

# Surplus Value and the Kalecki Principle in Marx's Reproduction Schema

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## 1 Introduction

A well-known interpretation of Marx's reproduction schema identifies the role played by the 'Kalecki Principle', or Widow's Cruse, that capitalists earn what they spend. As Marx writes in *Capital Volume II*: 'In point of fact, paradoxical as it may seem at the first glance, the capitalist class itself casts into circulation the money that serves towards the realisation of the surplus-value contained in its commodities' (Marx 1978, p. 409). In their particularly extensive analyses of the reproduction schema both Reuten (1998, p. 200) and Sardoni (1989, p. 212) argue that for Marx profits are determined by capitalist expenditure outlays.

There are two main ways in which this interpretation of the reproduction schema is underdeveloped. First, although Kalecki (1968, p. 459) claims that his model is 'fully in the Marxian spirit', he did not examine the direct relationship between his approach and Marx's original text. Sardoni (1989) has provided perhaps the most concerted effort to make this connection but does not engage directly with Marx's numerical examples. Second, coming from the other extreme, Reuten (1998) provides a most systematic and detailed exploration of Marx's original tables, giving special mention to the Kalecki Principle, but without providing a direct connection to Kalecki's analytical model of the reproduction schema.

The contribution of this paper is to provide a detailed analysis of the role of the Kalecki Principle in Marx's reproduction schema. Using Marx's original tables, in the first part of the paper a number of steps are followed to make the transition to Kalecki's model. This model is shown to provide a particular *ex post* interpretation of Marx's tables. A key problem with this interpretation is that it obscures the classical role of surplus value in the reproduction schema. This has led, perhaps unfairly, to Kalecki being described in some circles as 'non-Marxist' (Freeman and Carchedi 1996, p. xii). In the second part of the paper a different interpretation of the reproduction schema is offered using the Leontief input-output framework. On this interpretation, both the Kalecki Principle and the role of surplus value can be succinctly modelled in the context of Marx's original reproduction schema.

## 2 Kalecki's Interpretation of Marx's Reproduction Schema

The most developed of the expanded reproduction schema are referred to by Marx as 'schema (B)' of the 'First Example' in Section 3 of Chapter 21, *Capital Volume II* (Marx 1978, pp. 586-589). In the analysis that follows we will start with this two-sector numerical example and by a number of steps show how it relates to the three-sector model developed by Kalecki.

Table 1 reports the first two years of the schema, with Department I producing capital goods and Department II consumption goods.<sup>1</sup> In each department  $i$  the total value of production ( $X_i$ ) is made up of constant capital ( $C_i$ ), variable capital ( $V_i$ ) and surplus value ( $S_i$ ). In addition, Department I

produces non-durable outputs that are used up as constant capital during a single period of production. The rate of surplus value is assumed to be 100 per cent in each department, and £1 of output is assumed equal to a unit of labour.

**Table 1 Marx's Two-Sector Reproduction Schema**

Year 1	$C_i$	$V_i$	$S_i$	$X_i$
Dept. I	4000	1000	1000	6000
Dept. II	1500	750	750	3000
	5500	1750	1750	9000
Year 2	$C_i$	$V_i$	$S_i$	$X_i$
Dept. I	4400	1100	1100	6600
Dept. II	1600	800	800	3200
	6000	1900	1900	9800

Marx assumes that capitalists in Department I invest a half of their surplus value for accumulation in the next year. This invested surplus amounts to 500 units that are distributed in year 1 between 400 additional units of constant capital and 100 additional units of variable capital. The new volumes of 4400 constant capital and 1100 variable capital in year 2 show that the organic composition of capital, the proportion between constant and variable capital, is maintained at a 4:1 ratio. By also maintaining the composition of capital in Department II at its original 2:1 ratio a new position of balance between the two departments is established.

A first step in the introduction of Kalecki's model to the reproduction schema is to show explicitly how the elements of surplus value are allocated. Table 2 distinguishes between capitalists' consumption ( $u_i$ ), incremental changes in constant capital ( $dC_i$ ) and changes in variable capital ( $dV_i$ ). In Department I, for example, the half of surplus value that capitalists do not invest is allocated to 500 units of their personal consumption. Capitalists consume 1100 units in total.

**Table 2 The Allocation of Surplus Value in the Two-Sector Scheme**

Year 1	$C_i$	$V_i$	$S_i$			$X_i$
			$u_i$	$dC_i$	$dV_i$	
Dept. I	4000	1000	500	400	100	6000
Dept. II	1500	750	600	100	50	3000
	5500	1750	1100	500	150	9000

Following Kalecki (1968, p. 459), the reproduction scheme can be further disaggregated by dividing the activity of Department II, producing consumption goods, into a new Department 2 producing capitalists' consumption goods and a Department 3 producing wage-goods. The numbers in Table 3 provide an illustration of how Marx's scheme could be looked at from Kalecki's perspective. Note that with Department 2 producing 1100 units of capitalists' consumption goods, and Department 3 producing 1900 of wage goods, the combined total output of 3000 units is the same as the original output of Department II in Marx's scheme. Similarly, Department 1 produces exactly the same output (6000 units) as Department I in the original scheme. Table 3 can be seen as a decomposition of Marx's scheme to provide a more detailed analysis of the structure of consumption.

**Table 3 *Ex Ante* Three-Sector Reproduction Scheme**

Year 1	$C_i$	$V_i$	$S_i$			$X_i$
			$u_i$	$dC_i$	$dV_i$	
Dept. 1	4000	1000	500	400	100	6000
Dept. 2	550	275	220	$36\frac{2}{3}$	$18\frac{1}{3}$	1100
Dept. 3	950	475	380	$63\frac{1}{3}$	$31\frac{2}{3}$	1900
	5500	1750	1100	500	150	9000

The reproduction schemes shown thus far can be characterised as showing the *ex ante*<sup>2</sup> production of year 1 (see Desai 1979, p.149; Reuten 1998, p. 225). At the start of the year capitalists use 5500 units of constant capital in total and produce 6000 units of output of constant capital. There is an *ex ante* imbalance between these two quantities, and also between quantities of consumption goods produced and consumed. In order to ensure *ex post* balance, at the end of year 1, the additional units of constant ( $dC_i$ ) and variable ( $dV_i$ ) capital set aside for future production can be grouped together with the *ex ante* volumes of capital consumed at the start of the period (Table 4). Department 1, for example, has constant capital of 4400 units of constant capital at the end of the period, made up of the original 4000 consumed and the additional 400 required for production in the next period. Similarly variable capital is now 1100 units, made up of the original 1000 units and the new 100 inputs of variable capital. The new *ex post* categories of constant and variable capital are referred to in Table 4 as  $C_i^*$  and  $V_i^*$  respectively.

**Table 4 *Ex Post* Three-Sector Reproduction Scheme**

Year 1	$C_i^*$	$V_i^*$	$u_i$	$X_i$
Dept. 1	4400	1100	500	6000
Dept. 2	$586\frac{2}{3}$	$293\frac{1}{3}$	220	1100
Dept. 3	$1013\frac{1}{3}$	$506\frac{2}{3}$	380	1900
	6000	1900	1100	9000

A final rearrangement of the categories in Marx's numerical scheme can be achieved by introducing a different way of looking at profits. For Marx, profits in each department are specified as the surplus value left after accounting for *ex ante* inputs of constant and variable capital ( $S_i = X_i - C_i - V_i$ ). However, for Kalecki profits in each department ( $P_i^*$ ) are the total value left after accounting for *ex post* variable capital ( $P_i^* = X_i - V_i^*$ ). Kalecki is concerned with gross undistributed profits, a definition of profits that can be applied to the reproduction scheme by simply adding the constant capital components of Table 4 to the components for capitalists' consumption. In Department 1, for example, 4400 units of constant capital are added to 500 units of capitalists' consumption, resulting in 4900 of gross profits. This result is shown in Table 5, which gives a numerical demonstration of Kalecki's categories of wages ( $V_i^*$ ) and profits ( $P_i^*$ ). (The full algebraic structure of the three-sector schema is laid out in the Appendix.)

**Table 5 Kalecki's Interpretation of the Three-Sector Scheme**

Year 1	$V_i^*$	$P_i^*$	$X_i$
Dept. 1	1100	4900	6000
Dept. 2	$293 \frac{1}{3}$	$806 \frac{2}{3}$	1100
Dept. 3	$506 \frac{2}{3}$	$1393 \frac{1}{3}$	1900
	1900	7100	9000

Having reformulated Marx's categories and rearranged the reproduction scheme, along the lines suggested by Kalecki, a key result is established. Table 5 shows that Department 3 produces a surplus of  $1393 \frac{1}{3}$  wage goods, and these are sold to workers in the other two departments ( $1393 \frac{1}{3} = 1100 + 293 \frac{1}{3}$ ). Expressing this identity in algebraic terms:

$$P_3^* = V_1^* + V_2^* \quad (1)$$

Following Kalecki (1968, p. 460), adding  $P_1^* + P_2^*$  to both sides of equation (1) yields:

$$P_1^* + P_2^* + P_3^* = P_1^* + V_1^* + P_2^* + V_2^* \quad (2)$$

and hence:

$$P^* = X_1 + X_2 \quad (3)$$

This is an *ex post* identity between total profits ( $P^*$ ) and the economy's output of capital goods ( $X_1$ ) and capitalists' consumption goods ( $X_2$ ). Kalecki poses the key question as to how we should interpret this identity. Are expenditures upon capital goods and capitalists' consumption goods determined by profits, or are profits determined by these expenditures? He argues that 'capitalists can decide how much they will invest and consume next year, but they cannot decide how much they shall sell and profit' (Kalecki 1968, p. 461). It is the money expenditures by capitalists upon consumption and investment that generate the resultant volume of profits.

Cartelier (1996, p. 217) has linked this so-called 'Kalecki Principle', that capitalists earn what they spend, to the circulation of money. 'As a result of their ability to initiate circulation entrepreneurs, as a whole, more or less have the power to determine their income.' Moreover, he argues that '...the Kalecki Principle does not contradict the Classical view which makes profit equal to the value of surplus'.

Key passages in Marx's writings that demonstrate the role of the Kalecki Principle in relation to the circulation of money are in Chapter 17 of *Capital Volume II* (see Sardoni 1989, p. 211). Starting with the case of simple reproduction Marx considers the circulation of money using the example of an individual capitalist. 'During the first year he advances a money capital of £5,000, let us say, in payment for means of production (£4,000) and for labour-power (£1,000).' (Marx 1978, p. 409) At a 100 per cent rate of surplus value it can be assumed that £1,000 of surplus-value is appropriated. The problem is that the capitalist advances £5,000, which can be referred to as  $M$ , but receives back £6,000, the realised amount  $M'$ . Focussing upon the difference between the two amounts ( $M' - M$ ) Marx poses the question, 'where does this money come from?' (*ibid.*, p. 407).

The simple answer to this question is that the extra money is provided by the unproductive personal expenditure of the capitalist. The capitalist consumes the same £1,000 as the volume of surplus value. This '£1,000 is converted into money with the money that he threw into circulation not as capitalist, but as consumer, i.e. did not advance, but actually spent' (*ibid.*, p. 410). Moreover, this consumption is

financed out of the capitalist's own money hoard: it 'means nothing more than that he has to cover his individual consumption for the first year out of his own pocket...' (*ibid.*, p. 409).

Marx generalises this key role for unproductive expenditure to the capitalist class as a whole:

'It was assumed in this case that the sum of money that the capitalist casts into circulation to cover his individual consumption until the first reflux of his capital is exactly equal to the surplus-value that he produces and hence has to convert into money. This is obviously an arbitrary assumption in relation to the individual capitalist. But it must be correct for the capitalist class as a whole, on the assumption of simple reproduction. It simply expresses the same thing as this assumption implies, namely that the entire surplus-value is unproductively consumed...' (*ibid.*, p. 410).

Since there is no expansion of the capital stock under simple reproduction, all surplus value is directed to unproductive expenditure, but at the same time capitalists enable this mass of surplus value to be realised by financing unproductive expenditure out of money hoards.

The case of expanded reproduction, as considered in Tables 1 to 5 above, 'does not offer any new problems with respect to money circulation' (*ibid.*, p. 418). The difference is that part of the additional money cast into circulation ( $M' - M$ ) now consists of money capital advanced for productive purposes. (The other part consists of the money cast into circulation for purposes of unproductive expenditure by capitalists, as before in the case of simple reproduction.) 'As far as the additional money capital is concerned, that required for the function of the increased productive capital, this is supplied by the portion of realised surplus-value that is cast into circulation by the capitalists as money capital, instead of as the money form of revenue.' (*ibid.*, p. 418) Under expanded reproduction, surplus value is clearly realised by capital investment and capitalists' consumption. Hence for Sardoni (1989, p. 214): 'Capitalists' profits therefore now depend on their consumption and investment expenditure, just as in Kalecki's analysis.' There is strong evidence for the Kalecki Principle, that capitalists earn what they spend, operating in Marx's analysis of expanded reproduction.

The problem, however, as we have seen in the above manipulations of the reproduction schema, is that Kalecki's demonstration (of the Kalecki Principle) requires a gross definition of profits that is different from Marx's category of surplus value. The Kalecki Principle has not been precisely demonstrated in the context of Marx's reproduction schema, in which surplus value is the key category of analysis. To apply the Kalecki Principle directly to Marx's schema, attention can be focussed on an important difference between Marx and Kalecki about the way in which investment is specified. Whereas for Kalecki investment is associated specifically with capital-goods produced by the capital-goods producing department, for Marx, as shown in the above example, investment (accumulation) is directed to both constant and variable capital-goods – goods produced by both the capital- and wage-goods producing departments. Although Sardoni (1989, p. 211) mentions these different specifications of investment in his comparison of Marx and Kalecki, he does not highlight their importance. To demonstrate the importance of this difference, the next part of the paper will use Leontief's input-output framework to model the final demand of each department of production, such that investment demand cuts across departments. This application of the Leontief framework represents a particular interpretation of the reproduction

schema that allows Marx's categories to be retained alongside the Kalecki Principle.

### 3 The Kalecki Principle in an Input-Output Framework

A Leontief input-output table can be constructed by re-expressing the elements of Marx's numerical reproduction schema. Table 6(a) is a numerical representation of the three-sector reproduction scheme considered previously in Tables 3 to 5. Elements of this table can be read along the rows as outputs of a particular sector, or column-wise as inputs to that sector.<sup>3</sup> For example, Department 3 produces outputs of 1000 in wage goods for Department 1, 275 for Department 2 and 475 for itself. Reading column-wise, Department 3 uses inputs of 950 in constant capital from Department 1 and 475 inputs of wage goods from itself. On this interpretation the surplus value elements ( $S_i$ ) are viewed as inputs of value added to each department. Final demand is made up of the total amounts of new investment in constant capital ( $dC$ ) and variable capital ( $dV$ ), and the total personal consumption of capitalists ( $u$ ).<sup>4</sup> Taking these elements of the table into account, inputs and outputs are balanced for each department, with the column sums equal to the row sums ( $X_i$ ).

**Table 6 Marx's Reproduction Scheme as an Input-Output Table**

**(a) Numerical Representation**

Year 1	Dept.1	Dept.2	Dept.3	$S$			$X_i$
				$dC$	$dV$	$u$	
Dept. 1	4000	550	950	500			6000
Dept. 2						1100	1100
Dept. 3	1000	275	475		150		1900
$S_i$	1000	275	475				
$X_i$	6000	1100	1900				9000

**(b) Algebraic Representation**

Year 1	Dept. 1	Dept. 2	Dept. 3				
Dept.1	$a_{11}X_1$	$a_{12}X_2$	$a_{13}X_3$	$dC$			$X_1$
Dept.2						$u$	$X_2$
Dept.3	$h_3l_1X_1$	$h_3l_2X_2$	$h_3l_3X_3$		$dV$		$X_3$
	$S_1$	$S_2$	$S_3$				
	$X_1$	$X_2$	$X_3$				

To proceed from an input-output table to a model of input-output relations requires the specification of fixed coefficients. Technical coefficients  $a_{ij} = T_{ij}/X_j$  define the ratio between total flows of materials of production ( $T_{ij}$ ), from Department  $i$  to Department  $j$ , to gross output ( $X_j$ ) of Department  $j$ . Similarly, labour coefficients  $l_j = L_j/X_j$  define the ratio to gross output of the

total number of labour units employed in each sector ( $L_j$ ). Consumption coefficients  $h_i = C_i/L$  can be specified as the ratio to total labour employed ( $L$ ) of the amount consumed by workers ( $C_i$ ) of goods produced in Department  $i$ .

Using these coefficients an algebraic representation of the input-output table is displayed in Table 6(b). The relationship between the algebraic and numerical parts of the table can be explained by noting that:

$$a_{11} = \frac{4000}{6000} = \frac{2}{3}, \quad a_{12} = \frac{550}{1100} = \frac{1}{2}, \quad a_{13} = \frac{950}{1900} = \frac{1}{2},$$

$$l_1 = \frac{2000}{6000} = \frac{1}{3}, \quad l_2 = \frac{550}{1100} = \frac{1}{2}, \quad l_3 = \frac{950}{1900} = \frac{1}{2},$$

$$L = 2000 + 550 + 950 = 3500, \text{ and}$$

$$h_3 = \frac{1750}{3500} = \frac{1}{2}.$$

To calculate  $a_{12}X_2$  flows of capital goods between Departments 1 and 2, for example, we have  $\frac{1}{2} \times 1100 = 550$ . And similarly, the flow of wage goods  $h_3l_2X_2$  consumed by workers in Department 2 is calculated as  $\frac{1}{2} \times \frac{1}{2} \times 1100 = 275$ .

An input-output model of Table 6, closed with respect to households, takes the form:

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ h_3 \end{bmatrix} [l_1 \quad l_2 \quad l_3] \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} dC \\ u \\ dV \end{bmatrix} \quad (4)$$

or

$$X = AX + h l X + F \quad (5)$$

where  $X$  is the column vector of gross outputs for each sector,  $A$  is the square matrix of inter-industry technical coefficients,  $h$  is the column vector of worker consumption coefficients,  $l$  is the row vector of labour coefficients, and  $F$  is a column vector representing final demand.

To simplify this model, we can now define  $Y$  as a column vector of final outputs for each sector, such that  $X = AX + Y$ , and therefore

$$X = (I - A)^{-1} Y \quad (6)$$

By taking  $AX$  to the left-hand side of (5) and substituting (6) it follows that:

$$Y = h v Y + F \quad (7)$$

where  $v = l(I - A)^{-1}$  is a row vector of vertically integrated labour value coefficients of the type specified by Pasinetti (1981) and Morishima (1973).

Now by pre-multiplying (7) by the vector  $v$  such that

$$vY = vhvY + vF \quad (8)$$

and re-arranging, we have:

$$vY = \frac{1}{1 - vh} vF \quad (9)$$

This is an employment multiplier relationship, showing the relationship between final demand ( $F$ ) and total employment of labour power ( $vY$ ).

It follows that the value of labour power is represented in the denominator of this employment multiplier by  $vh$ , the labour required to produce the amount of wage goods consumed by each unit of labour. This term consists of the consumption coefficients  $h$  pre-multiplied by  $v = l(I - A)^{-1}$ , the vector of labour values. With  $vh$  interpreted to be the per capita value of labour power then  $1 - vh$  represents the corresponding per capita share of surplus value  $e$ , the amount of surplus value extracted for each unit of labour.<sup>5</sup>

Since in Marx's reproduction scheme  $v = i'$ <sup>6</sup> it follows that (9) is identical to the income multiplier relationship:

$$y = \frac{1}{e} f \quad (10)$$

where  $y = i'Y$  represents total net income and  $f = i'F$  is total final demand. This is a macroeconomic multiplier relationship, which closely resembles the Keynesian multiplier reported in Trigg (2001). Whereas the latter assumed a one-good economy, however, equation (10) is derived from multisectoral foundations.

With total final demand ( $f = u + dC + dV$ ) made up of investment ( $I_v = dC + dV$ ) and capitalist consumption ( $u$ ), equation (10) can be re-expressed as the identity:

$$S = u + I_v \quad (11)$$

or

Surplus Value = Capitalist Consumption + Investment

where  $S = ey$  represents the total volume of surplus value produced in the economy.<sup>7</sup> Equation (11) provides an alternative way of representing the Kalecki Principle in Marx's reproduction scheme. Instead of examining the determinants of gross undistributed profits, as in Kalecki's equation (3), an alternative *ex post* identity based on the input-output model is derived in which profits (surplus value) are set equal to investment plus capitalist consumption. The Kalecki Principle, that capitalists earn what they spend, can be applied to equation (11), with capitalist spending on capitalist consumption and investment in constant *and* variable capital determining the total volume of surplus value. In contrast to the Kalecki formulation there is a clear role for Marx's theory of surplus value. Capitalists cast money into circulation for expenditures in capitalist consumption and investment that are realised as surplus value.

#### 4 Conclusions

This paper examines the relationship between Kalecki's macroeconomics and Marx's reproduction schema. With Marx's two-department schema re-cast in a three-department framework, the role of capitalists' personal consumption can be

shown explicitly; and by also interpreting Marx's numerical examples as *ex post* schema, Kalecki's macroeconomic identity can be established between profits and capitalist expenditures on investment and consumption. This result enables the Kalecki Principle, that capitalists earn what they spend, to be directly established in the context of Marx's original reproduction tables.

The problem with Kalecki's interpretation, from a Marxian point of view, is that it obscures the role of surplus value in the reproduction schema. An alternative way of identifying the role of the Kalecki Principle is provided by Leontief's input-output framework. With Marx's wider definition of investment including increments in constant and variable capital, and by specifying the role of surplus value in the input-output multiplier, an alternative identity between profits and capitalist expenditures is established. This identity enables the Kalecki Principle to be represented in the reproduction schema whilst at the same time maintaining the role of surplus value in Marx's system. Capitalists can be argued to cast money into circulation for expenditures in investment and personal consumption, which enable the production and realisation of surplus value. Kalecki's macroeconomics can be seen as a way of developing our understanding of Marx's reproduction schema and their relationship to the circulation of money, without necessarily compromising the role of Marx's value categories.

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## Notes

1 By taking Marx's schema as the starting point, two key assumptions in Kalecki's reproduction schema are not retained in this analysis. First, as Lee (1998) has argued, Kalecki has a Burchardt production model in which each department is vertically integrated, producing its own raw materials. In contrast, Marx assumes that raw materials are a part of constant capital, produced in the first department and circulated to other departments. Second, Sardoni (1989) argues that for Marx capitalists operate at full capacity, in contrast to the Kalecki reproduction schema.

2 The expression *ex ante* should not be confused here with Kalecki's (1936) consideration of capitalists' investment decisions. In relation to the reproduction schema, *ex ante* refers specifically to the imbalance between row and column sums at the start of the production period.

3 There has been some concern in Marxian circles that the input-output approach imposes physical units of account upon Marx's categories of labour and money (see Moseley 1998). It should be noted, as stated in Section 2, that the only units of account considered here are money and labour units, and these are assumed to be equivalent. This demonstrates that the input-output approach can provide an improved understanding of Marx's reproduction schema without imposing a physical unit of account.

4 Each of these terms represents an aggregation of elements across departments, such that  $dC = dC_1 + dC_2 + dC_3$ ,  $dV = dV_1 + dV_2 + dV_3$  and  $u = u_1 + u_2 + u_3$ .

5 This interpretation of the multiplier, developed here in relation to the three-department model, has been established in relation to the two-department model (Dixon 1988), the one-good Keynesian multiplier (Trigg 2001), and the multisector input-output framework (Olgin 1992).

6 Since there is an assumed equivalence between money and labour units, the amount of direct labour power employed is equal to the total net income of the economy:  $L = vY = i'Y = y$ . To prove that  $v = i'$  in our numerical example:

$$v = l(I - A)^{-1} = \begin{bmatrix} 1/3 & 1/2 & 1/2 \end{bmatrix} \begin{bmatrix} 3 & 3/2 & 3/2 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$$

7 In terms of the numerical example,  $e = 1 - vh = 1 - h_3 = 1 - 1/2 = 1/2$  and total net income is equal to  $y = L = 3500$ . It follows that the total volume of surplus value (see Tables 1 and 6) is calculated by the equation:  $S = ey = 1/2 \times 3500 = 1750$ .

### Appendix: The Structure of the Three-Sector Reproduction Schema

The three-sector reproduction schema in Tables 3 to 5 can be displayed algebraically, showing more precisely the way in which Kalecki's interpretation is derived from Marx's numerical example. Starting with Marx's *ex ante* scheme, as represented in Table 3, there are three balancing equations:

$$\begin{aligned} C_1 + V_1 + u_1 + dC_1 + dV_1 &= X_1 \\ C_2 + V_2 + u_2 + dC_2 + dV_2 &= X_2 \\ C_3 + V_3 + u_3 + dC_3 + dV_3 &= X_3 \end{aligned} \quad (\text{A1})$$

Table 4, the *ex post* scheme, involves a simple re-arrangement of the elements of each equation such that:

$$\begin{aligned} (C_1 + dC_1) + (V_1 + dV_1) + u_1 &= X_1 \\ (C_2 + dC_2) + (V_2 + dV_2) + u_2 &= X_2 \\ (C_3 + dC_3) + (V_3 + dV_3) + u_3 &= X_3 \end{aligned} \quad (\text{A2})$$

In Kalecki's interpretation (Table 5) the equation terms are then grouped according to categories of wages ( $W_i^*$ ) and profits ( $P_i^*$ ):

$$\begin{aligned} (V_1 + dV_1) + (C_1 + dC_1 + u_1) &= X_1 \\ (V_2 + dV_2) + (C_2 + dC_2 + u_2) &= X_2 \\ (V_3 + dV_3) + (C_3 + dC_3 + u_3) &= X_3 \end{aligned} \quad (\text{A3})$$

where  $W_i^* = V_i + dV_i$  and  $P_i^* = C_i + dC_i + u_i$ .

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