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# Joan Robinson's intelligible Marxism and *The Accumulation of Capital*: a generalisation of the two-sector reproduction scheme

Andrew B. Trigg\*

Joan Robinson sought to make Marx's economics intelligible to both academic colleagues and followers of Marx, in a twofold approach. First, she adopted Kalecki's antipathy to the labour theory of value and his insights (following Rosa Luxemburg) into realisation problems in the schemes of reproduction; second, following Sraffa's reading of Ricardo, she recognised the importance of surplus production as an alternative to neoclassical theory: both culminating in a stripped down two-sector scheme her mature work, *The Accumulation of Capital*. This scheme is recast here as an input–output framework, providing a generalisation that addresses some of its limitations: the need for an interface with the Kahn/Keynes employment multiplier, the absence of circulating capital inputs, and the lack of a systematic treatment of prices. Furthermore, a somewhat surprising result is the derivation of a core role for Marx's category of surplus value in the employment multiplier derived from Robinson's system.

*Key words:* Joan Robinson, Kalecki, Employment multiplier, Reproduction scheme, Input–output

*JEL classifications:* B24, E11, E12

## 1. Introduction

Though steeped in the traditions of Marshall and Keynes in Cambridge, England, Joan Robinson's economics received something of a jolt from two important refugees of European fascism. In the 1930s, she was inspired by Michal Kalecki to adopt Marx's schemes of reproduction, as influenced by Rosa Luxemburg's insights into the demand-side realisation of surplus profits. In the 1950s, Piero Sraffa's introduction to Ricardo's *Collected Works* led her to realise the key importance of surplus-based production, as the basis for developing an alternative to neoclassical production theory. This two-fold perspective culminated in the development of a skeletal two-sector reproduction

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*Address for correspondence:* Professor of Economics, Social Sciences and Global Studies FASS, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK; email: [Andrew.Trigg@open.ac.uk](mailto:Andrew.Trigg@open.ac.uk)

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scheme in her mature work, *The Accumulation of Capital* (1956). Looking back on these influences, she wrote: ‘With the light that Sraffa has thrown on the theory of value and Kalecki on the process of realisation of the surplus, we can develop a complete system, not of *neo* Marxism but of *intelligible* Marxism, and, what is more important, adapt it to the analysis of contemporary problems of capitalism, socialism and “development”’ (Robinson, 1979F, p. 253, original emphasis).

As lamented by Pasinetti (2007), this system was never completed in her lifetime and remains underdeveloped. The contribution of this paper is to advance this unfinished theoretical project by addressing three limitations associated with the Robinson’s two-sector model. First, though Robinson’s objective in *Accumulation of Capital* was to generalise Keynes’s *General Theory* (see Marcuzzo, 2003), it is unclear how the two-sector model relates to the Kahn–Keynes employment multiplier: a key analytical tool for modelling effective demand. Second, as embraced in the post-Sraffa literature on production, a ‘brute fact about modern industrial economies’ is the importance of input–output relations between sectors; yet, following Kalecki, Robinson’s sectors are vertically integrated, producing their own inputs (Steedman, 1992, p. 134). Finally, in focussing on quantities of production, there is no systematic treatment of prices in Robinson’s two-sector model: a lacuna that is begging to be filled by Sraffa’s multisectoral price system (Sraffa, 1960).

Section 2 will review Joan Robinson’s intelligible Marxism, showing how the influences of Kalecki and Sraffa culminated in her two-sector system, together with a discussion of its limitations. In Section 3, these limitations are addressed by re-formulating the two-sector model into an input–output framework. Partly in sync with Robinson’s reading of Marx, and partly in contradistinction, a macroeconomic role for the category of surplus value will be identified in this system. A summary of conclusions is provided in Section 4.

## 2. Robinson’s intelligible Marxism

When Joan Robinson first met Michal Kalecki, in 1936, ‘there appears to have been a meeting of minds’ (Asimakopulos, 1989, p. 10). Though already open to the discovery of alternative foundations to (and escape from) her orthodox Marshallian roots in Cambridge, it was Kalecki who initiated a step change in Robinson’s approach. According to Geoff Harcourt, she came to two important conclusions: first, that Kalecki had ‘independently discovered the principal propositions of *The General Theory*’ in a way that was superior to that of Keynes (Harcourt, 2012, p. 226); and second that this discovery came from Kalecki’s reading of Marx.

Though Keynes was supportive of Kalecki, he was ‘prejudiced’ against his Marxist background (Pasinetti, 2007, p. 106). Toporowski (2013, p. 141) refers to the ‘incompatible personal chemistry of the two men, the one an urbane, “moderately conservative”, upper class Englishman, the other a Polish Jew of pronounced left-wing and Marxist sympathies, who was as socially awkward as he was confident in his views’. The more dissident Joan Robinson, however, was inspired to read Marx in detail, in the early part of the Second World War (1940–41), culminating in her *Essay on Marxian Economics*, first published in 1942.

Following in Kalecki’s slipstream, Robinson read Marx in a particular way. Kalecki’s approach, as reported by Sawyer (1985, p. 148), did not focus on ‘questions such as what Marx really meant?’ Robinson also did not feel it was necessary—as many Marxists do—to repeat Marx’s propositions using lengthy quotations. Lippi (1999,

p. 101) emphasises 'the contrast between her way of reading Marx and all the versions in which the complexity of the original text is kept, if not increased rather than dissolved into a sequence of clear statements'. She wanted to persuade her academic colleagues in the economics profession that there were serious ideas to be found in Marx's economics, and to do this she attempted a translation of these ideas into clear and modern economic language—a project that would also help followers of Marx to better understand his ideas (Kerr, 2007).

Reading Marx in this way, Robinson did not see any merit in accepting all of Marx's propositions. In particular, echoing Kalecki's approach, she did not adopt the labour theory of value. With respect to Kalecki, Bellofiore (2022, p. 97) states that value theory 'does not play any role in his argument'; although it should be noted that for Kerr (1997, p. 37) Kalecki's theory of pricing might be 'compatible with Marx's theory of value'. We do not know whether Kalecki revealed in conversation with Robinson what Brus (1977, p. 59) reported as Kalecki's 'strong distaste for the Marxian theory of value, which he considered metaphysical and (if I am not mistaken) never wanted to discuss'.

In the *Essay*, Robinson regarded the proportionality between value and prices, posited by Marx in the first volume of *Capital* (Marx, 1976), to be dogmatic: 'What is the relationship of *value* to price? At first Marx states dogmatically that commodities tend to exchange at prices which correspond to their values...' (Robinson, 1963, p. 14, original emphasis). Once Marx moves, in the third volume of *Capital*, to a consideration of a more realistic capitalist system in which capital can move freely between sectors, ensuring a tendency to uniformity in the rate of profit, then prices deviate from values (Marx, 1981). The transformation problem thus homes into view: 'According to Marx's own argument, the labour theory of value fails to provide a theory of prices' (Robinson, 1963, p. 17). The conundrum is summed up later in *Economic Philosophy* (Robinson, 1962, p. 38, original emphasis):

If we define *value* as the labour-time required to produce a commodity, and then advance the proposition that commodities normally exchange at prices proportional to their *values* in this sense, then we have reduced it from a metaphysical statement to a hypothesis. But it is a hypothesis that it would be a waste of time to test, for we know in advance, and Marx also knows, that it is not accurate.

Thus, for Robinson Marx's value theory is both dogmatic and metaphysical. It is also an unnecessary detour. She writes: 'none of the important ideas which he expresses in terms of the concept of value cannot be better expressed without it' (Robinson, 1963, p. 20).

This critique of value theory focuses at a microeconomic level of analysis on the role of Marx's values in the determination of prices. At the macroeconomic level, however, Robinson is more open to Marx's concepts. For Baragar (2003, p. 470), Robinson concurs with Marx that exploitation is more important at the aggregate level than in relation to relative prices: 'concepts such as the value of labour power and surplus value are macro concepts not micro ones, and Robinson rightly reminds us that the rate of exploitation is meaningful only at an aggregate social level, and not at the level of the individual firm or individual worker'.

Robinson's usual approach is to model aggregate exploitation using money prices of production (see, e.g. Bhaduri and Robinson, 1980; Robinson 1980A, 1980C). However, in Robinson (1979C), she does employ units of labour time. To do this the

wage bill and input costs are subtracted from proceeds in order to derive net profits, which are then translated into labour units: ‘Normalising by putting a unit of *value* (a quantity of labour time) equal to a unit of money proceeds we can then find the flow of *surplus value* per man employed’ (Robinson, 1979C, p. 693, original emphasis).

Following Kalecki, Robinson’s macroeconomic interpretation of Marx also incorporates his schemes of reproduction under which industrial activities are pooled into aggregate sectors which can be traced back to the influence on Kalecki of Rosa Luxemburg, whose ‘unorthodox’ adaptation of the schemes highlights the importance of demand constraints (Toporowski, 2013, p. 43). Instead of Kalecki’s three-sector scheme, however, Robinson goes back to Marx’s more rudimentary two-sector system (Marx, 1978). In the *Essay*, she states that ‘Marx devised a simple and penetrating argument’ in which he ‘divides total output in to two groups—capital goods and consumption goods’ (Robinson, 1963, p. 44). Even under the static case of simple reproduction it is not guaranteed that the outputs of the capital and consumption good producing sectors will be met by demand. At this macroeconomic level, Robinson no longer sees Marx’s approach as an irrelevant detour; instead, hints of an embryonic theory of effective demand are identified in Marx’s unfinished notes in the second volume of *Capital*.

This adoption of a two-sector reproduction scheme provides the cornerstone of Robinson’s mature work, *The Accumulation of Capital* (Robinson, 1956). In addition to attempting a generalisation of Keynes’s *General Theory*, to incorporate accumulation and growth, this two-sector scheme is also inspired by another source of influence: Sraffa’s introduction to Ricardo’s *Principles* (Ricardo, 1951). As shown by Marcuzzo (2003), Robinson gleans from Sraffa a key role for wage goods in the production of economic surplus—as exemplified in her essay, *On Re-Reading Marx* (Robinson, 1953). Under Sraffa’s interpretation of Ricardo, the wage good is represented by corn, which also happens to be a capital good; hence, the surplus is generated by the ‘difference between total output and capital advanced’ (Sraffa, 1951, p. xxxi).

The production of surplus wage goods can be identified in the skeletal two-sector model developed in Chapter 8 of *Accumulation of Capital*. The model is based on simplifying assumptions that ‘pare off all complications and allow us to examine the mere essence of the capitalist rules of the game’ (Robinson, 1956, p. 73). There is only one technique of production, with sector 1 producing capital (investment) goods and sector 2 producing consumption goods. Following the same heuristic approach as in Kalecki’s interpretation of the reproduction schemes (see, e.g. Kalecki, 1991B, p. 459), the output of capital goods constitutes gross investment: which are ‘added to the stock of capital or replace items that have reached the end of their useful life’ (Robinson, 1956, p. 74).

For Robinson (1956, p. 75, f1), all production is ‘divided into two sectors, investment and consumption...’, broad aggregates of industries producing types of investment goods or types of consumption goods. In addition, there are two income groups (capitalists and workers), with zero capitalist consumption and zero savings on the part of workers. Under Robinson’s notation, the wage bill in sector 1 is represented by  $W_1$ , the wage bill in sector 2 by  $W_2$ , and the quasi-rent (profit) made from the sale of consumption goods in sector 2 is represented by  $Q$  (Robinson, 1956, p. 75). Crucially, the source of this profit is provided by the surplus of consumption not required for consumption by workers employed in sector 2. In order to employ workers in the production of capital goods, as purchased with the wage bill ( $W_1$ ), there must be a matching available surplus of consumption goods ( $Q$ ) to feed them.

She presents a simple example where: 'wages bill in investment sector: 100; wages bill in consumption sector: 200. Value of sales of consumption goods: 300. Quasi-rent in consumption sector: 100' (Robinson, 1956, p. 75). The 100 profits in the consumption goods sector are generated by the surplus of 100 consumption goods sold to the investment sector, and consumed from the investment sector's wage bill. The process is more indirect than in the corn model, with capital produced in a different sector than that producing consumption goods, but surplus consumption goods are still the basis for accumulation of capital.

The flip side of this surplus-based argument (implicitly following Kalecki and Luxemburg) is a consideration of the two-sector model from a demand-side perspective. 'The relation between profits and accumulation is two-sided' (Robinson, 1956, p. 76). For the surplus consumption goods (produced in sector 2) to be sold there has to be sufficient investment in the capital goods sector in the employment of capital-goods producing workers. The realisation of the surplus ( $Q$ ) depends on exogenous investment in the employment of workers producing capital goods ( $W_1$ ). As summarised by Robinson (1956, p. 76):

For profit to be obtainable there must be a surplus of output per worker over the consumption per worker's family necessary to keep the labour force in being. But the existence of a potential technical surplus is not a sufficient condition for profits to be realised. It is also necessary that entrepreneurs should be carrying out investment.

This two-sided approach is emphasised in Robinson's discussions with her colleague at Cambridge, Maurice Dobb, who sought to defend Marx's ideas. As reported by Bellofiore (2014, p. 91), Dobb 'seems to suggest that exploitation could somehow exist independently of realisation, and accuse the post-Keynesian of regarding realisation as independent of exploitation, but, obviously neither can exist without the "other"' (Robinson, 1975, p. 122).

The two-sector system (rooted in Marx's reproduction schemes) is, of course, only a foundational starting point for Robinson's extensive and path breaking treatment of accumulation and economic growth; and, more widely, 'these schemes, with the necessary corrections and elaborations, are the basis of all modern theories of economic growth' (Robinson, 1979A, p. 28). Our focus here is on some of the limitations of these rudimentary foundations, as a basis for further generalisation of the system. The first limitation is that a direct link is not made between the two-sector scheme and the multiplier: an important building block (first formulated by Kahn (1931) as an employment multiplier) in the *General Theory* (Keynes, 1936). As reported by Robinson (1979E, p. 169), once Kahn 'worked out the theory of the multiplier in a more coherent manner' he helped persuade Keynes to reflect on his earlier policy explorations and conclude that 'employment was after all the central point'. However, it is not until chapter 21 of *Accumulation of Capital* that the employment multiplier is considered, representing 'the ratio of the total increase in employment to the increase in the investment sector' (Robinson, 1956, p. 205). Though Robinson does discuss this multiplier in relation to her two sectors (pp. 205–206), how its structure directly relates to the two-sector scheme is not clear. Bhaduri (1996) attempts to address this issue by specifying an employment multiplier ratio in terms of the proportion between employment in the capital and consumption good sectors. An additional analytical step is required, however, in which employment in the capital goods sector is related to *total* employment, as in the Kahn employment multiplier relationship.



A second limitation is Robinson's implicit assumption, following Kalecki, that each sector is vertically integrated. Steedman (1992) and Lee (1998) point out that each sector in the Kalecki scheme produces its own intermediate inputs, as stated by Kalecki (1991A, p. 96) in his adaptation of Marx's departments of production, 'including in each of them the respective intermediate products'. Though there is a separate sector that produces capital goods there is no treatment of how intermediate inputs are used and circulated in this restrictive production system. This problem is of ever-increasing importance since under Global Value Chains around half of world trade now is estimated to be in intermediates (World Bank, 2020). This modern phenomenon has sparked a burgeoning literature on input–output modelling and international trade (see, e.g. Johnson and Noguera, 2012; Timmer *et al.*, 2014)—a real world development that suggests the importance of incorporating input–output technology into production theory of the Kalecki–Robinson type.

It may be argued, in defence of Kalecki and Robinson either that the vertical integration assumption is permissible for such pioneers, with such embryonic constructions, or that rough approximations are permissible, especially since Kalecki was something of a statistician (see Steedman (1992, p. 127)). The use of vertically integrated sectors can certainly be seen as a heuristic device, which simplifies the presentation of foundational theory. Might the introduction of further complexities, such as input–output interactions, lead to the same conclusions? These remain Questions for Kaleckians, as first raised by Steedman (1992), to be explored rather than assumed. Robinson was certainly open to the input–output method, which she considered to have 'made a very great contribution to knowledge of the structure of various economies' (Robinson, 1979A, p. 29). Its introduction may be considered to be a generalisation and extension of Robinson's system.

Finally, this macroeconomic emphasis on investment and consumption, in *Accumulation of Capital*, leaves open the problem of how to systematically model prices in Robinson's system. Sraffa's price system, formulated in *Production of Commodities by Means of Commodities* (1960) provides a potential contribution to this lacuna, since it is based on the circular flow of capital inputs that is central to the Cambridge critique of orthodox capital theory, in which Robinson was an early contributor. As explained by Martins (2014, p. 55): 'Sraffa, together with Joan Robinson, shows the inconsistencies of the neoclassical production function, which assumes the aggregation of capital and of output'. Instead of seeing the measurement of capital as a technical issue, under Sraffa's approach the valuation of capital depends on the distribution of income. But for Pasinetti (2007, p. 113) 'Piero Sraffa's book appears too late for Joan Robinson to be able to incorporate it into her theoretical framework, and the brave efforts she later made to this effect are not always convincing'. Robinson's system is arguably incomplete with respect to the systematic modelling of prices, an issue that can in principle be addressed using Sraffa's insights. In particular, this involves an adaptation of the input–output method: 'Sraffa's equations describe the technique of production in use in terms of an input–output table' (Robinson, 1979D, p. 285). As also argued by Bhaduri and Robinson (1980, p. 103), a quantity system of the Robinson type can help generalise the 'very narrow basis for constructive analysis' provided by Sraffa's price system.

These three limitations—the absence in Robinson's two-sector system of an employment multiplier, intermediate inputs, and a systematic treatment of prices—will be addressed in the analysis that follows.

3. A two-sector model

Robinson's skeletal two-sector system, with her assumption of zero capitalist consumption and no savings out of wages, can be extended using an input-output system of the Leontief type. Let  $X_i$  represent gross physical output for sector  $i$ ,  $p_i$  money prices, and  $l_i$  labour coefficients. Instead of following Kalecki's assumption that each sector is vertically integrated,  $a_{ij}$  is introduced to capture the physical intermediate inputs required by each sector  $j$  from sector  $i$ . We can let  $i = 1, 2$ , with 1 representing the capital goods sector and 2 representing the consumption goods sector. These are no longer vertically integrated sectors, but sectors that aggregate across industries, on the one hand of different types of industries producing capital goods, and on the other of industries producing consumption goods. The real wage ( $\omega$ ) represents physical worker consumption per unit of labour, and  $r$  is the money rate of profit.

The flows between the two sectors are represented in Table 1. As we have seen, following Robinson (1956), the consumption good sector has to pay its wage bill ( $W_2 = p_2\omega l_2 X_2$ ), but also produces a surplus of consumption goods that are used to feed workers in the capital goods sector, as captured by its wage bill ( $W_1 = p_2\omega l_1 X_1$ ). But, instead of modelling gross investment, as in the Kalecki-Robinson interpretation of the reproduction schemes (see Section 2), the net investment ( $da$ ) in surplus capital goods is identified, that is, net of capital goods used for the reproduction of existing output ( $p_1 a_{11} X_1$  and  $p_1 a_{12} X_2$ ). As shown by Trigg (2006, chapter 3), a translation can be made between Kalecki's gross investment approach and the (more usual) Marxian net investment approach (i.e. consistent with a Leontief representation). The translation here of Robinson's system into a Leontief framework allows a generalisation of its foundations in a way that opens up interfaces with other strands of literature. One such interface concerns the Sraffa treatment of prices.

In order to address the absence in Robinson's two-sector system of a systematic treatment of prices, the money flows in Table 1 can be decomposed into interconnected (dual) price and quantity systems (see Pasinetti, 1977). They each provide an alternative dimension for modelling the same flows represented in Table 1.

A price system can be identified by cancelling out  $X_1$  in the first column of Table 1, and cancelling out  $X_2$  in the second column, to give two price equations:

$$\begin{aligned}
 p_1 &= p_1 a_{11} + p_2 \omega l_1 + p_1 a_{11} r \\
 p_2 &= p_1 a_{12} + p_2 \omega l_2 + p_1 a_{12} r
 \end{aligned}
 \tag{1}$$

Using matrix algebra these two equations can be collected together as

Table 1. Robinsons two-sector scheme as an input-output framework

	Capital goods sector	Consumption goods sector	Investment	Total
Capital goods sector	$p_1 a_{11} X_1$	$p_1 a_{12} X_2$	$p_1 da$	$p_1 X_1$
Consumption goods sector	$p_2 \omega l_1 X_1$	$p_2 \omega l_2 X_2$		$p_2 X_2$
Profits	$p_1 a_{11} X_1 r$	$p_1 a_{12} X_2 r$		
Total	$p_1 X_1$	$p_2 X_2$		



$$[p_1 p_2] = [p_1 p_2] \begin{bmatrix} a_{11} a_{12} \\ 0 \quad 0 \end{bmatrix} (1+r) + [p_1 p_2] \begin{bmatrix} 0 \\ \omega \end{bmatrix} [l_1 l_2] \quad (2)$$

or

$$\mathbf{p} = \mathbf{pA}(1+r) + \mathbf{p}\omega\mathbf{l} \quad (3)$$

This is a Sraffa-type price system in which prices are established under a circular flow of production and an open income distribution between the rate of profit and the real wage. Addressing two of the limitations discussed in [Section 2](#), this recasting of Robinson's two-sector scheme specifies a systematic treatment of prices under input-output technology.

This system could easily be further generalised to model a money wage with multiple sectors (as shown, e.g. in [Bellino, 2022](#), p. 101). It also provides a possible starting point (in future research) for considering Robinson's later dispute with Pierangelo Garegnani, another Cambridge colleague of Marxian sympathies who also contributed to the capital critiques. For [Garegnani \(1989\)](#), Marx's prices of production can be modelled as long period positions under a uniform rate of profit. But for [Robinson \(1979B, 1980B, 1980C\)](#), in her attempt to generalise from Keynes, the long period is highly restrictive, allowing no role for uncertainty and expectations. This dispute, with Sraffa's price system at its core, has implications for what Robinson's intelligible Marxism might look like (see also [Dvoskin and Tabucchi, 2021](#)).

A quantity system can now also be identified by cancelling out  $p_1$  in the first row of [Table 1](#) and  $p_2$  in the second row, to give two quantity equations:

$$\begin{aligned} X_1 &= a_{11}X_1 + a_{12}X_2 + da \\ X_2 &= \omega l_1 X_1 + \omega l_2 X_2 \end{aligned} \quad (4)$$

In matrix form:

$$\begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = \begin{bmatrix} a_{11} a_{12} \\ 0 \quad 0 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 0 \\ \omega \end{bmatrix} [l_1 l_2] \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} da \\ 0 \end{bmatrix} \quad (5)$$

or

$$\mathbf{X} = \mathbf{AX} + \omega\mathbf{lX} + \mathbf{i} \quad (6)$$

[Equation \(6\)](#) is a quantity system that is dual to the price system in [equation \(3\)](#). In contrast to the neoclassical approach, in which quantities and prices are determined simultaneously in a closed demand and supply framework, this is an open system in which the theorist may choose to focus on either prices given quantities or quantities given prices (see [Roncaglia, 1995](#)).

An important quantity relationship can now be established that follows directly from this two-sector model. By manipulation of [equation \(6\)](#), the Leontief inverse  $(\mathbf{I} - \mathbf{A})^{-1}$  can be isolated such that

$$\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1}\omega[\mathbf{lX}] + (\mathbf{I} - \mathbf{A})^{-1}\mathbf{i} \quad (7)$$

Pre-multiplying by the row vector of labour coefficients ( $\mathbf{1}$ ) gives

$$\mathbf{1X} = \mathbf{1}(\mathbf{I} - \mathbf{A})^{-1}\omega[\mathbf{lX}] + \mathbf{1}(\mathbf{I} - \mathbf{A})^{-1}\mathbf{i} \quad (8)$$

We can now, following Pasinetti (1973), specify  $\mathbf{v} = \mathbf{1}(\mathbf{I} - \mathbf{A})^{-1}$  as a row vector of vertically integrated labour coefficients (also referred to by Morishima (1973), in Marxian terminology, as embodied labour values). In addition, since total employment is represented by  $N = \mathbf{IX}$ , equation (8) can be re-expressed as

$$N = \mathbf{v}\omega N + \mathbf{vi} \tag{9}$$

It thus follows that

$$N = \frac{1}{1 - \mathbf{v}\omega} \mathbf{vi} \tag{10}$$

Addressing one of the limitations discussed in Section 2, this is a Kahn-type employment multiplier relationship between ‘primary employment’ and total employment (Kahn, 1931, p. 188). As primary employment, the component  $\mathbf{vi}$  is the direct and indirect labour embodied in net investment (since, from equations (5) to (6),  $\mathbf{vi} = v_1 da$ , this is the labour embodied in net production (investment) of capital goods in sector 1). By deriving this relationship, a clear procedure is established (fully in the spirit of Joan Robinson) for modelling the macroeconomic relationship between autonomous investment and total employment ( $N$ ). This closed economy starting point can easily be generalised to include a more sophisticated treatment of final demand, to include elements such as government spending and international trade.

Furthermore, with the extent of this impact of investment on employment captured by the size of the employment multiplier,  $(1/1 - \mathbf{v}\omega)$ , its structure can be understood as depending on the production of a surplus. Following Trigg (2006), its scalar term  $\mathbf{v}\omega$  can be interpreted in Marxian terms, as capturing the labour embodied, via  $\mathbf{v}$ , in the vector representing worker consumption per unit of labour ( $\omega$ ): the (labour) value of labour power. Hence, the denominator of the multiplier  $(1 - \mathbf{v}\omega)$  captures the amount of surplus value produced per unit of labour. In the spirit of Robinson’s interpretation of exploitation, as considered in Section 2, Marx’s value theory sharply reveals itself here in macroeconomic form, as part of Robinson’s two-sector quantity system. However, far from being an irrelevant detour—as in Robinson’s usual antipathy to Marx’s value categories—surplus value is core to the employment multiplier, derived here directly from Robinson’s system.

This system provides a vehicle for representing Robinson’s two-sided approach, discussed in Section 2. On one side, the economy has to be capable of directing primary employment to the production of surplus investment goods. This can be examined by re-expressing equation (10) as

$$(1 - \mathbf{v}\omega)N = \mathbf{vi} \tag{11}$$

From equation (11) it is clear, in an economy that employs workers ( $N > 0$ ), that for primary employment to be positive ( $\mathbf{vi} > 0$ ) it is necessary that the economy produces positive surplus value ( $\mathbf{v}\omega < 1$ ). This provides a representation of Robinson’s surplus condition on the production of investment goods in the two-sector scheme, but using value categories.

On the other side, the value categories have a role to play in the generation of employment by investment demand. The value of labour power term ( $\mathbf{v}\omega$ ) has a constituent role in the multiplier in equation (10). Once investment takes place, the multiplier impact on employment is inversely related to exploitation: the higher the exploitation (the lower is  $\mathbf{v}\omega$ ), the lower the size of the multiplier. The surplus value category has a

two-sided role in establishing the surplus and in determining the scale of employment generated by investment.

As considered in Section 2, Robinson (1956) uses the two-sector model in *Accumulation of Capital* as a starting point for considering accumulation and growth. For Harcourt and Kerr (2013, p. xiii), ‘Robinson was searching for fundamental and simple principles which underlie the process of growth’. The Leontief variant of this model presented here can be interpreted in the same light; and, in the same spirit as Robinson, a two-sided perspective on growth is made possible, with surplus established here in the form of surplus value, and a demand-side perspective modelled using an employment multiplier. This is not the place to build a full-blown Robinsonian model of growth and accumulation, in which periods of expanded reproduction are simulated with numerical examples, as per Marx, and different types of growth rates and stability conditions are considered. But pointers to this type of analysis, in which the surplus value category is used to model accumulation, can be found in the growth literature; see, for example, Lianos (1979) and Trigg (2006).

#### 4. Conclusions

An approach is therefore proposed which advances Joan Robinson’s intelligible Marxism. Her path breaking contribution, extending Keynes’s *General Theory*, was to strip the two-sector reproduction scheme down to its bare bones, showing how an economic surplus has to be produced and realised in this rudimentary model of capitalist production: as considered here in *Accumulation of Capital*, drawing on the impetus provided by Kalecki and Sraffa. The contribution of this paper is to address some of the limitations in Robinson’s two-sector system, and thus generalise its foundations in order to develop interfaces with other strands of literature. First, Robinson did not make a direct link between her two-sector scheme and the employment multiplier, which was so central to the economic analysis of Keynes. This is addressed by exploring the interface between Robinson’s two-sector scheme and the Kahn/Keynes employment multiplier. Second, the two-sector scheme did not take into account the circulation of intermediate inputs, a limitation that is addressed here by introducing input–output technology. Finally, Robinson did not systematically model prices in *Accumulation*. This is addressed by introducing a Sraffa-type price system that is interconnected (as a dual) to the Robinson-type two-sector quantity system.

Furthermore, using this generalised two-sector system, a core role for the category of surplus value is established in the two-sector employment multiplier, giving a clear and intelligible role for Marx’s value categories in the macroeconomic quantity system. This is argued to be in part consistent with Robinson’s view of Marx, with exploitation seen as a macroeconomic phenomenon; but it also contradicts her more usual antipathy to Marx’s value categories. By providing this synthetic starting point for different strands of Marxist and Keynesian theory, using simple matrix algebra, further generalisation of this two-sector model is possible, across multiple sectors, and with potential for a more sophisticated treatment of economic growth, income distribution and the structure of final demand.

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