

Reviewing Marx's schemes of reproduction by the System of National Accounts

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Abstract: This paper explored Karl Marx's schemes of reproduction (MSR) from the perspective of national accounting and the input-output table. MSR criticized Smith's dogma ($v+m$ dogma) and showed that the distribution of factor of production i.e., intermediate products and fixed capital depletion or renewal investment, exists independently of the distribution of income. However, MSR is a model with strict assumptions. For example, MSR has assumptions regarding additional variable capital — consumption — and prepayment of wage. Therefore, MSR is not suitable for use as a basis for real analysis or statistical tables.

Keywords: The schemes of reproduction, Marx's schemes of reproduction, national accounting, input-output table, national account, a System of National Accounts, SNA

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Introduction

Marxian economics, many a time, criticized the input-output table and national accounting. On the contrary, there are few studies on Marx's schemes of reproduction (MSR) based on national accounting or the input-output table. Therefore, this paper examines and evaluates MSR from the perspectives of national accounting and the input-output table.

I. Marx's schemes of reproduction

In this chapter, the contents and assumptions of MSR on simple reproduction and reproduction on an extended scale are studied.

Section 1. Simple reproduction¹⁾

Discussing the simple reproduction, the economy is composed of the following two departments.

Department I: department that produces means of production.

Department II: department that produces articles of consumption.

The following relationships exist in department I and department II.

$$\text{I: } C1 + L1 + S1 = M1$$

$$\text{II: } C2 + L2 + S2 = M2$$

where L : variable capital, wage

C : constant capital, purchase cost of means of production

S : surplus-value

M : value of product

Suffix 1, 2: department I, department II

The conditions for simple reproduction are the following three formulas. Because it is simple reproduction, it is assumed that the capitalist consumes all surplus-value $S1$ and $S2$ individually.

$L1 + S1 = C2$: The capitalist of II purchases the means of production of the value equivalent to $C2$ from department I, and the capitalist and the worker of I purchase the articles of consumption of the value equivalent to $L1 + S1$ from II.

$C1$ is demanded by the capitalist of I as a means of production within I.

$L2 + S2$ is demanded as articles of consumption by the capitalist and the worker of II within II.

By this means, MSR shows that the means of production has the unique distribution i.e., the constant capital of the department I and the department II, other than revenue — wage, surplus-value and land rent— and the final product. MSR criticizes Smith's dogma ($v + m$ dogma) which describe that the value of intermediate product is decomposed into wage and profit. The criticism is the merit of MSR in economic doctrinal history. Marx describes it in *Capital*, Volume 3, "Reproduction and Distribution of Total Social Capital" and Chapter 19 "Conventional Statements on Objects, Section 2, Adam Smith, and Smith's General Perspective".

The problem how the means of production are distributed was later dealt with by J. M. Keynes in a different way from Marx. Keynes's way is the income analysis that abstracts intermediate transactions. Modern macroeconomics and the national accounting follow this way. However, Keynes differs from MSR in that it distinguishes between fixed capital formation and intermediate demand. As described in the next section, I think that Keynes's way

1) See Marx, *Capital*, Volume II, Chapter 20. In this paper, the following edition of *Capital* is used.

Marx, Karl, *Capital A Critique of Political Economy, Volume II: The Process of Circulation of Capital*, Progress Publishers, Moscow, 1956, USSR; Transcribed: by Doug Hockin and Marxists Internet Archive volunteers in the Philippines in 1997; Proofed: and corrected by Andy Blunden and Chris Clayton (2008), Mark Harris (2010). <https://www.marxists.org/archive/marx/works/download/pdf/Capital-Volume-II.pdf>

is better than Marx's in this regard.

Section 2. Assumptions of Marx's schemes of reproduction

Because the terms of the national accounting are used in this section to discuss the assumptions of MSR, the meaning of the terms of the national accounting are confirmed to begin with. They are as follows.

Intermediate product, intermediate demand: Goods and services used for production, and its purchase.

Final product, final demand: Goods and services that were not used for production in the current period, and their purchase.

Fixed capital: Artificial durable goods.

Fixed capital formation: Construction and purchase of fixed capital.

Consumption of fixed capital: Depreciation of fixed capital in the current period.

Changes in inventories: Net increase in inventories during the period.

The assumptions of MSR are as follows.

(a) As is well known, Marx thinks only goods production productive and services unproductive. If the service industry was unproductive, it is necessary to set up a service department separately from department I and II, and to incorporate the relationships service department and personal consumption, capital formation and department I and II in a formula in order to complete the scheme. For example, the Soviet Union's national accounting "Material Product Balance" (MPS) is a very complex system that incorporates the service industry as a non-production sector. The situation does not change even if the service industry is included in department I or II. Therefore, there is no need to make the service industry non-productive.

(b) MSR is displayed by unit (labor) 'value', but there is no problem by unit 'price'. Many of the current analysis using MSR are also consciously or unknowingly analyzed by unit 'price'. Since it is also possible to use the market price, it is possible to examine and compare in the same dimension as input-output table.

(c) It is assumed that there is sufficient labor-power in MSR. MSR puts labor-power out of the scope of analysis, and discusses it without limiting labor-power (Marx, *Capital*, Part 2 Capital Distribution Process Volume 1 Capital Metamorphosis and Its Circulation). Furthermore, Marx made an assertion that there are no labor-power restrictions by the concept of the relative overpopulation or industrial reserve army (*Capital*, Part 1, Volume 7, Chapter 23, "General Law of Capitalist Accumulation").

(d) MSR put fixed capital and inventory stock outside the analysis. It does not mean that fixed capital depletion and renewal investment are ignored, but that fixed capital and inventory are placed outside the framework, and stock-related indicators such as capital coefficient are not used. It also means that MSR does not assume any restrictions on production volume

due to fixed capital stock.

Because MSR premises the equilibrium between supply and demand, and does not refer the utilization rate of fixed capital, MSR can proceed the analysis even when the utilization rate of fixed capital is below 100%. Furthermore, as mentioned in this section (c), it is assumed that there is sufficient labor-power. Thus, MSR is an equilibrium analysis, that is, it assumes that the supply and demand of goods in the market is equal, excluding the analysis of capital stock and labor-power.

MSR removes restrictions based on capital coefficient and labor-power, so the conditions are very loose as an economic growth model.

(e) MSR does not assume a company as a unique entity independent of the capitalist as physical person. Therefore, there is no concept of dividends to shareholders in MSR.

(f) MSR presupposes the existence of commerce and inventories. Marx described it in *Capital*, “Part 2 Capital Circulation Process, Part 1 Capital Metamorphosis and Its Circulation Chapter 1 Monetary Capital Circulation” p 15.

M — C represents the conversion of a sum of money into a sum of commodities; the purchaser transforms his money into commodities, the sellers transform their commodities into money. What renders this act of the general circulation of commodities simultaneously a functionally definite section in independent circuit of some individual capital is primarily not the form of the act but its material content, the specific use-character of the commodities which change places with the money. These commodities are on the one hand means of production, on the other labour-power, material and personal factors in the production of commodities whose specific nature must of course correspond to the special kind of articles to be manufactured. If we call labour-power L, and the means of production MP, then the sum of commodities to be.

(g) Finance does not exist in MSR. MSR assumes that the funds will be returned to the person who lent, invested in advance at the beginning of the term. Then there are no surplus or shortage of funds. Therefore, it is difficult to introduce finance into MSR based analysis.

(h) MSR states that production precedes distribution, purchase and demand. It is a *C-M-P-M-C* order.

where C: money
M: goods
P: production

Harvey (2013) states that it is assumed that there are no bankers or merchants in *Capital*, but it would be more appropriate to take the existence of merchants out of the discussion as a matter of course.

(i) MSR assumes no movement of capital between departments. The model in which capital does not move between departments, and accumulates cumulatively within the same depart-

ment over time has severe restriction. Furthermore, as mentioned above, the departments in MSR are not sorted out by products or industries but usage classifications, so they are very variable. Therefore, even in the same company or factory, capital goes around department I and II just by changing household consumption and raw material demand sources. These assumptions are made to avoid complicating the analysis.

Combining these assumptions with (j) in this section, MSR presupposes that the funds will be returned to the person who made the advance, investment, at the beginning of the term and will return to the end of the term.

(j) MSR assumes that all income will be spent in the term. That is, it is assumed that the savings rate equals 0%. Thus, all wages are consumed, and no capital formation is spent from wage. And the capitalist spends all income for their consumption and investment. Furthermore, as described in (i) this section, it is assumed that capital does not move between departments e.g., the capitalist of department I does not investment in department II.

On the other hand, the national accounts do not specify the relationship between income up to the previous term and final demand in the current term, regardless of the source of funds for the final demand. In that respect, the national accounts follow Keynes's theory.

(k) MSR assumes that wage is paid in advance. That is, it is assumed that the worker purchases consumer goods using their wage paid at the beginning during the term. Marx describes it in *Capital*, "Section 3 Conversion between the two sectors I ($L+S$) vs. IIC" p 244,

In department I, then, the aggregate capitalist has paid £1,000 (I say £ solely to indicate that it is value in the form of money), equal to $1,000v$, to the labourers for the value of product I already existing as the v -portion, i.e., of the means of production created by them.

and "Part 3 Reproduction and distribution of total social capital, Chapter 20 simple reproduction" p 244.

The capitalist buys the labour-power before it enters into the process of production, but pays for it only at stipulated times, after it has been expended in the production of use-values.

(l) In case that production precedes purchase, constant capital must exist in department I at the beginning of the production term. That is, if the means of production $C1$ does not exist in department I at the beginning of the term, the production cannot be started in department I. Therefore, the inventory of the means of production — raw material inventory, product inventory or distribution inventory — must exist at the beginning of the term. On the other hand, because it is assumed that department II purchases the means of production, constant capital from department I after the production of department I, constant capital does not have to exist in department II at the beginning of the term. Since this is a problem of inventory stock, it is a different problem from the existence of inventory fluctuation, increase or decrease of inventory stock during the term.

(m) The classification of department I and II in MSR and the distinction between production goods and consumer goods are not based on the natural nature of goods, but on how they are used. The classification is therefore not based on industry, goods, or activities as in the SNA²⁾.

Marx stated in *Capital*, “Part 2, Volume 3, Chapter 20, Section 2, Two Sectors of Social Production” p 242 that the classification of department I and II depends on the natural nature of the goods produced.

The total product, and therefore the total production, of society may be divided into two major departments:

I. Means of Production, commodities having a form in which they must, or at least may, pass into productive consumption.

II. Articles of Consumption, commodities having a form in which they pass into the individual consumption of the capitalist and the working-class.

However, in the logical development of MSR, it is appropriate to categorize department I and II only by how the products are used. Harvey (2013] also points out the ambiguity in the definition of production goods and consumer goods in MSR.

(n) Because the value of a good includes consumption of fixed capital in MSR, concepts in MSR are gross i.e., they include capital consumption. This point is discussed in *Capital*, “Section 11 Compensation of Fixed Capital” p 273, and it is assumed that consumption of fixed capital equals the renewal investment.

One portion of the value of the constant capital, which consists of instruments of labour in the strict meaning of the term (as a distinct section of the means of production) is transferred from the instruments of labour to the product of labour (the commodity); these instruments of labour continue to function as elements of the productive capital, doing so in their old bodily form.

If it is a gross concept, renewal investment is required even in simple reproduction. In other words, in order to make supply and demand equal, the renewal investment has to be allocated corresponding to consumption of fixed capital on the demand side, because consumption of fixed capital is included on the production side. Considering this point, the equilibrium condition of simple reproduction in MSR is shown as follows.

Personal consumption gross concept: $L1 + S1 + L2 + S2 + Dep2$

$= M2$: consumption means production value gross concept

where Dep : consumption of fixed capital.

Many commentaries on MSR do not understand this point and explain that there is no fixed capital formation in simple reproduction.

2) The SNA — System of National Accounts — is the standard for the national accounts by the United Nations and others. The first edition of the SNA was published in 1953, and revised editions were published in 1968, 1993, and 2008. They are abbreviated as the 53 SNA (United Nations (1953)), the 68 SNA (United Nations (1968)), the 93 SNA (Commission of the European Communities et al (1993)), and the 2008 SNA (European Commission (2009)).

(o) Marx's concept of constant capital includes fixed capital formation and changes of inventories in addition to intermediate inputs such as raw materials. This point is described in *Capital*, Section 2 (2), p 242.

2) Constant Capital. This is the value of all the means of production employed for productive purposes in this branch. These, again, are divided into fixed capital, such as machines, instruments of labour, buildings, labouring animals, etc., and circulating constant capital, such as materials of production: raw and auxiliary materials, semi-finished products, etc.

If a model is based on the assumption that production activities are carried out without any capital stock, it can be developed assuming that there is neither consumption of fixed capital nor renewal investment. But as shown in this section (n), Marx discusses MSR on the premise of the existence of consumption of fixed capital and capital stock.

In addition, Harvey (2013) states that there are various assumptions in Marx's *Capital*, e.g., no complex products, constant labor productivity, different value structures in both sectors, fixed labor-power value, and invariant reinvestment rate etc. But this paper does not discuss these problems because they are mainly technical problems.

Section 3 Reproduction on an extended scale

In case of reproduction on an extended scale i.e., when the output amount increases every period, MSR is shown in *Capital*, Chapter 21 "Accumulation and reproduction on an extended scale Section 3 Expressional description of accumulation 1st example".

The following relationships exist in department I and department II.

$$\text{I: } C1 + L1 + Sk1 + Sc1 + Sv1 = M1$$

$$\text{II: } C2 + L2 + Sk2 + Sc2 + Sv2 = M2$$

where Sk : consumption by the capitalist

Sc : accumulation of additional constant capital

Sv : accumulation of additional variable capital

Subscripts 1 and 2 indicate department I and II, respectively.

The accumulated additional variable capital of Sv does not exist in MSR in case of postpaid wage. And it is easier to analyze in such case. So, this paper premised on postpaid wage. However, the claims of other researchers are described in line with the assumption regarding Sv the research concerned.

The conditions for reproduction on an extended scale i.e., demand equals supply, are the following three equations.

$L1 + Sk1 = C2 + Sc2$: The capitalist of the department II purchases the means of production equivalent to $C2 + Sc2$ from the department I, and the capitalist and the worker of I purchase the means of production and the articles of consumption equivalent to $L1 + Sk1$ from the department II.

$C1 + Sc1$: $C1 + Sc1$ are demanded by the capitalist of department I as the means of production within the department I.

$L2+Sk2$: $L2+Sk2$ are demanded as articles of consumption by the capitalist and the worker in department II within department II.

The following problems and difficulties have been pointed out regarding MSR on an extended scale.

1) Additional variable capital³⁾

Consider the following MSR on an extended scale.

Department I: $4000C + 1000L + 400Sc + 100Sv + 500Sk = 6000$

Department II: $1500C + 750L + 100Sc + 50Sv + 600Sk = 3000$

In this formula, the supply and demand of articles of consumption are as follows.

Supply of articles of consumption = 3000

Demand for articles of consumption = personal consumption by the capitalist ($500Sk + 600Sk$) + consumption by the continuous worker ($1000L + 750L$)
= 2850

In this case, the demand for articles of consumption is fewer by 150, i.e., supply of consumption means 3000 - demand for consumption means 2850. This 150 is the wage — additional monetary capital — for the worker who will be hired next term on the reproduction on an extended scale. What is the source of wage to be paid to the additional worker? Is it the sale of 150 articles of consumption? Is there no demand in that term, because the additional worker's buying power will arise in the next term? This is the additional variable capital problem.

This additional variable capital problem has to be resolved in order to make demand equal supply in the current term. There are various explanations about this variable capital problem as follows (see Ryozyo Tomitsuka and Kiyoko Imura eds. (1990)).

First, there is an explanation that additional variable capital is inventory. There are two types in this explanation. One of them explains that the capitalist purchases the articles of consumption for the additional worker in this term and stores them until the next term. Another explains that commodity handling capital purchases the articles of consumption for the additional worker in this term and stores them until the next term. The former causes changes in product inventories, and the latter causes changes in distribution inventories. The ratio of changes of inventories to the increase in wage is relatively small looking at the actual data of the national accounts. Thus, this explanation of the inventory theory seems to be weak.

Next, there is an explanation that the demand from the gold production sector balances supply and demand, but it would be meaningless under the fiat money standard system as now.

Thirdly, there is an explanation that the additional worker purchases and consume consumer goods twice in both this term and the next term. But this explanation contradicts reality. Contrary to Marx's premise, there is an explanation that additional variable capital is

3) See, for example, Tomituka et al eds. (1990) for more information.

removed from the original principal in case of postpaid wage (Okishio (1967)). Furthermore, there is an explanation that shifts the production time and purchase time. But this is actually a deferred wage payment theory. These explanations are unconvincing except for the post-paid wage theory.

2) Reserve for depreciation is larger than renewal investment⁴⁾

In the reproduction on an extended scale, the depreciation is a value transfer from fixed capital. Because the depreciation increases term by term, it is larger than the renewal investment for the value of capital terminated and disposed. In this case, the demand by renewal investment becomes smaller than that of gross production including depreciation. And it results in a shortage of demand.

There are several interpretations and explanations of this problem. There is an explanation that this demand shortage exists in actuality and that it is factors of industrial cycle or imbalance in the capitalist economy. And another explanation is that this shortage is compensated by additional investment (see Tomitsuka and Imura eds. (1990)). In addition, there are several explanations about the monetary source of additional investment. However, none of them seem to be convincing enough.

Compared to simple reproduction, the reproduction on an extended scale leads to the problems described above. MSR on an extended scale postulates that all income is spent, and that the source of expenditure is specified, and income and the source of expenditure are one-to-one correspondent. These conditions are too strict, and they are the reasons of the problems. Simple reproduction is sufficient to criticize Smith's dogma, and reproduction on an extended scale was unnecessary. This point is explained in the next section using the national income account.

II. Marx's schemes of reproduction displayed by national accounts

In this section, MSR is displayed by the form of national account, especially the SNA, and the nature of MSR is clarified.

Section 1. The national income accounts

The national income accounts are the main group of accounts or tables in the national accounts. The national income accounts consist of Integrated Accounts for the entire country and Accounts classified by Institutional Sectors.

Integrated Accounts express the final demand of the country - final products - income - disposal / savings - capital formation / net lending / net borrowing - financial surplus or deficit. And Integrated Accounts are composed of the following account⁵⁾.

Gross Domestic Product Account: which records final demand - final product - income.

4) See, for example, Tomituka et al eds. (1990) for more information.

5) Although overseas transactions are abstracted in this paper, actual national accounts include overseas accounts. Strictly speaking, two accounts are added in consideration of social transfers in kind from the government to households, resulting in a total of seven accounts. But for the sake of simplicity, the transfer of physical society is omitted in this paper.

National Disposable Income and its Use Account: which records income - disposable – savings.

Capital Account: which records savings - capital formation and excess or deficiency of funds.

Financial Account: which records financing and operation.

Rest of the World Accounts: which records overseas transactions.

Accounts classified by institutional sectors i.e., non-financial corporations, financial corporations, general government, households including private unincorporated enterprises, private non-profit institutions serving households, express the flow of income - disposal or savings - capital formation or liability of each institutional sector. Because the production expenditure account covers the demand - production - distribution of the entire country, there is no production expenditure account for each institutional sector. And they consist of the following accounts.

Income and Outlay Accounts: which records income - disposal or savings

Capital Account: which records savings - capital formation and excess or deficiency of funds

Financial Account: which records financing and operation

The national income accounts do not cover stocks and intermediate transactions. But in the national accounts, SUT tables in the 2008 SNA, UV tables in the 68 SNA and the 93 SNA record intermediate transactions, and the stock accounts express stocks. There are also accounts classified by institutional sectors as mentioned above. Therefore, such criticisms are irrelevant that the national income account does not cover stock or intermediate transactions and that institutional sector analysis of the national income account is weak.

Section 2. Marx's schemes of reproduction displayed by the form of national income account

In this section, the nature of MSR is checked up by display it in the form of the national income accounts. The case of no government and no overseas is dealt in this section. And, for simplification, wages will be paid at the end of the term, and there will be no additional variable capital Mv . Furthermore, constant capital C is divided into intermediate transaction Cc and consumption of fixed capital Dep .

MSR on an expanded scale is written as follows.

Department I: $Cc1 + Dep1 + L1 + Sk1 + Sc1 = M1$

Department II: $Cc2 + Dep2 + L2 + Sk2 + Sc2 = M2$

The equilibrium condition is as follows.

$C1 = Cc1 + Dep1 + Sc1$: Intermediate transaction + renewal investment is produced and demanded within department I.

$Cc2 + Dep2 + Sc2 = L1 + Sk1$: Department II purchases intermediate transactions + renewal investment + additional constant capital from department I, and department I purchases the same amount of articles of consumption from department II.

Table 1 Gross Domestic Product Account

SNA			
MSR	Gross Domestic Product Account		MSR
$L1+L2$	Compensation of employees	Household final consumption expenditure	$L1+L2+Sk1+Sk2$
$Sc1+Sk1+Sc2+Sk2$	Operating surplus	Gross fixed capital formation	$Sc1+Sc2+Dep1+Dep2$
$Dep1+Dep2$	Consumption of fixed capital	Changes in inventories	0

MSR: Marx's schemes of reproduction

Dep: depreciation. Consumption of fixed capital

J: Changes in inventories

Sv: none or $Sv=J$

$L2+Sk2=L2+Sk2$: Articles of consumption are produced and demanded within department II.

The framework of MSR is that individual capitalist exists and no company exist. But in this section, we think of the case that the company produces goods and surplus-value, and distributes the entire surplus-value to the capitalist household, and the capitalist household consumes and accumulates capital from the entire surplus-value, because sectors of the national income accounts are companies and households, general government, private non-profit institutions serving households and overseas.

As shown in Table 1, the final demand is recorded on the credit - right side - and the gross income is recorded on the debit - left side - in the gross domestic product account. According to the assumption of MSR, the operating surplus is surplus-value, and since it is a gross concept, consumption of fixed capital is recorded as a debit. In the SNA type national income account, the source of income is not referred, but in MSR, income is specified, such as follows, because they are the source of demand.

household consumption = wage + personal consumption by the capitalist

fixed capital formation = additional constant capital by the capitalist

According to the assumption of MSR that the entire surplus value will be distributed from the company to the capitalist, the surplus is allocated to property income, i.e., dividend in the income and the outlay account and the national disposable income and its use account, integrated (the entire country) as shown in Table 2. And variable capital i.e., wage and consumption by the capitalist are allocated to household consumption, then savings equals $Sc1+Sc2$.

According to the 2008 SNA, the income and outlay account of household is divided into three stages, which are the primary income distribution account, the income secondary distribution account, and the income usage account (see Table 3). Because MSR eliminates finance and government, interest payments are zero, taxes and current transfers equals zero, and savings are $Sc1+Sc2$.

Income and outlay accounts of companies are also divided into three accounts in the 2008 SNA, similar to households (see Table 4). In the primary income allocation account, the operating surplus is surplus-value $Sc1+Sk1+Sc2+Sk2$, and the dividend payment is surplus-value $Sc1+Sk1+Sc2+Sk2$. Because MSR assumes that there is no rent or interest, receipt

Table 2 National Disposable Income and its Use Account

SNA			
MSR	National Disposable Income and its Use Account		MSR
$L1+L2+Sk1+Sk2$	Household final consumption expenditure	Compensation of employees	$L1+L2$
$Sc1+Sc2$	Saving	Property income	$Sc1+Sk1+Sc2+Sk2$

Table 3 Income and Outlay Accounts (Households)

Households			
MSR	Allocation of Primary Income Account		MSR
0	Interest	Compensation of employees	$L1+L2$
$L1+L2+Sc1+Sk1+Sc2+Sk2$	Balance of primary incomes	Property income (Dividends)	$Sc1+Sk1+Sc2+Sk2$
Secondary Distribution of Income Account			
0	Current taxes on income, wealth, etc. and social contributions	Balance of primary incomes	$L1+L2+Sc1+Sk1+Sc2+Sk2$
$L1+L2+Sc1+Sk1+Sc2+Sk2$	Disposable income		
Use of Income Account			
$L1+L2+Sk1+Sk2$	Final consumption expenditure	Disposable income	$L1+L2+Sc1+Sk1+Sc2+Sk2$
$Sc1+Sc2$	Saving		

Table 4 Income and Outlay Accounts (Corporations)

Corporations			
MSR	Allocation of Primary Income Account		MSR
$Lc1+Lk1+Sc2+Sk2$	Property income	Operating surplus	$Sc1+Sk1+Sc2+Sk2$
0	Balance of primary incomes	Property income	0
Secondary Distribution of Income Account			
0	wealth, etc. and social contributions	Balance of primary incomes	0
0	Disposable income		
Use of Income Account			
0	Saving	Disposable income	0

of property income of company equals zero. Also, as the case of household, there is no tax or current transfer. Disposable income and savings of company equal zero, because it is assumed that all income of company is distributed to the capitalist.

The integrated capital account is as shown in Table 5. Double entry is established for each item in the account, and the national income accounts are completed.

Assuming that the capitalist uses a part of their own surplus-value as a source of fixed capital formation, and the worker consumes the entire amount of variable capital, i.e., wage according to the assumption of MSR, the financing for capital formation equals zero, so all items of household capital account equal zero. Then household capital account does not exist. If the capitalist is identical with company according to the assumption of MSR, there is

Table 5 Capital account

MSR	Total Economy		MSR
$Dep1 + Mc1 + Dep2 + Sc2$	Gross fixed capital formation	Saving	$Sc1 + Sc2$
$J1 + J2$	Changes in inventories	Consumption of fixed capital	$Dep1 + Dep2$

Table 6 Financial Account

Total Economy		
0	Changes in assets	changes in liabilities
0	Net lending/net borrowing	0

no company, so there is no capital account of the company.

As mentioned above, there are many items that equal zero when MSR is expressed in the national income accounts, and there are several accounts that do not exist because all items in them equal zero. The reason of them is that MSR has many strict assumptions as shown in "I. Marx's schemes of reproduction" in this paper. Of course, these items have numerical values in the actual national income account.

Since MSR does not assume finance, all items in the financial account, integrated or classified by institutional sector, will be zero (see Table 6).

If it is assumed that wages are paid at the beginning of the term, additional variable capital Sv ($=Sv1 + Sv2$) is added to the operating surplus in gross domestic product account, the amount equivalent to Sv is recorded in changes of inventories, and additional capital Sv is added to savings and property income (dividend), in income and outlay account (integrated), additional variable capital Sv is added to primary balance and property income, dividend in income and outlay account of household, and additional variable capital Sv is added to operating surplus and dividend payments in income and outlay account of non-financial corporations.

Thus, MSR includes income disposal and saving-lending implicitly, and its coverage corresponds to the national income accounts. The input-output table has the same target as gross domestic product account, which is a part of the national income accounts, as will be described later. Consequently, the coverage of MSR is wider than that of the input-output table.

In order to clear up the nature of MSR, the premises of MSR are confirmed by expressing it by national income account. The assumptions of MSR are as follows, which are pointed in this paper "I. Marx's schemes of reproduction".

All corporate operating surplus is distributed to the capitalist. Thus, corporate savings equals zero.

The capitalist spends all surplus-value i.e., operating surplus as household consumption and capital formation in the current term.

The capitalist also spends all of return from the intermediate product and consumption of fixed capital in the current term. Therefore, the capitalist's savings equals zero.

The worker also spends all their wages in the current period. Thus, worker's savings

equals zero.

All of the funds are returned to the capitalist.

These assumptions and conditions are stricter than usual models of economic growth theory such as Harrod, Dormer, or Neoclassical. On the other hand, there are some loose conditions, such as no restriction on labor-power in MSR.

In the national income accounts, these movements of economy are expressed by multiple tables i.e., gross domestic product account, national disposable income and its use account, capital account, and financial account. This treatment is clearer than explaining two equations and three equilibrium condition equations as in MSR. The national accounts also cover finance and stock that MSR does not include. In reality, the various final demands for the next term are largely independent, because they are defined by the savings, net lending or borrowing of each sector— corporations, household, government, overseas, etc. and various factors, forecasts, etc. . The national accounts do not cover spending by each sector in the next term, therefore make no assumption on this relation. MSR, especially reproduction on an extended scale, models this relation and argues it on specific assumptions.

As observed above, MSR is a model analysis. And MSR analyzes the time course of demand - production - income - expenditure and savings by making specific assumptions about the source of expenditure, propensity to consume, investment behavior, etc. . In this respect, it is a model analysis similar to neoclassical growth theory. The “model” in this paper means to extract a specific relationship from an object, and develop the motion of the object only from those relationships. Harvey (2013) also states that MSR is a model. But Harvey alleges that MSR is a model to show the certainty of depression in capitalism. While on the other hand, this paper alleges that MSR is a model to criticize Smith’s dogma and to show the unique circulation of constant capital, and that the difficulties of MSR, particularly on an extended scale, arise from the problem of setting this formula.

In simple MSR analysis, assumptions are evaluated as effective in order to criticize Smith’s dogma. However, in MSR on an extended scale, there are some serious problems, for example, the additional variable capital or depreciation - renewal investment problems as shown in the previous section. These assumptions are often made in model analysis, but they are too strict format or standard for statistical tables that describe actual economy.

The national account statistics, which include the input-output table as a part, are statistical tables to express real economy. Therefore, the national account statistics set no specific premise or condition for behaviors of the economy. For example, the worker accumulates their savings and has share of stock. And the capitalist does not always capitalize their all profits. On the contrary, they may invest more than their own funds. The national accounts also do not assume the return of funds to individual capitalist at the end of the term. In MSR, economy moves in the order of expenditure - distribution - production, but the national accounts are Keynesian, and think economic movements begin at demand. In that respect, MSR is quite different from the national accounts.

Therefore, MSR is a model more abstract than a statistical table e.g., the national accounts that reflects the real economy. Furthermore, the conditions of MSR are very strict among various models, and MSR in reproduction on an extended scale has some problems as seen in this paper “1. Marx's schemes of reproduction (3) reproduction on an extended scale”.

III. Marx's schemes of reproduction and the Input-output table

In this section, the MSR is described in the Input-output table form, and the character of the MSR reconfirmed by the notation in the national income account.

Section 1. The input-output table

As seen in II. Section 2 of this paper, the input-output table covers the same phase — distribution - production - expenditure — as the gross domestic product account in the national accounts. It does not cover income disposal, savings, or capital formation. It covers narrower than the MSR.

Actually, the SNA includes the input-output table. The 68 SNA and the 93 SNA include UV table, the 2008 SNA includes SUT table in which the input-output table is divided into two tables i.e., industry - product table and product - industry table, which is closer to reality than the normal input-output table and show more information. As the 68 SNA shows, UV table and SUT table can be converted to the normal input-output table of from industry to industry with some assumptions. However, the normal input-output table has more convenient operability i.e., input-output analysis.

The Material Product Balance (MPS) of Soviet Union is characterized by displaying the material production industry as a basis and by treating non-material industry separately. But division in MPS is not a division by department I and II of MSR, but by goods or services or by industry, so basically MPS should be evaluated as a modification of the input-output table.

Section 2. Marx's schemes of reproduction displayed by the input-output table form

Yokokura (1978) displayed simple reproduction MSR by the input-output table form (Table 7). As shown in I. Section 1 of this paper, consumption of fixed capital and renewal investment also exist in simple reproduction. Most Marxian economists seem unaware of this, and Yokokura (1978) also does not show consumption of fixed capital in gross income, and does not show renewal investment in final demand.

Kawakami (1973) displayed MSR on an extended scale by the form of the input-output table (Table 8). Kawakami (1973) also does not show consumption of fixed capital as gross value added, and does not distinguish renewal investment from new investment. Although additional variable capital is included in changes of inventories in department II, Kawakami (1973) does not consider this problem sufficiently. In addition, this Table includes this additional variable capital only changes of inventories. Then changes of inventories of means of production — changes in raw material inventory, product inventory and distribution inventory — are not included in this Table. Since consumption expenditure outside households is mainly for production activities such as business trip expenses, it is appropriate to include

Table 7 Simple reproduction MSR displayed Input-output table form by an Marxian economist

	Dep. I	Dep. II	(Consumption by Workers)	(Consumption by Capitalists)	Sum
			Productive consumption	Unproductive consumption	
Department. I	C1	C2			M1
Department. II			$L1+L2$	$S1+S2$	M2
Variable capital	L1	L2			
Surplus value	S1	S2			
Sum	M1	M2			

Yokokura [1978], p 126

Table 8 MSR on an extended scale displayed Input-output table form by an Marxian economist

to from		Department			Final demand					Output
		I	II	小計	Consumption		Investment		Subtotal	Sum
					Workers	Capitalists	equipment	inventories		
Department	I	4,000	1,500	5,500	—	—	500	—	500	6,000
	II	—	—	—	1,750	1,100	—	150	3,000	3,000
	Subtotal	4,000	1,500	5,500	1,750	1,100	500	150	3,500	9,000
Value added	Wage(L)	1,000	750	1,750						1,750
	Profit(S)	1,000	750	1,750						1,750
	Subtotal	2,000	1,500	3,500						3,500
Sum of Input		6,000	3,000	9,000	1,750	1,100	500	150	3,500	12,500

Kawakami [1973]

Table 9 MSR on an extended scale displayed Input-output table form — post paid wage, no added variable capital

	Intermediate transaction		Consumption		Capital formation	Sum
	Dep. I	Dep. II	Workers	Capitalists	Constant capital	
Department. I	C1	C2			$Sc1+Sc2+Dep1+Dep2$	M1
Department. II			$L1+L2$	$Sk1+Sk2$		M2
Wage	L1	L2				
Profit	S1	S2				
Consumption of fixed capital	Dep1	Dep2				
Sum	M1	M2				

C: Constant capital (intermediate demand)

L: Variable capital (constant capital)

S: Surplus value (profit)

Sk: Personal consumption by capitalists

Sc: Capital formation from surplus value

Dep: consumption of fixed capital

the endogenous sector.

Considering these problems, MSR is expressed in the form of input-output table as Table 9. The presuppositions of this are as follows.

Wages are paid at the end of term. Therefore, there is no additional variable capital.

The worker's propensity to consume equals 100%

Surplus-value equals capital formation. That is, all surplus-value is invested in this term.
 Therefore, consumption by the capitalist equals 0
 Eliminate imports and exports.
 Eliminate the government.

Thus, MSR seems to be displayed in the input-output table form without important problems. However, as pointed out in I. Section 3, the input-output table is equivalent to the gross domestic product account, i.e., a part of national accounts, but the target of MSR is wider than the input-output table in the point that MSR covers the range of national disposable income and its use account and the capital account in addition. As pointed in Chapter II, the input-output table has strict assumptions about transactions that national disposable income and its use account and the capital account cover. That is, the savings propensity of the worker equals 0%, the savings of the capitalist equals capital formation, and so on. These assumptions are unlikely to appear in the input-output table evidently. MSR assumes the flow of production - income - expenditure, but the input-output table assumes the flow of demand - production - income distribution.

Conclusion

MSR should not be recognized as a representation of the actual economy, but should be recognized as a model that explains the nature of the economy with a considerable number of assumptions. For example, MSR has the assumptions on consumption propensity of the worker and the capitalist, investment rate, and resources for expenditure. The assumptions that constant capital includes intermediate goods and consumption of fixed capital are also hard to accept from the perspective of the national accounting. These conditions are unrealistic and too strict for displaying a statistical table.

MSR has great significance to criticize Smith's dogma and to clarify that intermediate products have their own flow. However, simple reproduction is sufficient to criticize Smith's dogma. MSR on an extended scale has the problems shown in this paper due to its strict conditions.

The coverage of the input-output table is narrower than that of MSR, because the input-output table does not cover income disposal, savings and capital formation. However, the input-output table is a part of the national accounts, and display demand-production-distribution. And the national accounts are broader than MSR, because the national accounts also include finance and stock.

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