialist industrialization by prioritizing the development of the heavy industry is not a mistake of strategic choice, nor does reform and opening up deny it with the comparative advantage strategy.

However, objectively, due to lack of experience in large-scale socialist construction and defects of the highly centralized planned management system itself, there were also some overall issues to be addressed during the "First Five-Year Plan" period. To summarize experiences and avoid detours that the Soviet Union took in socialist construction, Chairman Mao Zedong delivered an important speech titled *On the Ten Major Relationships* at an enlarged meeting of the Political Bureau of the Communist Party of China (CPC) Central Committee and a supreme state conference on April 25 and May 2, 1956 after in-depth investigation and research, which gave a systematical answer to the overall issue related to socialist construction and stated ten major relationships that needed to be handled appropriately and the guidelines to handle them. *On the Ten Major Relationships* combined the basic principles of Marxism with China's socialistic practices, which blazed a new trail for exploring socialism with Chinese characteristics and began China's economic system reform. In this ground-breaking document, Mao Zedong regarded the relationship among heavy industry, light industry and agriculture as the first major relationship that needs to be appropriately handled. Mao Zedong emphasized the necessity of handling the relationship among heavy industry, light industry, and agriculture properly, and pointed out that China should focus on heavy industry construction and prioritize developing the production of the means of production without ignoring that of the means of subsistence, especially food; otherwise, there would be no foundation for developing the heavy industry. In the long term, more development of agriculture and light industry would boost better and faster growth of the heavy industry. Although during the "First Five-Year Plan" period, China did not have the same problem of lop-sided stress on heavy industry as the Soviet Union and Eastern European countries encountered; Mao Zedong still emphasized the necessity to properly adjust the proportion of investment in heavy industry, agriculture and light industry based on heavy industry as majority, and to develop agriculture and light industry more for laying a solid foundation for the faster and better growth of the heavy industry (Mao, 1977, pp. 268–269).

These thoughts of Mao Zedong were essentially an exploration and significant results of the sinicization of Marx's social capital reproduction theory regarding the situation in China. However, in practice, the over-fulfillment of the "First Five-Year Plan" fostered a rush for quick results, which violated objective economic laws, caused significant difficulties in national economic construction, and ultimately led to a major overhaul of the national economy. It was in the above context that from the late 1950s to the early 1960s, China's academic circle started to conduct in-depth studies of Marx's social capital reproduction theory with the combination of the practice of socialist economic construction, explored the concretization and sinicization of Marx's social capital reproduction theory, and achieved a series of crucial results.

2. Sinicization of Marx's social capital reproduction theory

Chinese economists' contributions focus on three main aspects: Firstly, it is proven with mathematical methods that the preferential growth in the means of production in expanded reproduction is an objective law and that the maximum growth rate of Department I is limited (He and Luo, 1957a, b, 1958). Secondly, the study focuses on the concretization of Marx's two-department formula under the premise of affirming the preferential growth in the means of production, that is, to concretize the abstract two-department formula into the departmental formula from the end-use of products based on the two-department formula, considering the specific factors abstracted by Marx in the analysis of social capital reproduction. Based on

the departmental formula, the internal relations of social reproduction represented in the reproduction formula and the proportional relationship of various physical quantities of social reproduction in different ways of expanded reproduction are studied, combining the concrete reproduction formula with the balance sheet of interdepartmental product production, distribution and use (Dong, 1963, 1964). Thirdly, the three-industry (sector) division of agriculture, light industry and heavy industry adopted by China in economic practice is combined with the two-department division in Marx's abstract analysis of social capital reproduction so that agriculture, light industry and heavy industry could be included in Marx's two departments. On this basis, the quantitative relationship between the proportion and speed of socialist reproduction, as well as the restriction for reproduction on an extended scale, are analyzed (Liu, 1961, 1962a, b) [3]. The exploration in the above three aspects, especially the latter two, has concretized Marx's social capital reproduction theory to varying degrees from different perspectives. Among others, the exploration in the second aspect from the late 1970s to the early 1980s formed a research approach to concretize Marx's social capital reproduction theory using transformed input–output analysis developed by Wassily Leontief under the guidance of Marxist economics. However, Professor Liu adopted a different approach in his study. His study focused on not only the concretization of Marx's social capital reproduction theory but also its sinicization, constituting a prominent feature of his research on Marx's social capital reproduction theory.

As discussed above, Marx's social capital reproduction theory reveals the inherent law of capitalist reproduction. This theoretical principle also applies to the socialist economy based on the value composition redefined according to socialist relations of production. However, as Marx's social capital reproduction theory was developed at a highly abstract level, the theoretical principle developed at this level cannot apply to the concrete level of economic operation directly. Therefore, it is necessary to concretize Marx's theory of social capital reproduction according to the basic principles of Marxist economics and the objective laws revealed by the social capital reproduction theory, following Marx's approach of rising from the abstract to the concrete, with the focus on concretizing the two departments of social production divided by Marx based on the end-use of products regarding composition and content. At the same time, the use scope of end products should be extended according to the practice and objective requirements of socialist economic construction. By doing so, the concrete factors temporarily abstracted in Marx's theoretical analysis of social capital reproduction are reintroduced to the reproduction analysis.

Regarding the research approach of concretizing Marx's social capital reproduction theory, Liu Guoguang combined the division of agriculture, light industry, and heavy industry adopted by China in practice with Marx's two-department division and regarded these three sectors as the concretization of the two departments in economic reality. In Liu's paper *A Preliminary Discussion on the Determinants of the Development Speed of Socialist Reproduction* published in 1961, he combined with the actual situation in China and pointed out that the proportional relationship between the two major departments was arranged through the relationship among agriculture, light industry and heavy industry in real life. He also believed that the CPC's policies – "based on agriculture, led by industry" and "focusing on simultaneous development of industry and agriculture, heavy and light industry sectors under the conditions of prioritizing the growth of heavy industry" – were proposed based on the internal correlation between two major departments of social production (Liu, 1980, pp. 56–57). In *On the Demand of Accumulation for Means of Consumption and the Restriction of the Production of Means of Consumption on Accumulation* (1962c) and *A Preliminary Discussion on the Quantitative Relationship between the Proportion and Speed of Socialist Reproduction* (1962a), Liu illustrated the internal correlation between agriculture, light industry, and heavy industry and two major departments from the perspective of the mutual

restriction relationship between accumulation and consumption of national income. Liu argued that to clarify the correlation between the accumulation of means of production and the production of means of consumption, a methodological issue needed to be addressed, that is, how to investigate the relationship between accumulation and consumption of national income based on the two-department division principle combined with the relationship between agriculture, light industry and heavy industry. As the accumulation part of the means of production in the accumulated fund is equal to $I(v + m) - IIc$ or $I(c + v + m) - (Ic + IIc)$ in value and the production of means of consumption is equal to $II(c + v + m)$ in value, their sum equals exactly to the national income produced in the current year. Hence, analyzing the relationship between the accumulation of means of production and the production of means of consumption is essentially about exploring the relationship between the production of means of production (Department I) and the production of means of consumption (Department II), that is, the relationship between two major departments. In terms of physical form, the means of production for accumulation are composed of productive infrastructure and machine manufacturing products and the products manufactured by other indirect productive and accumulative departments for means of production, including a series of heavy industry sectors, such as building materials, metallurgy, power and mining. Thus, Department I can be regarded as consisting of productive infrastructure and heavy industry departments. All means of consumption consist of agricultural products, light-industrial products, and nonproductive infrastructure products for personal consumption or other nonproductive consumption directly and products that indirectly provide raw materials and other means of production for producing the means of consumption. Basically, Department II can be regarded as consisting of agriculture and light industry (Liu, 1980, pp. 114–115).

Liu indicates that the purpose of combining agriculture, light industry and heavy industry with the two major departments is to explore the relationship between the accumulation of means of production and the production of means of consumption from the perspective of the relationship among agriculture, light industry and heavy industry (Liu, 1980, p. 115). That is, under the conditions of concretizing the two major departments into agriculture, light industry and heavy industry, analyzing the relationship between two major departments and their respective internal relations from the perspective of extended reproduction is actually based on the proportional relationship between three sectors (agriculture, light industry and heavy industry) and within each industry. For example, when analyzing the determinants for the growth rate of socialist reproduction, Liu argued that the production ratio within Department I affected not only its own growth rate but also the growth rate of the whole social production. Among others, the notable primary proportional relationships included the ratio of the departments that provided the fixed capital material elements (infrastructure and equipment manufacturing) to those that provided the current fund material elements (raw materials, fuel and power production), the correlation and ratio of raw material departments and processing departments, and the relationship between key departments and general departments (Liu, 1980, pp. 57–58). Apparently, they are relationships of the different departments within the heavy industry; hence, the production proportions within Department I are concretized.

With the industrial capital active in production, surplus-value creation and national income as the research object, Marx abstracted the nonproductive fields in his social capital reproduction theory temporarily. However, in the real economy, these nonproductive fields are closely related to the productive ones. In order to concretize Marx's social capital reproduction theory combined with the reality of China's economic construction, it is necessary to reintroduce these abstracted factors to the reproduction analysis. Liu believed that the expansion of the social production scale required a certain increase in the consumption levels of original and newly added laborers, which, in turn, required the

expansion of nonproductive service fields accordingly. To this end, Liu proposed the following equilibrium formulas according to the basic conditions of Marx's social capital expanded reproduction by combining two major departments with agriculture, light industry and heavy industry:

$$
\begin{aligned}
P_1 &= c_1 + v_1 + m_1 = (c_1 + c_2) + (\Delta c_1 + \Delta c_2) \\
P_2 &= c_2 + v_2 + m_2 = (v_1 + v_2) + (\Delta v_1 + \Delta v_2) + h \quad\quad (1)\\
P_1 &+ P_2 = P
\end{aligned}
$$

where P is the total social product, the subscript represents the department and h is the part of social products to meet the consumption needs of nonproductive personnel and institutions (Liu, 1980, p. 55). This part of products is provided by agriculture and light industry. Thus, Liu introduced nonproductive services into the analysis of reproduction theory on the premise of adhering to Marx's theory of productive labor.

Based on Marx's social capital reproduction theory, Lenin applied mathematical methods and put forward the proposition that under the condition of technological progress year by year, namely continuous increase in the organic composition of capital, the production of the means of production grew fastest, which was the law of preferential growth in the means of production. However, Lenin also pointed out that the production of the means of production could not grow solely based on producing the means of production independent of Department II or develop entirely independent of the production of the means of consumption, nor should the two be considered irrelevant; otherwise, it would be an abuse of formula (Lenin, 1984, pp. 64–68). Lenin's argument indicated that the preferential growth of Department I was not unconditional, which was ultimately constrained by Department II. However, Lenin did not further demonstrate the mathematical relationship of such restriction as he did the preferential growth in the means of production, which provided room for the theoretical exploration of such a restriction relationship.

Meanwhile, in China's practice of planned economy, the rush for quick results due to various reasons and lop-sided stress on the preferential growth in the production of means of production were manifested as emphasizing the preferential growth of heavy industry and pursuing excessive growth rates, resulting in an imbalanced ratio of agriculture, light industry and heavy industry in economic construction. This also urgently requires exploring the restrictive relationship between two major departments under the condition of preferential growth in the means of production based on the combination of theory and practice. In such exploration, Liu Guoguang expressly considered the nature of the restrictive relationship between two major departments under the condition of preferential growth in the means of production as the mutual restriction between accumulation and consumption in national income. Specifically, the restriction is embodied by the relationship among agriculture, light industry and heavy industry under the condition of accumulation. Hence, Liu (1980, pp. 112–114) proposed that the restrictive relationship between accumulation and consumption in national income should be studied based on Marx's two-department division principle combined with the relationship among agriculture, light industry and heavy industry. Centered on this restrictive relationship, Liu conducted in-depth research using mathematical methods based on the basic principles of Marxist economics, in which he analyzed the mutual restrictions among agriculture, light industry, and heavy industry under the condition of accumulation, as well as the internal connection between these three sectors and two major departments. Besides, he also explored profoundly the determinants for socialist reproduction growth rate, the quantitative relationship between reproduction percentage and speed, and in particular, the demand of accumulation for means of consumption and the restriction of the production of means of consumption on accumulation, forming a systematic Marxist total social reproduction theory with Chinese characteristics,

which was an important achievement in the sinicization of Marx's social capital reproduction theory and an outstanding contribution to developing the social capital reproduction theory of Marxist political economy (Liu, 1980, pp. 27–65, 60–97). Liu's contributions are concentrated in his analysis of the mutual restriction between accumulation and consumption under the condition of expanded reproduction. Such restriction is a major topic to be urgently addressed both in theory and in practice.

According to Liu Guoguang, during the objective process of socialist economic growth, there could be different combinations of the speed and proportion of reproduction in a certain range, which would further affect the proportion and speed in the subsequent periods to varying degrees. The mission of socialist economic work is to choose the most appropriate proportional scheme so that the socialist economy can grow at high speed in proportion. Among various possible combinations of speed and proportion, the prerequisite for making the right choice is to recognize the inevitable objective correlation between different combinations, especially to understand and master the quantitative relationship between speed and proportion correctly – how proportion will inevitably affect speed, and what proportion is required by a specific speed. For this purpose, Liu illustrated the determination for the production growth rate of social products and national income with the first numerical example of the expanded reproduction in Chapter 3, Volume II of Marx's *Das Kapital*. Based on this example, Liu summarized the following formula for the net growth rate of total social products:

$$t_P = \frac{\Delta P_n}{P_{n-1}} = \frac{\Delta C}{P_{n-1}} \times \frac{\Delta P_n}{\Delta C} = \frac{\Delta C/P_{n-1}}{\Delta C/\Delta P_n} \tag{2}$$

Hypothetically, $\alpha = \frac{\Delta C}{P_{n-1}}, \beta = \frac{\Delta C}{\Delta P_n}$. Then the above formula can be written as $t_P = \frac{\alpha}{\beta}$, where α is the proportion of the accumulation of means of production in the total amount of social products in the base period, that is, the relative accumulative potential of means of production; β is the accumulative fund of means of production required for producing one more unit of product, that is, the coefficient of accumulation fund occupancy, and n is the period. t_P is directly proportional to α and inversely proportional to β. From $\Delta C = P_I - c$ (c is the means of production consumed by two major departments), $\alpha = \frac{P_I - c}{P}$ can be obtained. That is, α is positively correlated with the proportion of Department I products in total products (P_I/P) and negatively correlated with the average consumption coefficient for the means of production (c/P). If the consumption coefficient for the means of production remains unchanged, the larger P_I/P, the greater α, and the higher the expanded reproduction speed. However, Liu emphasized that the increase in P_I/P would inevitably affect the consumption coefficient for the means of production and the capital occupancy coefficient. Hence, the proportion structure of the two major departments could not be considered in isolation. In the long term, it is the distribution ratio of productive fixed fund investment between two major departments that is decisive. To investigate the impact of the accumulation direction of means of production on the subsequent accumulation potential, α can be transformed into

$$\alpha = \frac{C_I}{C} \times \frac{f}{f_I} - \frac{c}{P} = a \times \frac{f}{f_I} - \frac{c}{P} \tag{3}$$

where $C_I/C(a)$ is the proportion of Department I production fund in total production funds, f and f_I are the occupation coefficients of production funds per unit product in the whole society and Department I, respectively. To simplify the analysis, it is assumed that the consumption coefficient for the means of production and the occupancy coefficient of

production funds are not affected by changes in the proportions of two major departments. Thus, the relative accumulation potential for the means of production depends on the change in a. Since a is greater than the proportion of Department I in the original social production fund (C_I/C), its influence on increasing the reproduction speed can only last for a certain period. Therefore, for the continuous increase of reproduction speed, it is necessary to raise a or the proportion of accumulation fund for the means of production invested in Department I constantly. However, there is an insurmountable absolute limit on the proportion of the accumulative fund invested in Department I. Under normal circumstances, a cannot be greater than 1; otherwise, it means the reduction in the capacity to maintain simple reproduction in Department II and the shift to expanded reproduction in Department I. In fact, under the normal operation of socialist reproduction, neither $a > 1$ nor $a = 1$ (that is, all accumulation funds for the means of production are invested in Department I) is imaginable because before reaching the absolute limit of 1, a will hit its maximum limit, that is, the minimum accumulation required for the necessary expansion of Department II. Hence, it is impossible to increase a continuously. Not only will the share of accumulative input of the means of production in Department I be restricted by Department II, but the production of means of production for accumulation is also subject to the restriction of Department II. Based on Marx's reproduction principle, the accumulation required for expanded reproduction includes not only means of production but also a certain proportion of means of consumption, which are all related to the balance of Department II products and inevitably involve the issues of labor resources, employment and consumption levels in expanded reproduction.

To explain the restriction on the production of means of production for accumulation and its influence on the reproduction speed, Liu Guoguang introduced the levels of employment and consumption into the reproduction analysis. Three sectors (agriculture, light industry and heavy industry) in reality were combined with Marx's two-department division to create a two-department reproduction model containing agriculture, light industry and heavy industry. Mathematical methods were used to prove that the production of means of production for accumulation would ultimately be restricted by the production capacity of agriculture and light industry, indicating the mathematical relationship that the preferential growth of Department I would be restricted by Department II as proposed by Lenin.

Liu assumed that all employed laborers were engaged in material production and that the needs in the nonmaterial production fields were deducted as necessary. The final result of their production in a year was reflected in the national income for consumption and accumulation in the current year, namely the total means of consumption and means of production for accumulation. Based on the final result of production, Liu divided all laborers into two categories: laborers who produced the means of consumption directly or indirectly, that is, those who worked in the agriculture and light industry sectors, known as productive laborers for means of consumption and denoted by N'''; laborers who produced the means of production for accumulation directly or indirectly, that is, those who worked in the productive infrastructure construction sector, machinery and equipment manufacturing sector, and heavy industry such as building materials, metallurgy, and power, known as productive laborers for accumulated means of production and denoted by N'. Based on such division of laborers, those who provided the means of production (mainly in the agricultural raw material department) were classified into the productive laborers for the means of consumption, slightly different from the original division of laborers in two major departments. If the total social labor resource is set as N, then $N = N' + N''$.

Under the above assumptions, Liu demonstrated that the scale and speed of expanded reproduction would ultimately be restricted by the production and consumption of means of consumption based on the fact that accumulation must produce the means of production

required for accumulation, which needed additional labor accordingly. This is because regardless of the source of additional laborers required for producing the means of production accumulated for expanded reproduction, the additional laborers' consumption must obtain compensation from the means of consumption produced in the current year. It was, what Lenin (1984, p. 125) stated, "consumption" developed after "accumulation", or after "production". In other words, the production of means of consumption, apart from meeting the consumption needs of laborers who engaged in producing the means of consumption in the current year, directly and indirectly, requires a surplus to meet the consumption needs of additional laborers. To this end, the most fundamental condition is that the average labor productivity represented by the output of end products, namely means of consumption, should be greater than the average consumption level of laborers. With the labor productivity of productive laborers for the means of consumption as h'' and the average consumption level of social laborers designated as i, the total annual production of the means of consumption is equal to $N'' \times h''$, and the total consumption of productive laborers for the means of consumption is equal to $N'' \times i$; the surplus means of consumption provided by the production department for the means of consumption is shown as follows:

$$N'' \times h'' - N'' \times i = N''\left(h'' - i\right) \tag{4}$$

Under the preceding conditions, the number of laborers (N') who can engage in producing the means of production for accumulation can be determined by the following formula:

$$N' = \frac{N''\left(h'' - i\right)}{i} \tag{5}$$

The above formula indicates that the number of laborers who can engage in producing the means of production for accumulation is restricted by the quantitative relationships among the number of productive laborers for means of consumption, their productivity and the consumption level of social laborers. Under the condition that total social labor resources are fixed, the ratio of the number of laborers who can engage in producing the means of production for accumulation to those who can engage in producing the means of consumption is N'/N'', so the absolute quantity (N') of the former depends on the ratio of the labor productivity of the production department for means of consumption over laborers' own consumption to the average consumption level, namely

$$\frac{N'}{N''} = \frac{h'' - i}{i} \text{或} N'i = N''\left(h'' - i\right) \tag{6}$$

This is the criterion for determining whether the proportion of two major departments and the speed of expanded reproduction are appropriate. From the above formula, Liu came to a critical conclusion: Expanding the absolute and relative potential for the accumulation of means of production by raising N' and N'/N'' to drive the increase of reproduction speed is restricted by $(h'' - i)/i$, which ultimately depends on the labor productivity level in the means of consumption department over laborers' own consumption needs. In this sense, the agricultural labor productivity over agricultural laborers' personal consumption was of great significance for determining the investment scale of the heavy industry and productive infrastructure construction and thus for the development of the whole social production. Liu discussed two typical cases of $(N'/N'' > (h'' - i)/i$ and $N'/N'' < (h'' - i)/i)$, respectively.

If $N'/N'' > (h'' - i)/i$, the production scale in Department I, especially the production scale of the means of production for accumulation and expanded reproduction has exceeded the affordability of the production of means of consumption, especially the existing

productivity of agricultural labor. Thus, it is necessary to adjust the proportion of two major departments, invest more labor resources in the means of consumption and their raw material departments, namely agricultural departments, tap the existing potential to increase the labor productivity of these departments and further develop the production of means of consumption. If $N'/N'' < (h'' - i)/i$, it is indicated that the surplus means of consumption provided by the production department for means of consumption allows larger-scale production of the means of production with not fully utilized production potential, inappropriate reproduction proportion, and the possibility of further improving the proportion of Department I in the social production structure and thereby increasing the reproduction speed. These situations suggest that there is a close quantitative correlation among the relative potential for the accumulation of means of production, the speed of expanded reproduction, and the levels of production and consumption of means of consumption. In socialist economic construction, when planning and arranging the accumulation scale of means of production and the reproduction speed, China should consider not only that the production scale in Department I, especially the productive infrastructure and a series of heavy industry departments, can provide the required quantity of means of production for accumulation, but also whether such development scale of productive construction and heavy industry is affordable to the production capacity for means of consumption, especially to the agricultural labor productivity over agricultural laborers' personal consumption needs.

On this basis, Liu further introduced the accumulation of means of consumption (ΔV) and developed the aforementioned determination criterion as follows:

$$N'i = N''(h'' - i) - \Delta V \tag{7}$$

Liu integrated the demand of accumulation for the means of consumption and obtained the following formula:

$$P' = \frac{P''(1-e)}{a + b + \frac{1}{c} + d} \tag{8}$$

where P', P'', a, b, c, d and e represent total accumulated means of production, total means of consumption produced in the current year, the proportion of remuneration to laborers who directly participate in producing the accumulated means of production in the output value of their products, the proportion of remuneration to laborers who indirectly provide the means of production for producing the accumulated means of production in the abovementioned output value of products, the average coefficient of accumulation fund, the average ratio of the consumption demand of nonproductive institutions and personnel related to the extended accumulation of means of production to the accumulation scale of means of production, and proportion of remuneration to laborers who produce the means of consumption in the total value of their products, respectively. The formula indicates that the accumulation scale of means of production is restricted by the available surplus of means of consumption and the demand coefficients for various means of consumption related to the accumulation of means of production.

Liu not only analyzed the restrictive relationship of the affordability in the production of means of consumption and the necessary accumulation of means of consumption for the accumulation potential of the means of production but also demonstrated that a had a maximum limit determined by the minimum investment required for the necessary extension of production in Department II. Moreover, the quantitative method was used to analyze the influence of the investment ratio of the accumulated means of production between two major departments on the extended reproduction speed, which was essentially Liu's growth model

of national income and consumption level. Based on his calculation example, Liu's analysis can be shown with the following model.

Setting the labor population as L, the growth rate of labor population as n, the fund for means of production in Department I as C_I, the fund for means of production in Department II as C_{II}, the fund occupancy coefficient for means of production in two major departments as f_I and f_{II}, the investment in accumulated means of production as ΔC_I and ΔC_{II}, and the national income as Y, the national income represented by means of production and means of consumption as Y_m and Y_n, the average consumption level is $X = Y_n/L$, with the growth rate of x, $t = 1$ at the beginning of the period, and $t > 10$ is time series. Thus, the following growth model for national income and consumption level can be established:

$$
\begin{cases}
L(t) = L(1)e^{nt} \\
C(t) = C_I(t) + C_{II}(t) \\
f_I(t) = f_{II}(t) \\
Y(t) = Y_m(t) + Y_n(t) \\
\Delta C(t) = \Delta C_I(t) + \Delta C_{II}(t) \\
X(t) = X(1)e^{xt}
\end{cases}
\tag{9}
$$

Liu assumed that when $t = 1$, $L(1) = 400$, the working population grew at a constant rate – $n = 0.01$, $C_I(1) = 400$ (unit designated as 100, the same for the other units except f and X), $C_{II}(1) = 1600$, $f_I(1) = f_{II}(1) = 2$ and remained unchanged, $Y_m(1) = 200$, $Y_n(1) = 800$, $\Delta C_I(1) = 184$, $\Delta C_{II}(1) = 16$, $X(1) = 200$, $X(1) = X(t)e^{xt}$, the consumption growth rate $x = 0$, that is, the average consumption level was fixed. These assumptions were made based on the minimum requirements for the working population growth in the next period. Hence, a in the first year was up to 0.92. According to these assumptions, Liu did the calculation from $t = 1$ to $t = 10$. The month-on-month growth rate of national income ranged from 0.1 in the second year to 0.42 in the tenth year. Liu pointed out that although the national income growth rate continued to increase, the consumption level of laborers did not increase during the decade, which was unreasonable from the perspective of the purpose of socialist production. This suggested that there was a contradiction between production and consumption: On the one hand, to enhance the consumption level substantially in the near future, it was necessary to increase the proportion of accumulation invested in Department II and reduce that in Department I accordingly. However, it would limit the further growth of accumulation potential for the means of production and the expanded reproduction speed in the later period, thereby restricting the further improvement of people's living standards in the future. On the other hand, the continuous improvement of consumption level could only be achieved based on the development of production, which depended on establishing a solid material production basis in the long term. This required the investment of a large proportion of accumulation in Department I first so that the accumulation potential for means of production and the scale of extended reproduction could increase faster, thereby providing greater possibilities for expanding the production scale of means of consumption. To illustrate the mutual restriction between the investment ratio of two major departments, the expanded reproduction speed and the consumption level, Liu assumed that

$$a(0, 0.1, 0.2, 0.3, 0.5, 0.7, 0.9), \ t = 12$$

The same economic growth model and initial values were used for the numerical calculation to obtain different speeds of expanded reproduction under different values of a and the corresponding time series values of various average consumption levels. These values reflected different influences of various investment ratios between two major departments on the expanded reproduction speed and the average consumption level. On this basis, Liu

concluded as *a* got greater, the growth rates of accumulation potential for means of production and expanded reproduction speeds would become higher with higher future consumption levels than the average consumption level at low values of *a* and yet, a longer time spent in exceeding the average consumption level at low values of *a*. Hence, different combinations of the investment ratio of accumulated means of production between two major departments with the expanded reproduction speed reflected the relationship between the consumption interests of the working people in the near future and those in the far future in economic substance. To realize the purpose of socialist production, it is necessary to weigh the short-term and long-term consumption interests, with neither concentration on the accumulation investment in Department II for the immediate consumption interests, which could damage the future reproduction speed and was not conducive to increasing the consumption level, nor doing the same in Department I for the final effect of accumulation on increasing the consumption level in the distant future, which could affect the appropriate increase of people's consumption level in the recent period. Liu thought that how to obtain the most appropriate combination through balancing was an issue to be further explored theoretically. To solve this issue, in consideration of the restriction illustrated above, the achieved level of socialist productivity and people's consumption, the formed structure of social production, and the domestic/foreign political conditions and situations of socialist countries in a certain period must be taken into account.

Professor Liu Guouguang concretized the two departments of Marx's social capital reproduction theory into three sectors (agriculture, light industry and heavy industry) and fine-tuned the composition of the two departments from this perspective with the combination of the practice of China's socialist economic construction. The proportional relationship between the two departments was concretized into that between agriculture, light industry and heavy industry, while the two-department analytical framework of Marx's social capital reproduction theory was maintained. Through this sinicization approach, Liu has achieved not only the concretization of Marx's social capital reproduction theory but also its sinicization, creating a sinicized Marxist social capital reproduction theory, which is a significant contribution to Marxist political economy. Meanwhile, Professor Liu conducted dynamic analysis on the accumulation and consumption with the Marxist social capital reproduction model he developed using mathematical modeling and essentially created a distinctive economic growth model, which should occupy an important place in the Marxist economic growth theory.

3. Several reflections

With Professor Liu Guoguang as a typical representative, the process and achievements in the sinicization exploration of Marx's social capital reproduction theory were reviewed. With the reform and opening up, fundamental changes have occurred in China's economic system – the centralized planned economic system has been transformed into a socialist market economic system. The planned management of the national economy is replaced by a macro-regulation system characterized by gross control gradually, and the concepts of agriculture, light industry, heavy industry and their intercorrelation are no longer applied in theory and policy. However, the sinicization exploration of Marx's social capital reproduction theory in the older generation of Marxist economists represented by Liu is not only of historical significance but also of important practical significance.

Firstly, to develop Marxism and integrate Marxism with the concrete practice of socialist construction in China, China must uphold Marxism, which requires a thorough study of Marxism and mastery of the Marxist theoretical system. Meanwhile, it is necessary to have an in-depth understanding of new problems raised in China's socialist practice and employ Marxist principles to analyze and ruminate over them. Any reflection that is divorced from

the adherence to Marxism or Marxist guidance on the new problems in socialist practice can hardly facilitate the development of Marxism.

Secondly, in the socialist market economy, the economic relationship between producers who treat each other as outsiders determines the contradiction between the independence of producers and their interdependence due to social division of labor and that between individual and social labor of producers. As a result, the proportional distribution of total labor can only be accomplished through market competition under the spontaneous action of the value law. Market competition is a process where producers, guided by the price mechanism, adopt a "speculative assumption" decision-making method proposed by Marx to maximize their interests using the contradiction between individual and social labor. This process will inevitably cause periodic destruction of the social reproduction ratio while driving productivity growth and technological innovation, which requires government intervention and regulation of the national economy if necessary.

Based on Marx's social capital reproduction theory, the conditions for the reproduction balance include two interrelated aspects: gross volume and structure; the destruction of the reproduction ratio is mainly reflected in the severe imbalance of gross volume and structure. However, the prevailing macro-regulation system based on the Keynesian theory of national income determination (gross national product) focuses only on the balance/imbalance of gross volume. Fundamentally, such macro-regulation systems are not suitable for the socialist market economy. The macro-regulation system of the socialist market economy should be based on Marx's social capital reproduction theory. In this sense, the reproduction theory with Chinese characteristics containing three sectors (agriculture, light industry and heavy industry) developed by Liu based on Marx's two-department division with aggregate–structure unification is of important practical significance for establishing a macro-regulation system for socialist market economy. In fact, the supply-side structural contradictions formed at present and the "three rural issues" (i.e. issues related to agriculture, rural areas and farmers) lasting for some time in China are essentially a reflection of the imbalance between and within the three sectors (agriculture, light industry and heavy industry).

The 19th National Congress of CPC expressly proposed the construction of a modern economic system. Based on the principles of Marxist economics, the modern economic system should be established based on the real economy. In this sense, building a modern industrial system that reflects the fundamental role of the real economy is the core of establishing a modern economic system. Constructing a modern industrial system means establishing an industrial system with a reasonable structure, strong adaptability, and high innovation capacity and building a balanced national economic system on this condition, which is a crucial way to address unbalanced development. Liu's reproduction theory with Chinese characteristics based on Marx's two-department division is a balanced system of the national economy with the object of the real sector, the goal of meeting laborers' needs to the greatest extent, and the basic content of revealing the unity of speed, aggregate-structure and proportion. Hence, the logic and methodology contained in Liu's reproduction theory with Chinese characteristics based on Marx's two-department division are of great enlightening significance for building a modern industrial system today.

Thirdly, with the industrial capital creating national income as the analysis object, Marx excluded non-industrial capital from his social capital reproduction theory, which manifests his thought of productive labor. Professor Liu followed Marx's principle of analyzing social capital reproduction, excluded the departments that could not generate national income in his study and analyzed the demand for material goods in these departments as the output of three sectors (agriculture, light industry and heavy industry) that created national income. Thus, the reproduction relationship between national income-generating departments and the other departments has been taken into account, which also provides an idea for handling

the relationship between productive department (i.e. department generating national income) and nonproductive department (i.e. department not generating national income) properly.

Notes

1. Where *C, V,* and *M* represent constant capital, variable capital, and surplus value, respectively (same below).

2. This is actually a continuation and reproduction of the early "Theory of Two-Time Revolution" since the end of the 1970s.

3. In this period, there were many research documents on Marx's social capital reproduction theory, especially the preferential growth in producing the means of production and the ratio of accumulation to consumption. Here is just a summary from a perspective closely related to the research purpose of this paper.

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