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The Status of Marx's Reproduction Schemes: Conventional or Dialectical Logic?

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INTRODUCTION

Marx's *Capital* is an unfinished project, in the narrower sense of the plan for the work with this title, dating from 1862, and even more so in the wider sense of a theory of the interconnection of economy and state and of the development of world capitalism. The evaluation of what is there obviously depends on the method adopted by Marx, but opinions diverge on the interpretation of that method.¹

Some prefer to read Marx in a 'conventional' way, as adopting a method of inquiry in line with formal logic; that is, not different *in principle* from approaches of modern orthodox economics. In this case one has to 'neglect', 'de-emphasize', 'purify it from' some supposedly superfluous jargon of Marx, stemming from his flirtation with an obscure dialectics. One finds such a position held by people ranging from adversaries and sympathetic critics to scholars themselves working in the Marxian tradition. Others see Marx adopting a systematic–dialectical method, in line with – though not necessarily the same as – Hegel's dialectical logic (1812, 1817).² Here most commentators agree that Marx's *Capital* did not reach a full systematic–dialectical presentation and that the work requires reconstruction and further development.³

Both groups can find support for their position in quotations from Marx concerning his relation to Hegel's dialectic, spread out over the course of his writing life. It is useful then to study the texts

of *Capital* and see if these resolve the matter. This is the aim of the case study reported in this paper. However the reader interested in decisive answers only can stop reading here: it will appear that the case presented below is compatible with both positions.

The systematic presentation of Marx's *Capital* is organized in its parts rather than its chapters (eight parts for Book I, three for II and seven for III). The second book of *Capital*, 'The Process of Circulation of Capital' (1885), is made up of parts on the circuits of capital, the turnover of capital, and the reproduction and circulation of capital. In this paper I investigate the methodological status of this last part, 'The Reproduction and Circulation of the Total Social Capital'. As indicated, of particular interest is the question to what extent we find in this part a (systematic) dialectics going on, or rather some other method, perhaps the groundwork for a modelling approach as adopted by much of modern orthodox economics. As will be argued towards the end of this paper, a case can be made for this latter thesis of a modelling approach. The questions then remain how it differs – if at all – from modern orthodox modelling approaches and how this approach might fit – if at all – into a systematic-dialectical methodology. In order to put those questions into perspective, and prior to outlining the case, I first provide some information on the case material.

THE NOTEBOOKS FOR THE CHAPTERS ON REPRODUCTION AND CIRCULATION

Both Book II and Book III of *Capital* were edited by Engels from Marx's notebooks. These notebooks differ in status from notes to preliminary drafts to revisions of the various drafts. Generally it seems that Book II has more the status of reordered though barely edited notebooks than Book III. Many of the Book II chapters show signs of being a first study of the subject; their analytical rigour and depth differ greatly, and some parts are very repetitious. One may speculate as to how the work might have looked if Marx had drafted it for publication. Engels, anyway, did not consider it his task to rewrite the material (see Engels's preface).

The material for Part Three, on reproduction and circulation, was taken from Notebooks II (written in 1870), and VIII (1878) – see Engels's preface (in Marx, 1885: 103–4).⁴ The 1878 Notebook VIII,

redrafting the part on reproduction, was probably the last work Marx undertook for *Capital* (see Oakley, 1983: 101–3).

All the quotations below are from the Penguin edition in Fernbach's translation; all page references are preceded by a Roman number, indicating the notebook from which it is taken. For example II:109 means that the quotation is from Notebook II, page 109 in the Penguin edition (Marx, 1885). Part Three is made up of four chapters: Chapter 18: Introduction (8 pages); Chapter 19: Former Presentations of the Subject (33 pages); Chapter 20: Simple Reproduction (97 pages); Chapter 21: Accumulation and Reproduction on an Expanded Scale (35 pages).

Chapter 19 deals mainly with the theories of Quesnay and Smith. The piece on Quesnay and his *Tableau Économique* is relatively brief.⁵ Whilst he considers the Physiocratic system 'the first systematic conception of capitalist production', he sees in Smith *vis-à-vis* the Physiocrats on the one hand progression – for his generalizing '*avances primitives*' and '*avances annuelles*' into 'fixed' and 'circulating' capital – and on the other retrogression consisting in 'the acceptance and the perpetuation of the concepts of "fixed" and "circulating" as decisive distinctions' (VIII:438).⁶

The introductory chapter sets out the interconnection of the subject under investigation with the analysis of Book I of *Capital* ('the immediate production process of capital') as well as with Parts One and Two of the present Book II: (1) 'the various forms that capital assumes in its circuit, and the various forms of this circuit itself'; (2) 'the circuit as a periodic one, i.e. as a turnover'. In Book I, 'the capitalist production process was analysed both as an isolated event and as a process of reproduction: the production of surplus-value and the production of capital itself'. Parts One and Two dealt with 'no more than an individual capital, the movement of an autonomous part of the social capital'. However, Marx continues, 'the circuits of individual capitals are interlinked, they presuppose one another and condition one another, and it is precisely by being interlinked in this way that they constitute the movement of the total social capital' (II:427–9).

Thus this is what is presented in Chapters 20 and 21: 'the circulation process of this total social capital' which, taken in its entirety, is 'a form of the reproduction process' (II:430). These two chapters will be discussed in the next two sections. Note that in what follows I will frequently use the term 'model' for Marx's representations of

reproduction. It is taken to be a general term that can be adopted in dialectical as well as non-dialectical discourses – each time, however, with different qualifications. I will come back to this in the last Section.

SIMPLE REPRODUCTION

The Construction of a Macroeconomics

Perhaps the most important aspect of the chapters on reproduction is to be found in the opening section of Chapter 20: here we find in fact the construction of a macroeconomics, the ‘functioning of the social capital’, as Marx calls it, the movement of individual capitals being ‘an integral link in the movement of the total capital’. We have, on the one hand, the elements of production of the individual capital, ‘in so far as they are of the objective kind’, forming a component of the social capital; and, on the other hand,

the movement of the part of the social commodity product that is consumed by the worker in spending his wage, and by the capitalist in spending surplus-value, not only forms an integral link in the movement of the total product, but is also interwoven with the movements of the individual capitals, so that its course, too, cannot be explained by being simply presupposed. (II:469)

The problem of reproduction, then, is: ‘How is the *capital* consumed in production replaced in its value out of the annual product, and how is the movement of this replacement intertwined with the consumption of surplus-value by the capitalist and of wages by the workers?’ (II:469).

Whereas Marx’s solutions to the problem are of interest – as we will see – the major achievement is the particular posing of the problem. Of course many aspects of the problem may be obvious from the standpoint of the end of twentieth-century economics. It is therefore useful to quote three opinions from a time when Keynes’s macroeconomics had been on the scene for only a few years, and these issues were less evident:

Marx ... developed the fundamental scheme describing the interrelation between consumer and capital goods industries. (Leontief, 1938:93)

His theory is probably the origin of macro-economics. (Klein, 1947:154)

The theory adumbrated in Volume Two of *Capital* has close affinities with Keynes. (Robinson, 1948:103)

Whilst it is perhaps arbitrary where we locate 'the' origin of macroeconomics (Klein) – Quesnay and Ricardo certainly also provided seminal elements – it is certain that Marx conceived the multiple dimensions of the problem: material and value, as well as production and circulation in their several aspects. In this respect we see here the culmination of both Marx's value-form theory (*Capital*, I) and the theory of the metamorphoses of capital and their circuits (*Capital*, II, Part One). We see this in the extract from Marx given above, and it is even more obvious one page further on in the text:

As long as we were dealing with capital's value production and the value of its product individually, the natural form of the commodity product was a matter of complete indifference for the analysis, whether it was machines or corn or mirrors. ... But this purely formal manner of presentation is no longer sufficient once we consider the total social capital and the value of its product. ... [The latter's movement is] conditioned not just by the mutual relations of the value components of the social product but equally by their use-values, their material shape. (II:470)

Thus we see the construction of not only a macroeconomics, but a particular macroeconomics emphasizing the twofold conflicting guises of the capitalist economy – value and use-value – for which at least temporary modes of operation have to be established (modes which Marx shows to be ridden with contradictions, as manifest especially in economic crises). Thus we have, on the one hand, use-value, the material component of production necessary for 'natural survival' – however much shaped by the actual capitalist mode of production. On the other hand, we have value (ultimately money profits), driving and shaping the course of production, necessary for 'capitalist survival'. But for capitalism the two are one; the one has no existence without the other.

This twofold macroeconomics contrasts sharply with the post-Keynes orthodox macroeconomics approaches dichotomizing the problem into two separate sides, or reducing the problem to one of

its sides (either monetary or physical, the latter homogenized via index numbers).

For the further construction of the macroeconomics model Marx operates in two stages. Starting in Chapter 20 with a model of 'Simple Reproduction', where capitalists consume all surplus value, he considers in Chapter 21 'Expanded Reproduction'; that is, the realistic situation where capitalists accumulate (part of) the surplus value. This is a very remarkable procedure, one which he had also adopted in the earlier parts of the book (see especially Chapter 2). Marx emphasizes over and over again that accumulation of capital is essential to the system. At the very end of the book he states forcefully that simple reproduction is 'incompatible with capitalist production from the very start' (VIII:596). So why start with something that is alien to the object of inquiry? What kind of abstraction or kind of simplification is this? Indeed for a simplification we might expect simplification to what is essential. Or is Marx rather cutting up the problem into (non-essential) parts that can be analysed separately?

- a⁷ Simple reproduction on the same scale seems to be an abstraction, both in the sense that the absence of any accumulation ... is an assumption foreign to the capitalist basis, and in the sense that the conditions in which production takes place do not remain absolutely the same in different years (which is what is assumed here). ... But since, when accumulation takes place, simple reproduction still remains a part of this, and is a real factor in accumulation, this can also be considered by itself. (VIII:470-71)

Some pages later the point is stated again, but now in terms of the Faustian conflict between the capitalist passion for accumulation and the desire for consumption, alluded to in Part Seven of *Capital*, I (740-41): 'Simple reproduction is oriented by nature to consumption as its aim. ... In so far as simple reproduction is also part of any reproduction on an expanded scale, and the major part at that, this motive remains alongside the motive of enrichment as such and in opposition to it' (VIII:487). As we will see below (towards the end of the next section) simple reproduction, even if 'foreign to the capitalist basis', appears to be the sea on which accumulation moves.

The opening section of Chapter 20 contains another assumption disregarding an essential characteristic of capitalism:

- b** Moreover, we assume not only that products are exchanged at their values, but also that no revolution in values takes place in the components of the productive capital. (II:469)

This assumption is maintained throughout the remainder of the book.⁸ Its first part (exchange at values) is not surprising: it fits into the general systematic of *Capital*, and is in fact dropped in Part Two of Book III. The question is whether dropping this assumption would affect the macroeconomic construct as well as the particular 'schema' to be developed later on. The answer is no; hence any divergence of price from value is *irrelevant* for the problem at stake:

In as much as prices diverge from values, this circumstance *cannot exert any influence* on the movement of the social capital. *The same mass* of products is exchanged afterwards as before, even though the value relationships in which the individual capitalists are involved are no longer proportionate to their respective advances and to the quantities of surplus-value produced by each of them. (II:469; emphasis added)⁹

The second part of the assumption is remarkable to the extent that in *Capital*, I 'revolution in values' has already been shown as essential to the system. However this part of assumption **b** is evidently of different status from the previous one, **a**. With it the very construction of the macroeconomics is at stake. Whereas the distinction related to **a** is relevant for the problem, it seems to be made for heuristic reasons. For **b**, however, Marx holds that for the problem at hand the issue of 'revolutions in value' is *irrelevant*, or neglectable:

As far as revolutions in value are concerned, they change nothing in the relations between the value components of the total annual product, as long as they are generally and evenly distributed. In so far as they are only partially and unevenly distributed, they represent disturbances which, *firstly*, can be understood only if they are treated as *divergences* from value relations that remain unchanged; *secondly*, however, given proof of the law that one part of the value of the annual product replaces constant capital, and another variable capital, then a revolution ... would alter only the relative magnitudes of the portions of value that function in one or the other capacity. (II:469–70)

In other words, even unevenly distributed 'revolutions in value' – though affecting the magnitudes of the components of (social) capital – would not change the particular macroeconomic *interconnections* between constant and variable capital (as well as between them and surplus value) in the way they will be seen to be set out by Marx.

A Two-sector Macroeconomic Model

The next phase for constructing the model is central to Marx's approach. He constructs a two-sector macroeconomics model – as far as is known, the first in the history of economics, even if the inspiration for thinking in *similar abstract* categories may have come from Quesnay (1759). The model is composed of two 'departments'. Department I is the sector producing means of production, department II the one producing consumption goods. At the same time this composition fits Marx's particular value-theoretical distinction between constant capital and variable capital.

- c The society's total product, and thus its total production process, breaks down into two great departments:

1. *Means of production*: commodities that possess a form in which they either have to enter productive consumption, or at least can enter this.

2. *Means of consumption*: commodities that possess a form in which they enter the individual consumption of the capitalist and working classes.

In each of these departments, all the various branches of production belonging to it form a single great branch of production ... The total capital applied in each of these two branches of production forms a separate major department of the social capital. (II:471)

In the text there follow definitions of variable and constant capital (471–2) which emphasize again the twofold character of capital: its material constituent and its value constituent.

So we have three sets of abstractions (retained throughout this volume – Book II – as well as Book III): First the abstraction of the macroeconomic categories of total product, total production process and social capital; second, the division of these categories into two material functional forms (means of production and means of consumption) – which is a *generic* abstraction, applicable

in principle to all modes of production; third, we have the *determinate* abstraction, particularly applicable to the capitalist mode of production, of the division of the same categories into their value constituents (constant capital, variable capital, surplus value) and which, at the same time, reflects the class division in this society.¹⁰ Together these constitute a major analytical and synthetical achievement.

Further Assumptions

d Apparently so as to reduce the problem to its bare elements, Marx next assumes temporarily (that is, throughout the earlier sections of Chapter 20) that there is no fixed capital or, equally, that all fixed capital is used up during the production period (VIII:473). Note that we still have a *flow* both in value (constant capital) and in the 'natural form' of means of production.¹¹

e It is further assumed that for both departments the rate of surplus value (s/v) is equal, constant and given (100 per cent). This assumption is maintained throughout this part. Although it is not commented upon (it is treated at length in both Book I and Book III of *Capital*), it seems a simplifying device without particular relevance to the problem at hand.

f The next assumption concerns the value composition of capital ($c/c + v$), which is, for each department, taken as equal, constant and given. This assumption is maintained throughout Chapter 20, but relaxed several times in Chapter 21. Marx comments:

What is arbitrarily chosen here, for both departments I and II, is the ratio of variable capital to constant capital; arbitrary also is the identity of this ratio between the departments ... This identity is assumed here for the sake of simplification, and the assumption of different ratios would not change anything at all in the conditions of the problem or its solution. (VIII:483)

In fact both simplifications e and f can be made because their possible departmental divergences do not fundamentally affect the problem. This is related to the more severe assumption b: the possible divergences at hand would not affect the interconnection between the departments – yet to be developed. (From the point of view of method, all this is most important: the transformations in

Capital are systematic, not historical. Thus, for example, the value-price transformation in Book III is conceptual and cannot be said *actually* to affect the size of the departments.)

A final assumption, which is maintained throughout the part, is made explicit much further on in the text:

- g Capitalist production never exists without foreign trade. ... Bringing foreign trade into an analysis of the value of the product annually reproduced can ... only confuse things ... We therefore completely abstract from it here. (VIII:546)

This is again an assumption of simplification of the type 'neglectable' for the current problematic.

The Schema of Simple Reproduction and the Condition for Simple Reproduction

The departmental *schema*, and the numerical example, that is used throughout the chapter (in the dimension of money, that is £ or \$ and so on) is the following (VIII:473):

	c	v	s	x	
I.	4000	+ 1000	+ 1000	=	6000 (means of production)
II.	2000	+ 500	+ 500	=	3000 (means of consumption)
	6000	+ 1500	+ 1500	=	9000 (social gross product) ¹²

where:

- I = department I, producing means of production (6000);
- II = department II, producing means of consumption (3000);
- c = constant capital, the value of the means of production applied;
- v = variable capital, the value of the social labour power applied;
- s = surplus value, the value that is added by labour minus the replacement of the variable capital advanced. (Cf.II:472.)

Although Marx does not comment on the numbers in the schema, they do not seem arbitrary. In an earlier chapter (Ch. 17, II:397–8) Marx quotes an estimate of the ratio of the total capital stock and the total consumption for Britain and Ireland (as reported) by Thompson (1850). This ratio amounts to 3.¹³ A similar ratio in the

schema above is 2. However fixed constant capital has been excluded for the time being.

Generalizing the schema, Marx uses the notation:

$$I_c + I_v + I_s = I$$

$$II_c + II_v + II_s = II$$

In what follows, we adopt the notation that has become conventional in modern Marxian economics:

$$c_1 + v_1 + s_1 = x_1 \quad (A)$$

$$c_2 + v_2 + s_2 = x_2 \quad (B)$$

$$\frac{c_1 + v_1 + s_1}{c + v + s} = \frac{x_1}{x^{14}} \quad (C)$$

For simple reproduction, then,

$$x_1 = c \quad \text{or equally,} \quad (D)$$

$$x_2 = v + s \quad (E)$$

Analyzing at length the mutual exchange between the departments, which is 'brought about by a money circulation, which both mediates it and makes it harder to comprehend' (VIII:474), Marx derives the following proportionality condition for simple reproduction (VIII:478):

$$v_1 + s_1 = c_2 \quad (F)$$

He does not use the term equilibrium, but talks of 'proportionate part', and holds that the proportionate part on the left side 'must be equal' to the proportionate part on the right side (VIII:474, 478). The result is:

The new value product of the year's labour that is created in the natural form of means of production (which can be broken down into $v + s$) is equal to the constant capital value c in the product of the other section of the year's labour, reproduced in the form of means of consumption. If it were smaller than IIc [that is, c_2], then department II could not completely replace its constant capital; if it were larger, then an unused surplus would be left over. In both

cases, the assumption of simple reproduction would be destroyed. (VIII:483–4)

Note that condition (F) and the conditions (D) and (E) each imply each other. Representation (F) specially emphasizes the interconnection between the two departments as revealed in their mutual exchange.

The Value of the Total Product and the Value Product of Labour

In an alternative formulation the concept of value-added is brought to the fore:

On the premise of simple reproduction ... the total value of the means of consumption annually produced is equal to the annual value product, i.e. equal to the total value produced by the labour of the society in the course of the year, and the reason why this must be the case is that with simple reproduction this entire value is consumed for the capitalists in department II, the value of their product breaks down into $c + v + s$ [that is, $c_2 + v_1 + s_2$], yet, considered from the social point of view, the value of this product can be broken down into $v + s$. (II:501–2)

Marx formalizes this as:¹⁵

$$x_2 = (v_1 + s_1) + (v_2 + s_2) \quad (\text{G})$$

which has condition (F) at its base.

On the same theme (remember that the numerical schema for department II runs: $2000_c + 500_v + 500_s = 3000_x$) Marx writes:

As far as the constant value component of this product of department II is concerned ... it simply reappears in a new use-value, in a new natural form, the form of means of consumption, whereas it earlier existed in the form of means of production. Its value has been transferred by the labour process from its old natural form to its new one. But the *value* of this two-thirds of the value of the product, 2000, has not been produced by department II in the current year's valorization process. (II:503)

Hence, again, the importance of formula G.¹⁶

Conversely, for department I ($4000_c + 1000_v + 1000_s = 6000_x$) the 4000 constant capital

is equal in value to the means of production consumed in the production of this mass of commodities, a value which reappears in the commodity product of department I. This reappearing value, which was not produced in the production process of department I, but entered it the year before as constant value, as the given value of its means of production, now exists in that entire part of the commodity mass of department I that is not absorbed by department II. (II:498)

Thus we have $c_1 + v_1 + s_1 = x_1 = c_1 + c_2$. Or, in terms of the circuits of *Capital*, II, Part One:

$$\begin{array}{ccccccc}
 M & \text{---} & C & \{MP; LP\} & \dots & P & \dots & C' & \{MP = x_1\} & \text{---} & M' & \quad (H) \\
 | & & | & | & & & & | & & & | \\
 5000 & & 4000_c & 1000_v & & & 4000_{x_1} + 1000_{x_1} + 1000_{x_1} & & & & 6000
 \end{array}$$

These distinctions gain even more force when explicitly linked to the twofold character of capitalist economic entities, central to Marx's theory (cf. *Capital*, I, Ch. 1):

Thus the difficulty does not lie in analysing the value of the social product itself [$c + v + s = 9000$]. It arises when the *value* components of the social product are compared with its *material* components.

The constant portion of value, that simply reappearing, is equal to the value of the part of the social product that consists of means of *production*, and is embodied in this part. The new year's value product = $v + s$ is equal to the value of the part of the annual product that consists of means of *consumption*, and is embodied in this. (II:506; cf. 504)

This is even more forcefully expressed in a later notebook:

The overall annual reproduction [$c + v + s = x$], the entire product of the current year is the product of the useful labour of this year [$l'' \rightarrow x$]. But the value of this total product is greater than the portion of its value which embodies the annual labour, i.e. the

labour-power spent during this year [$l^v \rightarrow v + s = y$]. The *value product* of the current year, the value newly created during the year in the commodity form [y], is smaller than the *value of the product*, the total value of the mass of commodities produced during the year [x]. (VIII:513)

Here we see the distinction related to the twofold character of the labour process as technical and valorization process.

Money Circulation and 'the Widow's Cruse'

Throughout the text much emphasis is on the money circulation within and between the two departments (see Campbell in the present volume); a recapitulation is on 491–2; cf. Ch. 17 on the same issue. Especially here we may notice similarities with Quesnay's 'zigzag' in his *Tableau Économique*.¹⁷ In the course of outlining money circulation, Marx formulates the so-called 'widow's cruse' argument (it is derived in Keynes's *Treatise on Money* and in Kalecki (1935); in Kaldor's (1955/6:85) well-known phrase it runs: 'capitalists earn what they spend, and workers spend what they earn'): '*it is the money that department I itself casts into circulation that realizes its own surplus-value*' (VIII:495; Marx's emphasis). And in more general terms (cf. Chapter 17, II:409):¹⁸ 'In relation to the capitalist class as a whole, however, the proposition that it must itself cast into circulation the money needed to realize its surplus-value ... is not only far from paradoxical, it is in fact a necessary condition of the overall mechanism' (VIII:497).

Maintenance of Fixed Capital and Disproportionate Production

In Section 11 of Chapter 20, Marx drops assumption d and considers the effect of the incorporation of fixed capital for his model. Thus in terms of annual reproduction he incorporates constant capital components whose life is longer than a year (cf VIII:525). For the individual capital, 'the part of the money received from the sale of commodities, which is equal to the wear and tear of the fixed capital, is not transformed back again into ... productive capital ... it persists in its money form', that is, hoard formation, to be expended when the fixed capital components have to be replaced (VIII:526). Thus the commodity value 'contains an element for depreciation of ... fixed capital' (VIII:528).

For simple reproduction, then, as a 'precondition', the annual total of fixed capital to be renewed 'has to be equal to the annual wear and tear'. 'Such a balance accordingly appears as a law of reproduction on the same scale' (VIII:540). Next Marx discusses the two cases in which this equality does not hold. In the first case, fixed capital has to be renewed, for which there has been insufficient production; thus 'there would be an insufficient amount of reproduction, quite independent of the monetary relations' (VIII:543). 'The reverse happens in the second case, where department I ... has to contract its production, which means a crisis' (VIII:544). Marx emphasizes that such 'disproportionate production of fixed and circulating capital' ('a factor much favoured by the economists in their explanation of crises') can 'arise from the mere *maintenance* of the fixed capital', that is with simple reproduction. 'Within capitalist society ... it is an anarchic element' (VIII:545).

Conclusions to the Model for Simple Reproduction

The first major achievement of the chapter on simple reproduction is the construction of a macroeconomics generally, with its particular emphasis on the twofold character of the capitalist mode of production. This leads Marx to the – now familiar – distinction between 'value of the product' (production value) and 'value product' (value-added). The second major achievement is to grasp the macroeconomic relations in terms of a two-sector system fitting Marx's approach of general and determinate abstractions. And the third is the general thread in Marx's analysis: to search for the necessary interconnections between the two departments of production. Therefore, rather than the two equations $x_1 = c$, or $x_2 = v + s$, it is the equation $v_1 + s_1 = c_2$ that is central to the analysis. We will see in the next section that a similar equation also provides the guiding thread for Marx's analysis of the macroeconomics of expanded reproduction.

EXPANDED REPRODUCTION

More so than in the previous chapter (Ch. 20), the last chapter (Ch. 21) has the character of an unfinished draft. A main part of the text is a meticulous analysis of how economic growth (twofold) is possible at all. What are the conditions? The import one gets from it

is that the two-department abstraction (carried on from the previous chapter) is a powerful analytical instrument. For example, in the course of the analysis Marx is able to grasp all kinds of spiral (multiplier) effects, such as on page 580, where, starting from an accumulation in department I, there results an overproduction in department II, whence a spiral effect influence department I. At times the two-department division is further differentiated (subdivisions within departments) so as to get to grips with particular problems. Perhaps most importantly, his use of the two-department abstraction indeed brings to the fore the problematic of the twofold character of capitalist entities, processes and relations. With the exception of this last issue, Marx's end result seems generally not too complicated – as judged from the point of view of the end of twentieth-century economic theory on cycles and growth. However, even if that maturation required some 80 years, the real trail-blazing activity was the way in which the problem of this dynamics of the capitalist economy was posited by Marx.

The General Frame for the Analysis: General Assumptions and Abstractions

The chapter on expanded reproduction starts with an analysis of fixed constant capital and the addition to it, which from the side of individual capitals runs in gradual lumps of hoarding (depreciation allowances) and discrete dishoarding (investment); within a department and its branches, one section of capitalists will be engaged in stages of the former ('one-sided sale'), while another section actually buys additional elements of constant capital ('one-sided purchase') (VIII:565–70).¹⁹

The fact that the production of commodities is the general form of capitalist production already implies that money plays a role, not just as means of circulation, but also as money capital within the circulation sphere, and gives rise to certain conditions for normal exchange that are peculiar to this mode of production, i.e. conditions for the normal course of reproduction, whether simple or on an expanded scale, which turn into an equal number of conditions for an abnormal course, possibilities of crisis, since, on the basis of the spontaneous pattern of this production, this balance itself is an accident. (VIII:570–1)

However, Marx's aim for this chapter is *not* the analysis of crises, but rather the accidental balance. (In this respect the point of application is similar to that of the 'equilibrium' growth models of Harrod and Domar.) To this end he assumes, even for the case of expanded reproduction, that

- h balance exists ... that the values of the one-sided purchases and the one-sided sales cover each other. (VIII:570)
- i In the same vein, Marx assumes a sufficient monetary accommodation for expanded reproduction (VIII:576).
- j A further delimitation of the problematic is revealed in the assumption of a sufficient labour force; that is, that 'labour-power is always on hand' (VIII:577). This assumption, however, is not an analytical one, as Marx for its explanation refers back to *Capital* I.

Nevertheless a problem of potential imbalance – or, rather, of potential overproduction – is central to reproduction on an expanded scale insofar as we consider either a transition from simple to expanded reproduction or a transition to further expansion, that is, to a higher growth path. Marx states: 'in order to make the transition from simple reproduction to expanded reproduction, production in department I must be in a position to produce fewer elements of constant capital for department II, but all the more for department I' (VIII:572). In effect, then, department I would substitute spending part of surplus-value (s_1) to means of consumption (some equivalent part of c_2) for spending it on additional means of production (which are now to that equivalent available in commodity form from department I). Department II would thus be stuck with a commodity stock to that equivalent: 'There would thus be an overproduction in department II, corresponding in value precisely to the expansion of production that took place in department I' (VIII:580).

The 'normal' reaction would be for department II to cut back production, which would be fine if it were to the extent of the means of production they could not get from department I anyway. However, given their overproduction, they might want to cut back production more than that, and thus buy even less means of production: 'The over-production in department II might in fact react so strongly on department I ... [that the] latter would thus be inhibited even in their reproduction on the same scale, and inhibited,

moreover, by the very attempt to expand it' (VIII:580). We thus have a real paradox. Marx brings up the problem and refers back to it several times, but does not analyse it any further: from the text it is clear that he purposefully wants to abstract from any crisis elements so as to set out the situation of accidental balance (assumption h).

The Schemes for Expanded Reproduction

In setting out expanded reproduction, Marx proceeds on the basis of – apart from the assumptions h to j just mentioned – the earlier assumptions b to g (assumption a was the one of simple reproduction). However, assumption f, about the composition of capital, is sometimes relaxed so as to allow for divergent compositions as between the departments; nevertheless within a department it remains constant. Apparently Marx does not aim to set out the transition from simple to expanded reproduction. Indeed he assumes that:

k there has 'already been reproduction on an expanded scale' (VIII:566).

For the analysis of expanded reproduction, Marx uses three numerical schemes, which I refer to as Schemata A, B and C.²⁰ Marx treats Schema A very briefly, and its analysis is apparently a preliminary one. Below I present an outline of Schema B, which is also the best worked out case in Marx's text. Towards the end of this section I make some remarks on Schema C.

Once again these schemes are in numerical form; each with different starting values. For all schemata it is at first sight unclear why these specific starting values in particular have been chosen – only towards the end of the chapter does it become clear that they are meant to be representative cases for three particular circumstances. (Quite apart from this it is also obvious from the text that Marx tried to employ 'easy numbers' for his calculations.)

Each schema (A, B, C) is presented for a sequence of periods, each representing the *production* in that period. At the end of each period capitalists in each department make plans ('arrangements') to accumulate capital for an expanded production in the next period (= *intended exchange arrangement*). Thus they aim to use more means of production (*c*) and labour-power (*v*) than they did in the running period. However, these plans may not match, for example, the means of production that have actually been produced in the

running period, thus there might be over or underproduction in comparison with these plans. Thus especially for the case of underproduction there may be bottlenecks preventing steady growth. At the end of each period then the confrontation of the realised *production* and the *intended exchange arrangement* gives rise to some *actual exchange arrangement* which is the basis for the next round of production.

Once we are in a situation that the *intended* exchange arrangements match the *actual* arrangements (and therefore also production), and no new changes in parameters occur, we are on a steady growth path. I will call a situation of a fixed set of parameters a 'regime'. Marx then analyses the transition from one regime to another by varying just one parameter, which is the rate of accumulation out of surplus-value for department I (α_1). Particularly he assumes that in department I half of surplus-value is being accumulated; the rate for the other departments stays, as intended, initially at the old rate (in the proportions of the existing compositions of capital in each department).²¹

In the way Marx makes his model work (at least for Scheme B, as we will see) there is only one period of *transition* from the old regime to the new one. Hence starting from a steady state regime in period 1, and changing the regime at the end of that period (intended), a new steady state will already be reached in period 3.

Thus schematically we have the following sequence:

- | | |
|-------------------------|--|
| a. <i>period 1:</i> | <i>production old regime – steady state</i> |
| b. <i>end period 1:</i> | intended arrangement for old regime (would old regime have continued; matches a) |
| c. <i>end period 1:</i> | intended arrangement for new regime (would have to match a) |
| d. <i>end period 1:</i> | actual arrangement for new regime (= basis for production period 2) |
| e. <i>period 2:</i> | <i>production new regime – transition</i> |
| f. <i>end period 2:</i> | intended arrangement for new regime (would have to match e) |
| g. <i>end period 2:</i> | actual arrangement for new regime (= basis for production period 3) |
| h. <i>period 3:</i> | <i>production new regime – steady state</i> |

Although I interpret the starting situation (period 1) of each schema as one of proportionality for a specific steady state growth path,

Marx does not say this explicitly. Nor does he calculate the steady state parameters for the starting situation (as I will do below). (And as we see later on, his omission to do this may have put him on the wrong track for his conclusions from the model.)

The schemes of production (a, e, h) that I present below are identical to the ones that Marx gives. The other schemes (b, c, d, f, g) are presented by Marx in different and varying formats. The following notation is used:

- g = rate of growth;
 u = surplus-value consumed by or via capitalists ('unproductive consumption');
 Δc = surplus-value accumulated in constant capital;
 Δv = surplus-value accumulated in variable capital.

Thus we have for surplus-value (s):

$$s = u + \Delta c + \Delta v$$

The actual rate of accumulation out of surplus value (α) is defined as:

$$\alpha = (\Delta c + \Delta v) : s$$

(α' = rate for the old regime; α = rate for the new regime); the *intended*, or planned, rate of accumulation is indicated by α^p .)

The parameters for Marx's scheme (old regime) are only explicit by his numbers. These are for the composition of capital:

$$c_1 : (c_1 + v_1) = \gamma_1 = 0.80 \quad (7)$$

$$c_2 : (c_2 + v_2) = \gamma_2 = 0.67 \quad (8)$$

For the rate of surplus-value:

$$s_1 : v_1 = \varepsilon = 1 \quad (9)$$

$$s_2 : v_2 = \varepsilon = 1 \quad (10)$$

For the rate of accumulation out of surplus value:

$$(\Delta c_1 + \Delta v_1) : s_1 = \alpha_1 = 0.45 \quad (11)$$

$$(\Delta c_2 + \Delta v_2) : s_2 = \alpha_2 = 0.27 \quad (12)$$

Where Δc and Δv have the same proportions as in (7) and (8):

$$\Delta c_1 : (\Delta c_1 + \Delta v_1) = \gamma_1 = 0.80 \quad (13)$$

$$\Delta c_2 : (\Delta c_2 + \Delta v_2) = \gamma_2 = 0.67 \quad (14)$$

Thus there is no technical change – at least no change in the value composition of capital (assumption b).

The remainder of (potential) surplus-value is the ‘unproductive consumption’ (u) by or via capitalists:

$$u_1 = (1 - \alpha_1)s_1 \quad (15)$$

$$u_2 = (1 - \alpha_2)s_2 \quad (16)$$

Thus ‘hoarding’ is set aside, that is all incomes are expended – at least in the aggregate. (In his text, however, Marx devotes considerable attention to hoarding, for example in the opening section of Chapter 21. Indeed he conceives of hoarding as crucial to the circulation and reproduction process – see Campbell in the present volume.)

Schema B: Expanded Reproduction

I reiterate that for the model below the ratios $c/c + v$ and s/v are given and constant. Thus once we have a starting value for e.g. c the numerical values for the other variables follow.

a. Period 1: Production old regime – steady state (VIII:586)

	c		v		s		x
I.	4000	+	1000	+	1000	=	6000
II.	1500	+	750	+	750	=	3000
	5500	+	1750	+	1750	=	9000

Since $(x-c)/c = (6000 - 5500)/5500 = 9.1\%$, this might be a schema of proportionality for a steady growth path of $g = 9.1\%$, if $\alpha_1' = 45.5\%$; $\alpha_2' = 27.3\%$; with $\Delta c_1/s_1 = 36.4\%$; $\Delta c_2/s_2 = 18.2\%$; and for both departments $\Delta v/s = 9.1\%$. (Marx does not calculate these ratio's). Equivalently: for such a steady state growth the ratio c_1/c_2 is fixed so that we can find $\Delta c = \Delta c_1 + \Delta c_2$. Next, given $c/(c + v)$ we also find $\Delta v_1 + \Delta v_2 = \Delta v$. From these values then we derive the necessary rates of accumulation $\alpha_1' = (\Delta c_1 + \Delta v_1)/s_1 = 45.5\%$ and $\alpha_2' = (\Delta c_2 + \Delta v_2)/s_2 = 27.3\%$.

Accordingly, had the old regime continued, we would have had the following intended exchange arrangement at the *end* of period 1 (Marx does not mention this).

b. End period 1: Intended exchange arrangement for old regime (would old regime have continued; matches schema a)

	<i>c</i>	<i>v</i>	<i>u</i>	Δv	Δc	<i>x</i>	
I.	4000	+ 1000	+ 545	+ 91	+ 364	= 6000	($\alpha_1^{P'} = 45.5\%$) [$= \alpha_1'$]
II.	1500	+ 750	+ 545	+ 68	+ 137	= 3000	($\alpha_2^{P'} = 27.3\%$) [$= \alpha_2'$]
	5500	+ 1750	+ 1091*	+ 159	+ 500*	= 9000	

* rounding off

Here *u*, Δv and Δc are the (intended) destination of the total of profits *s*. This schema *b* matches schema *a* so the intended exchange arrangement can also be the actual exchange arrangement ($x_1 = 6000 = c + \Delta c$ and $x_2 = 3000 = v + u + \Delta v$).

The part of the surplus product that is accumulated (Δv and Δc) seems to have a different status from the other components (*c*, *v*, *u*). Although Δv in particular is materially produced within the period under consideration, this part of (potential) surplus value is only realized within the next, when the extra labour power is hired (VIII:580–1). The realization of Δc can be conceived of in the same way (VIII:575). Thus the realization of these components of scale increase, in a way lags behind. Of course it applies to all components, and not just the last-mentioned, that their production and circulation – even within a period under consideration – involves complex intertemporal processes:

The continuous supply of labour-power on the part of the working class in department I, the transformation of one part of departments I's commodity capital back into the money form of variable capital, the replacement of a part of departments II's commodity capital by natural elements of constant capital IIc [that is, c_2] – these necessary preconditions all mutually require one another, but they are mediated by a very complicated process which involves three processes of circulation that proceed independently, even if they are intertwined with one another. The very complexity of the processes provides many occasions for it to take an abnormal course. (VIII:571)

Nevertheless the lagging behind of realization, Marx concludes, is not the vital point of difference between simple and expanded reproduction:

Just as the current year concludes ... with a commodity stock for the next, so it began with a commodity stock on the same side left over from the previous year. In analysing the annual reproduction – reduced to its most abstract expression – we must thus cancel out the stock on both sides ... and thus we have the total product of an average year as the object of our analysis. (VIII:581)

Now instead of carrying on at the old regime (schema b) at the end of period 1, department I decides to increase the rate of accumulation (department II intends to maintain the old rate). Thus Marx fixes $\alpha_1 = 50$ per cent and then analyses the transition numerically. For this he takes as starting-point the condition for simple reproduction ($v_1 + s_1 = c_2$), *gradually* developing this in the course of the examples into a condition for expanded reproduction.

It is self-evident that, on the assumption of accumulation, $I_{(v+s)}$ [that is, $v_1 + s_1$] is greater than IIc [that is, c_2], ... since (1) department I incorporates a part of its surplus product into its own capital and transforms ... [Δc_1] of this into constant capital, so that it cannot simultaneously exchange this ... for means of consumption; and (2) department I has to supply the material for the constant capital needed for accumulation within department II [Δc_2] out of its surplus product. (VIII:590).

Thus we have:

$$(v_1 + s_1) - \Delta c_1 = c_2 + \Delta c_2 \quad (I)$$

or

$$(v_1 + u_1) + \Delta v_1 = c_2 + \Delta c_2^{22} \quad (J)$$

In further presenting the numerical schemes, I will indicate for each schema whether it satisfies this condition. Marx does not do this. Again he derives generalizations *from* his numerical schemes. Thus they are not illustrations, but rather heuristic tools. So, for schema B-b we have the condition satisfied, as

$$1000 + 545 + 91 = 1500 + 136.$$

Following on from the change in the rate of accumulation ($\alpha_1 = 50$ per cent) we get, instead of this schema, the following intended arrangement at the end of period 1.

c. End of period 1: intended arrangement for new regime (would have to match a)

	<i>c</i>	<i>v</i>	<i>u</i>	Δv	Δc	<i>x</i>
I.	4000	+ 1000	+ 500	+ 100	+ 400	= 6000 (new regime $\alpha_1^p = 50\%$)
II.	1500	+ 750	+ 545	+ 68	+ 137	= 3000 (old regime: $\alpha_2^p = 27\%$)
	5500	+ 1750	+ 1045	+ 168	+ 537	= 9000

With these plans there is imbalance, the intended arrangement does not match production (a):

$$v_1 + u_1 + \Delta v_1 < c_2 + \Delta c_2 \quad (1600 < 1637)$$

This situation cannot be. There are fewer means of production on offer (6000) than there is intended demand for (5500 + 537). Conversely there are more means of consumption on offer (3000) than the intended demand (1750 + 1045 + 168). So what happens? In fact Marx lets the course of development be dictated by department I as they hold the means of production. (Note that it is assumed there are no price changes.) Thus department I fulfils its plans and department II is stuck with a shortage of means of production (37), plus an equivalent unsold stock of commodities for consumption. However it will then hire proportionally less extra labour power (from 68 to 50) giving rise to an extra stock of 18. (Thus we have the paradox for department II: eager to expand at overcapacity. If department II were to react to its overcapacity by decreasing demand for means of production from department I, we would have the same paradox for department I. In sum, a downward spiral would be plausible. Cf. previous subsection.) Marx shortcuts the transition, apparently because he wants to make the strongest possible case for 'balance', by assuming that department II capitalists absorb the stock of means of consumption (37 + 18) by consuming it unproductively, thus realizing their surplus value to that extent. (We see the 'widow's cruse' in effect.) Thus we get the following arrangement (the differences from the previous scheme c are in italics).

d, End of period 1: actual arrangement for new regime (= basis for production period 2)

	<i>c</i>	<i>v</i>	<i>u</i>	Δv	Δc	<i>x</i>	
I.	4000	+ 1000	+ 500	+ 100	+ 400	=	6000 ($\alpha_1 = 50\%$)
II.	1500	+ 750	+ 600	+ 50	+ 100	=	3000 ($\alpha_2 = 20\%$)
	5500	+ 1750	+ 1100	+ 150	+ 500	=	9000

(where condition (J) is met: $1000 + 500 + 100 = 1500 + 100$).

This is the 'rational' reaction for department II to have, $\alpha_2 = 20\%$ being the result. In effect the plan for department I to increase the rate of accumulation results in a decreased rate for department II (and this, according to Marx, is the only way in which an (extra) expansion can come about: VIII:572). The schema for the next period then becomes the following.

e. Period 2: production new regime – transition (VIII: 587)

	<i>c</i>	<i>v</i>	<i>s</i>	<i>x</i>	
I.	4400	+ 1100	+ 1100	=	6600 ($g_1 = 10\%$)
II.	1600	+ 800	+ 800	=	3200 ($g_2 = 6.7\%$)
	6000	+ 1900	+ 1900	=	9800

Consequently the rate of growth for department I has increased, to 10% and that for II has decreased to 6.7% (both initially at 9.1%). For the end of period 2, Marx then (implicitly) assumes that department II intends to reach the old rate of accumulation ($\alpha_2' = 27.3\%$; $\Delta c/s = 18.2\%$; that is, 146) and moreover to catch up with the former level of accumulation (in means of production 36). Thus the intended Δc_2 becomes $146 + 36 = 182$. Department I maintains $\alpha_1 = 50\%$.)

f. End of period 2: intended arrangement for new regime (would have to match e)

	<i>c</i>	<i>v</i>	<i>u</i>	Δv	Δc	<i>x</i>	
I.	4400	+ 1100	+ 550	+ 110	+ 440	=	6600 ($\alpha_1^p = 50\%$)
II.	1600	+ 800	+ 527	+ 91	+ 182	=	3200 ($\alpha_2^p = 34\%$)
	6000	+ 1900	+ 1077	+ 201	+ 622	=	9800

Again $v_1 + u_1 + \Delta v_1 < c_2 + \Delta c_2$ ($1760 < 1782$), again department I can dictate the course and again department II absorbs the potential overproduction (22 plus 11, since labour-power hired decreases proportionally). Accordingly we have for the actual exchange arrangement the following (differences from schema f in italics):

g End of period 2: actual arrangement for new regime (= basis for production period 3)

	<i>c</i>	<i>v</i>	<i>u</i>	Δv	Δc	<i>x</i>
I.	4400	+ 1100	+ 550	+ 110	+ 440	= 6600 ($\alpha_1 = 50\%$)
II.	1600	+ 800	+ 560	+ 80	+ 160	= 3200 ($\alpha_2 = 30\%$)
	6000	+ 1900	+ 1110	+ 190	+ 600	= 9800

(where condition (J) is met: $1100 + 550 + 110 = 1600 + 160$).

Department II has recovered part of the former level of accumulation, but not all. As a result the schema for the next period becomes the following.)

h. Period 3: production new regime (new steady state) (VIII:588)

	<i>c</i>	<i>v</i>	<i>s</i>	<i>x</i>	
I.	4840	+ 1210	+ 1210	= 7260	($g_1 = 10\%$)
II.	1760	+ 880	+ 880	= 3520	($g_2 = 10\%$)
	6600	+ 2090	+ 2090	= 10780	

With this schema we are at the new steady state growth path. From now on all entries can increase at a growth rate of 10% ($g = 10\%$ for both departments). Department II cannot catch up with accumulation any further, so α_2 stays at 30%. (Though for this example it will have caught up in absolute quantity after two more periods, since the growth rate has risen.) Marx calculates the schema for three more periods (VIII:589). So much for Schema B.²³

As has been said above, Marx's schemes are not illustrations; they are tools for arriving at a generalization. He (implicitly) applies the formula $v_1 + u_1 + \Delta v_1 = c_2 + \Delta c_2$ in all his examples, and explicitly derives it from them (590 and 593). Nevertheless, at the very end of

the text (595–7), when Marx is preparing to draw general conclusions from his schemes, he once again falls back on the modified simple reproduction condition $v_1 + u_1 = c_2$. Why? The easy answer is to refer to the unfinished shape of the text: it was perhaps meant to be followed by a piece indicating the relevant difference between the conditions for simple and expanded reproduction.

However there is another explanation, which directly relates to Marx's examples. Note that his generalizations (595–7) follow just after setting out Schema C (590–95). The problem is not so much that he takes the formula $v_1 + u_1 = c_2$ for a *starting-point* of the analysis. Indeed, with Schema C, Marx takes an example for which this formula does *not* apply in the initial situation – as it did for Schemata B and A.²⁴ The point is that Schema C is an unlucky example (though, since Marx neglects to calculate the relevant *initial* properties of his schemes – especially the rates of accumulation and growth – he seems unaware of this). In fact, with his Schema C, he describes the transition to a *decreasing* rate of accumulation and growth, whilst it is apparently meant to describe (further) expansion, taking off with a rate of accumulation of 50% for department I as in all his examples.

Schema C: Expanded Reproduction; Production, Period 1, Initial Situation

	<i>c</i>		<i>v</i>		<i>s</i>		<i>x</i>
I.	5000	+	1000	+	1000	=	7000
II.	1430	+	286*	+	286*	=	2002
	6430	+	1286	+	1286	=	9002

*Marx has 285 here.

This might be a schema of proportionality for a steady growth path of $g = 8.9\%$, if for both departments $\Delta c/s = 44.3\%$; $\Delta v/s = 8.9\%$; hence $\alpha' = 53.2\%$ (Marx does not calculate these ratios). The new rate of accumulation *decreases* to $\alpha_1 = 50\%$.

For our purposes we do not need to go through this example any further (in the end, the new growth rate will slow down to 8.3%). Indeed, for the new situation, $v_1 + u_1 < c_2$ (that is, 1500 < 1430). What is relevant, however, and whence we have potential *overproduction* in department I, is that $v_1 + u_1 + \Delta v_1 > c_2 + \Delta c_2$ (that is, 1000 + 500 + 83 > 1430 + 127, thus 1583 > 1557).

A Formal Recapitulation of the Model for Expanded Reproduction: Conclusions

Marx's main tool, as has been indicated, is numerical schemes with some elementary formalization. Thus, although we do not find the formalization given below in the text, this *type* of formalization may be said to be in there spirit.

Apart from the properties of the model for expanded reproduction described below, we have the following assumptions, as discussed earlier on:

- prices do not change (or prices are equal to values) (assumption b);
- there is no fixed capital (or it is used up within the production period) (assumption d);
- there is no foreign trade (assumption g);
- monetary accommodation is sufficient (assumption i);
- sufficient labour power is available (assumption j).

(Assumptions and equations marked* are identical to the ones for simple reproduction.)

We have the system:

$$c_1 + v_1 + s_1 = x_1 \quad (1)^*$$

$$c_2 + v_2 + s_2 = x_2 \quad (2)^*$$

$$c + v + s = x \quad (3)^*$$

There are three definitions for aggregation:

$$c_1 + c_2 = c \quad (4)^*$$

$$v_1 + v_2 = v \quad (5)^*$$

$$s_1 + s_2 = s \quad (6)^*$$

We have four equations fixating the dynamics of the structure of production: in each department, one for the value composition of capital ($c/c + v$) and one for the rate of surplus value (s/v):

$$c_1 : (c_1 + v_1) = \gamma_1 \quad (7)^*$$

$$c_2 : (c_2 + v_2) = \gamma_2 \quad (8)^*$$

$$s_1 : v_1 = \varepsilon \quad (9)^*$$

$$s_2 : v_2 = \varepsilon \quad (10)^*$$

(These 10 equations, together with the condition $c_2 = v_1 + s_1$, comprise the model for simple reproduction analysed in the second section). The ratios γ and ε may in principle be estimated; here, however, they are fixed, for analytical purposes.

The crucial element is α , the rate of accumulation out of surplus value (commented upon below), which is defined as follows:²⁵

$$(\Delta c_1 + \Delta v_1) : s_1 = \alpha_1 \quad (11)$$

$$(\Delta c_2 + \Delta v_2) : s_2 = \alpha_2 \quad (12)$$

Where Δc and Δv have the same proportions as in (7) and (8):

$$\Delta c_1 : (\Delta c_1 + \Delta v_1) = \gamma_1 \quad (13)$$

$$\Delta c_2 : (\Delta c_2 + \Delta v_2) = \gamma_2 \quad (14)$$

Thus there is no technical change – at least no change in the value composition of capital (assumption **b2**).

The remainder of (potential) surplus value is the ‘unproductive consumption’ (u) by or via capitalists:

$$u_1 = (1 - \alpha_1)s_1 \quad (15)$$

$$u_2 = (1 - \alpha_2)s_2 \quad (16)$$

Thus ‘hoarding’ is abstracted from.

The rates of accumulation, α_1 and α_2 , may in principle be estimated (elsewhere Marx further theorizes α as a necessary force in capitalism). Here, however, α_1 is fixed, for analytical purposes; α_2 , on the other hand, is taken for a semi-variable. Its starting intended value is that of the previous period (see below), but within the

period it acts as a *result*. Unproductive consumption u_2 varies accordingly. In this way, Marx's account short-cuts adaptation after any changes in the system (α , γ , ε); it also precludes downward spiral effects: effective overproduction is ruled out. Any potential overproduction (given a rate of accumulation α_1) is absorbed via the adaptation in α_2 : either by unproductive consumption (for means of consumption) or by accumulation (for means of production).²⁶ Finally expanded reproduction and proportionality is defined by the condition:²⁷

$$c_2 + \Delta c_2 = v_1 + u_1 + \Delta v_1 \quad (17)$$

which centres the analysis on the interconnecting exchanges between the two departments.

So we have 17 equations and 19 unknowns, leaving two degrees of freedom. Similarly as for simple reproduction it is within the logic of Marx's reasoning to start from a given accumulation of capital in each department, from which follow numerical values for the other variables (given some initial value for α_2 , that is, intended accumulation in department II). However, as α_2 is a semi-variable (its intended value may not be equal to its realized value, or its 'ex-ante' value may not be equal to its 'ex-post' value), condition (17) may be violated.

Thus, in the face of the pattern for α , γ and ε , the starting values c_1 and c_2 , or $(c_1 + v_1)$ and $(c_2 + v_2)$, determine the course of things, notably smooth adaptation or *potential* overproduction in department I or department II, with their potential downward spiral effects. Each time condition (17) may turn out to be an inequality 'at the end' of the period, the resulting accumulation of capital ('ex-post') thus determining the course for the next period. The following three cases can be distinguished:²⁸

(1) potential overproduction in department II (cf. Schemata A and B), if:

$$v_1 + u_1 + \Delta v_1 < c_2 + \Delta c_2 \quad (\text{Marx has: } v_1 + u_1 = c_2)$$

(2) smooth adaptation, if:

$$v_1 + u_1 + \Delta v_1 = c_2 + \Delta c_2$$

(3) potential overproduction in department I (cf. Schema C), if:

$$v_1 + u_1 + \Delta v_1 > c_2 + \Delta c_2 \quad (\text{Marx has: } v_1 + u_1 > c_2)$$

In effect the process of adaptation runs as follows. Ensuing upon a (positive) change in the rate of accumulation from a previous α' to a new intended α (requiring a relative increase of department I), (new) proportionality is established via a readaptation of the rates of accumulation α_1 and α_2 . In Marx's model the period of transition is short-cut by a pre-emptive readaptation for especially α_2 , thus absorbing any overproduction and evading downward spirals. In other words, upon the change of α_1' to α_1 , the Δc_1 (that is, $\alpha_1 \gamma_1 s_1$) is a constant fraction of c_1 , whence we have a constant rate of growth for department I. However $v_1 + u_1 + \Delta v_1$ (that is, $v_1 + (1 - \alpha_1) s_1 + \alpha_1 (1 - y_1) s_1$) is also a constant fraction of c_1 ; at the same time it determines $c_2 + \Delta c_2$ (that is, $c_2 + \alpha_2 + \alpha_2 (\gamma_2 s_2)$): the extra production of means of production in department I that it does not use up itself – department II cannot have more, only less; however, given the α_2 planned, it absorbs what is available. Therefore department II becomes chained to the growth rate of department I. (In this process of adaptation, department I thus dictates the course. The ownership of means of production for producing means of production is thought of as crucial: department II cannot expand unless I does.)

More so than the chapter on simple reproduction, the chapter on expanded reproduction reveals the defects of an unfinished draft and an unfinished analysis. Guiding Marx's generalizations is an adjustment of the condition for simple reproduction. However the adjustment is not carried through to its full extent; it is nevertheless effected in the numerical schemes. Even if unfinished, the power of the model is revealed very well. Heuristically it also leaves plenty of room for further analysis of dynamic processes. At the core of the model are the same fundamental macroeconomic abstractions, developed into a two-sector approach, as those of simple reproduction (equations (1) to (3)). Generally Marx succeeds in showing convincingly that, even abstracting from all sorts of further complications, proportionality between the two sectors – or generally, steady-state growth – is most unlikely. In the process of transition from one growth path to another, we saw in effect, as an interesting digression, the 'widow's cruse' mechanism: 'capitalists earn what they spend, and workers spend what they earn'.

MARX'S METHOD FOR THE THEORY OF REPRODUCTION AND CIRCULATION OF THE SOCIAL CAPITAL

With the case material of the previous sections we are now prepared to return to the initial questions in the introduction. What is the method adopted by Marx in the part of *Capital*, II, on reproduction and circulation of the social capital? Is the method akin to a modelling approach as we find it in modern orthodox economics? Does the approach fit into a systematic–dialectical methodology? We can be relatively brief in answering the first question. The second will take more time.

Precursor to the Modern Conventional Economic Modelling

Marx's text abounds with elements demonstrating similarities to modern economic modelling approaches. We find a set of explicit assumptions delineating the problematic in its – purposefully – core elements. We are then left with a set of variables and parameters ready for analysing the properties of their interconnection. Generalizations concerning the problematic can be drawn from this analysis. Although the main tool for the analysis is a numerical schema, we also find an elementary formalization.²⁹ The approach also contains a heuristic: the findings of an earlier model – simple reproduction – can be carried over to be adjusted for a model dealing with different or more complex phenomena – expanded reproduction.

If we add to this that a dialectics, at least a dialectical jargon, is almost absent from this text, at least apparently so (see below), it is no wonder that of all of Marx's economics this part especially has much influenced orthodox economics. Of course that is not just a matter of method. It is also the case that the content of the approach, the construction of a particular macroeconomics, was seen to be fruitful, especially for the theory of the business cycle and of economic growth.

So is this a decisive case for defending the thesis that Marx adopts a method of inquiry in line with formal logic, that is, not different *in principle* from modern orthodox economics approaches? The textual evidence certainly favours this view (this may of course be different for other cases).³⁰

A next question is whether there are any important differences distinguishing Marx's modelling approach from the conventional.

In this respect we may emphasize that Marx, as we have seen, adopts as a methodological requirement a particular abstraction procedure: the particular *designation of his representations* at an early phase of the exposition is intended to *anticipate later expositions*, earlier abstractions remain in force at later stages, albeit in modified form. We have seen this prominently in the carrying over of the condition for simple reproduction to expanded reproduction. This is in fact the case for many of the representations in *Capital*, II: they are still applicable, in modified form, when their underlying simplifying assumptions are dropped (for example, V: 162).

From the perspective of a systematic-dialectical methodology (see below) this requirement is no surprise. Most of the reviewers of Marx that question his systematic *dialectics* have at the same time no doubt that he adopts a systematic in his work. Even if dialectics and its particular way of logical proceeding are suppressed, the methodological requirement for abstractions (in anticipation of later exposition) enforces a *systematic* for presentation, as well as an order for the process of model building. In this case, as with a systematic-dialectics, the process of discovery cannot be the same as the process of presentation (an issue much stressed by Marx; see Marx, 1867:102).

First and Second Thoughts on Systematic-Dialectics

Let us now consider arguments stemming from this case for the view that Marx adopts a systematic-dialectical method. Two relevant issues will be discussed: first the general point of the (in)compatibility of 'model building' within a systematic-dialectical approach; second the specific point of the notebook status of the text.

For the *first* point I start with a contentious thesis: even if Marx's method were systematic-dialectic, it would not prevent the conceiving of *Capital* as a model of the capitalist economy.³¹ In this view, the term 'model' is itself neutral as to a particular logic and method of constructing models. However, since the capitalist system entails contradictory entities, relations and processes, a dialectical logic is most appropriate, as it is able to grasp contradictions. Hegel's logic, in this view, is the proper logic of and for capitalism.³² Several layers (parts) of *Capital* can next usefully be seen as 'sub-models', the one presented in this paper being a case of such a sub-model. In dialectical jargon it would be called a *moment*;

that is, 'an element considered in itself, which can be conceptually isolated, and analysed as such, but which can have no isolated existence' (Reuten & Williams, 1989:22). Indeed the great advantage of a systematic-dialectical method is that it is called upon to connect its 'sub-models' within the systematic whole.³³ If my initial thesis of conceiving the whole of *Capital* as a model is for some unacceptable, we may restrict the matter to conceiving particular moments as dialectical models, our case being a possible example.

This view, however, if useful at all, seems not particularly illuminating for the case at hand: a systematic-dialectical logic seems largely absent from it. Undoubtedly that is the first impression one gets from the text, but rather than leaving the point at that, let us list what one might expect for a systematic-dialectical text.

(1) An abstract-general starting-point. Of course for the case at hand this cannot be an all-embracing starting-point, as we are already under way (Part Three of *Capital*, II). However the case as a 'moment' may have its own relatively abstract-general starting-point. This can be well defended by the macroeconomic abstractions that Marx starts with.

(2) The positing of contradictions. Absent (but see below).

(3) The transcendence of contradiction. Consequently absent.

(4) Along with 2-3, a gradual conceptual progress, in layers of abstraction, towards concretization, distinguishing necessary from contingent moments. Although apparently not *along with* 2-3, one can show that aspects of this are happening in the text: notably the very move from simple to expanded reproduction (even if we were not to agree with Marx that the former is in some way essential – he *does* argue for it); and along with it there is obviously conceptual progress on the notions of reproduction and circulation, including money (even if this has not been emphasized in the present paper); indeed, after Part Three, we have a better grasp of Part One. A possible distinction between necessary and contingent moments, however, is awkward in the text, especially if we consider 'balance' and the 'normal imbalance' or even crisis. The text is unclear on this point. On the one hand, Marx convincingly shows the 'knife edge' of balance, whereas on the other at least a degree of balance must prevail for the system to exist at all (necessity). Of course this would have been an obvious point for grasping dialectically. So perhaps we can grant this point, though, to say the least, with a dialectics suppressed.

(5) Along with 2-3, showing the systematic interconnection of what is theorized, within the whole of the object of inquiry. Again,

although apparently not *along with* 2–3, the interconnection is shown: first that with the earlier parts of *Capital*, II, as well as with *Capital*, I (see p. 189 on the introductory chapter), secondly within the theory at hand (Part III) the interconnection of the elements theorized ranks high.

(6) Points 1–5 together determine the systematic for the proceeding. Generally transcendence of contradiction and the new problems created by it show the insufficiency of the previous theorization, and hence the way to proceed. Given the absence of contradiction and transcendence, at least explicitly, this kind of systematic seems absent from the text (even if there is the systematic of ‘anticipative abstraction’ referred to above).

Thus, on second thoughts, considering the six points together, perhaps the case is not that clear-cut methodologically? It is even less so if we bear in mind the emphasis in the text on the twofold character of the entities (material, value) (pp. 191 and 199–200 above). This, in retrospect, seems very much to guide Marx’s approach in this part, at least as far as the positing of the problems is concerned (in my view, the citations given on pp. 199–200 above, are the most thought-provoking of the whole text). The twofold character seems after all central to Marx’s schemes (which is no surprise in the face of the rest of *Capital*, especially Book I, Chapter 1).³⁴ Unfortunately, and this is perhaps misleading, the theme is not carried through systematically – at least not in a clear way. Manifestly so, not only do the major entities discussed (c_2 , v_1 , and so on) have a twofold character (value, material), but there is also a ‘redoubling’ in that they stand for two material guises, and their two value forms (for example, c_2 is means of production as well as means of consumption – emphasized in the guises it goes through in the capital circuit). This might have been expressed in a different notation, perhaps akin to the circuit models of Part One.

It must be emphasized that none of this affects the fact that within a dialectical presentation one can build in analytical ‘moments’. *Within* its restrictedness there is nothing wrong with formal logic or a formal model. They are indispensable tools in research practice; formal logic and formal modelling can have a proper place within systematic-dialectics (cf. Reuten & Williams, 1989:27). Rather it is the other way around that is difficult.

So where does this leave us? From point, 1–6 above we saw that, dialectically, a main defect of the text is that contradictions and their transcendences are not made explicit, and do not explicitly

lead the systematic conceptually. However, at the same time, there is the emphasis in the text on the twofold character of entities, which is the major contradiction of the system. In the text it is perhaps too often expressed abstractly, rather than at the level of concreteness that we have already attained. Nevertheless this is an obvious anchor for a systematic-dialectical presentation. All this, however, does not lead to the conclusion that this is a systematic-dialectical text. It is not. However there are arguments for conceiving it as *compatible* with a systematic-dialectical method.

This takes us to the *second* point, which can be dealt with briefly: the notebook status of Book II of *Capital*. It is rather speculative to argue about something that *might* have been if ... Nevertheless, to answer the leading question of this paper, this notebook status must be taken into account. All the more so since it is not only that, as we have just concluded, the Part Three text we have considered is compatible with a systematic-dialectical approach, but we also have the textual evidence of *Capital*, I and of Part One of *Capital*, II (see the paper by Arthur in the present volume) which are written in a dialectical vein, even if perhaps not perfectly from several points of view. I have no doubt whatsoever (partly because of personal experience) that a dialectical presentation is often preceded by an *analytical* stage of inquiry: even more so for the study of new problems. The dialectical hard work lies in the way of *systematizing* the material one has at hand. Indeed empirical inquiry and analytical inquiry are the building stages and material for a systematic-dialectic. From this we cannot answer the question whether Marx intended a systematic-dialectical presentation, let alone that of how the *kind of analysis* we find in the Book II manuscripts might have been incorporated in a dialectical presentation. It is rather that this notebook status strengthens the conclusion that the text we have considered is compatible with a systematic-dialectics methodology.³⁵

Conclusions

This case is fascinating. We see the construction of a macroeconomics with a powerful two-department division. We see the core problems related to the fact that a capitalist economy must materially reproduce itself for survival (generic) but cannot, inherently, do this without being a monetary economy at the same time (determinate). The two processes may not coincide. Consequently we see the 'knife-edge' of balanced growth together with the potentialities

for economic crisis, and thus the important groundwork for later theory on business cycles.

Methodologically the case is just as intriguing. It is a wonderful work from the formal-logical conventional modelling point of view. How, then, may the case fit other apparently systematic-dialectical parts of *Capital*? As I have indicated, the text is *not* systematic-dialectical, although it contains elements for developing such an approach. While the text is *compatible* with both methodological positions, the better arguments are on the conventional modelling side.

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Notes

1. Strictly the material for such interpretation comprises the three books of *Capital* (1867, 1885, 1894) and perhaps also the material for the planned fourth book, *The Theories of Surplus-Value* (1904/10). Various other works, however, may be relevant.
2. This position is most vehemently argued for by Smith (1990, 1993). Whereas he considers his work 'an interpretation', I see it as an original reconstruction.
3. Most of these authors at the same time emphasize the value-form theoretical elements in Marx: for example, Backhaus (1969, 1992); Eldred (1984); Eldred *et al.* (1982/85); Reuten & Williams (1989); Reuten (1993, 1995); Williams (1998). Arthur (1993) is a most important development.
4. Thus according to Engels's information, Notebook VIII was written in 1878. However the text contains references to two 1879 works, one of which was *The Nation* of October 1879 (p. 591).
5. It is more extensively dealt with in *Theories of Surplus-Value*, Part One (Marx 1904/10, pp. 308–44; 378–80) where we also find a representation of the *Tableau*. On Marx's appreciation of and inspiration from Quesnay, see Gehrke & Kurz (1995, esp. pp. 62–9 and 80–84).

6. See further Moseley in the present volume.
7. Successive abstractions/assumptions are indicated in bold letters throughout this paper.
8. The same assumption was already posited at the opening of Ch. 1 (II:109) and reasserted in Ch. 2 (V:153). Next the assumption is relaxed in the same chapter (V:162) and further discussed again in Ch. 4 (V:185–9).
9. Incidentally this seems relevant for some interpretations of the Book III value to price transformation.
10. See Murray (1988, Ch. 10) for the difference between generic and determinate abstraction.
11. If we had capital fixed for more than one production period, this would not affect the problem for the value calculations (as long as we refrain from investigating the rate of profit: cf. VIII:597); that is in case of simple reproduction and its schema. For expanded reproduction this would be different as part of surplus value would get accumulated into fixed capital – more than the expanded flow of constant capital. (Cf. Robinson, 1951, p. 16, discussing Luxemburg's schemes.)
12. Here the fourth column is total gross production (including intermediate production) and the third row is total gross expenditure (including intermediate expenditure). So for the shape of a modern Leontief input–output table (derived from the schema), one has to rotate the schema 90 degrees to the west, and move the initial third row to the outer east, with c_1 (4000) and c_2 (2000) remaining in the first quadrant of intermediate expenditure and production.
13. Or three times the year's labour of the community ... 'Tis with the proportions, rather than with the absolute accurate amount of these estimated sums, we are concerned' (William Thompson, *An Inquiry into the Principles of the Distribution of Wealth*, London 1824/1850, quoted by Marx, 1884: 398).
14. Although Marx uses his notation throughout the text, for example for the derivation of conditions of reproduction (see below), a full schema, like this one, is always cast in numerical terms.
15. In his notation: $\Pi_{(c+v+s)} = \Pi_{(v+s)} + I_{(v+s)}$.
16. Or in Keynesian symbols: $C = Y$. The question is whether the circuit aspect indicated in the quotation above can be grasped from the Keynesian formula. In the post-Keynes economics there is an ambiguity (at least) as to the meaning of Y . It is considered both 'real' net income as deflated by an index number (value-added in terms of a commodity index) and output (product) as deflated by an index number. This is not meant to be a 'contradiction' – in the post-Keynes economics these are both conceived of as commodity bundles, in each case looked upon from a different aspect. Note that to Keynes himself these indexes would have been a horror: he called them 'conundrums'.
17. In general, however, there is quite a conceptual distance between Quesnay's *Tableau* and Marx's schemes. See also Marx's version of the *Tableau* (1904/10: 308, 378).
18. Thus Kaldor is wrong when he writes that 'this model' [that is, "his" model] 'is the precise opposite of the Ricardian (or Marxian) one' (1955/6, p. 85). See also the end of his footnote 1.

19. These monetary aspects are dealt with in detail by Campbell in the present volume.
20. In the text these are mentioned as follows: Schema A = 'schema a' (pp. 581–5); Schema B = 'first example' (pp. 586–9); Schema C = 'second example' (pp. 589–95).
21. See pages 586 and 590. Note that for the preliminary Schema A, Marx assumes an intended rate of accumulation of 50% for *both* departments (p. 582). As we will see, that has no effect on the actual rate of accumulation for department II.
22. This also derives from the balance equation:

$$x_1 = (c_1 + \Delta c_1) + (c_1 + \Delta c_2)$$
 or from:

$$x_2 = (v_1 + u_1 + \Delta v_1) + (v_2 + u_2 + \Delta v_2)$$
23. In the literature the object of Marx's reproduction scheme is variously appreciated, especially the status of its 'accidental balance'. In my view Marx sets out the best possible case for capitalism (a case that lives up to the system's self-image), showing how unlikely it would be for its conditions to be met. As will be shown in more detail below, the difference between the 'intended' or 'planned' and the realised rate of accumulation is central to Marx's account. (In later theories of the business cycle a similar difference is that between 'ex ante' and 'ex post' variables.) Closest to my own account is that of Desai (see below). A review of that literature is beyond the scope of this chapter therefore I restrict myself to a few comments on three well known scholars in the field.

I cannot agree with Foley's (1986, p. 85) interpretation of what Marx is doing: it is not the case that Marx's *initial* schemes (period 1) were meant to represent reproduction for the *new* rate of accumulation (which they clearly cannot, as Marx indicates). Foley suggests that Marx merely wanted to find an adequate schema for 'period 1' and that the 'discrepancy' between the initial schema and the rate of accumulation 'annoyed Marx', and that he therefore 'devoted several pages of his notes to the attempt to find a schema that would exhibit proportional expanded reproduction'. No, Marx analyses the *process of change* following on from a change in the rate of accumulation. Koshimura (1975, pp. 17–19) equally neglects the transitional process.

Morishima (1973) hardly analyses the properties of Marx's schemes of expanded reproduction or the transitional process (pp. 117–20), concerned as he is to 'replace' Marx's 'special investment function' (department I's rate of accumulation determining the course) by what he considers the 'more reasonable' case for which capitalists of departments I and II 'have the same propensity to save' (p. 122). Whilst this precludes him from getting to grips with the logic of the schemes themselves, his exercise is of interest. In Morishima's reconstruction the model is one of unstable growth (with, depending on the compositions of capital, either explosive oscillations or monotonic divergence from the balanced growth path – p. 125). The account of Harris (1972) is along similar lines.

Desai (1979, pp. 147–53, 161–71), although he has a somewhat different view of the periodization from that outlined above, appreci-

ates the 'ex-ante' versus 'ex-post' character of Marx's schemes. His account de-emphasizes the level of abstraction at which the schemes operate and, consequently, we differ about the interpretation of the aim of the schemes. Desai also thinks that the dimensions of the schemes are 'labour-values' (so does Mandel, 1978, pp. 38) and that the schemes fail 'to pose the problem of expanded reproduction in the price domain'. On the first point he is wrong (at least, Marx says otherwise, for example on p. 473) and on the second he neglects Marx's view about its irrelevance for the problem at hand (see my comment on assumption f). Finally, and relatedly, he neglects Marx's emphasis on the twofold character of the entities he deals with. Therefore I cannot agree that Marx's problematic is 'entirely confined to the circuit of commodity capital'. (I do not want to disclaim the Marxian theories of these three authors in this field; however I am concerned here strictly with Marx's reproduction theory.)

24. Schema A has the same relevant properties as Schema B, except that it is somewhat simpler as the compositions of capital are equal. Its initial make-up is:

Schema A: expanded reproduction; production, period 1, initial regime

	c	v	s	x
I.	4000	+ 1000	+ 1000	= 6000
II.	1500	+ 375*	+ 375*	= 2250
	5500	+ 1375	+ 1375	= 8250

*Marx has 376, apparently to facilitate the calculations.

This might be a scheme of proportionality for a steady growth path of $g = 9.1\%$ ($6000 - 5500/5500$), if for both departments $\Delta c/s = 36.4\%$; $\Delta v/s = 9.1\%$; hence $\alpha' = 45.5\%$ (Marx does not mention this). The new rate of accumulation increases to $\alpha_1 = 50\%$. Note that for the new regime (end period 1) it just happens to be the case that $v_1 + u_1 = c_2$. But the same applied to Scheme B! Apparently Marx is then led to take this formula (much akin to the simple reproduction condition (F) as the starting-point for his analysis.

25. Marx uses the term this way (VIII: 595); α is of course linked to capital accumulated ($c + v$, abstracting from fixed capital) via equations (7) to (10).
26. The latter happens in Schema C. Whereas Marx lets department I dictate the course of things (α_1 fixed) – and whilst that may make sense within his line of thought – either or both of α_1 and α_2 might in principle be taken as semi-variables (with 'ex-ante' and 'ex-post' divergences).
27. It can be derived directly from either $x_1 = c + \Delta c$ or $x_2 = v + u + \Delta v$.
28. As I have indicated on p. 209, Marx sets out the interconnection in his numerical schemes; not quite, however, as generalizations. Nevertheless the latter are not difficult to derive from his schemes.
29. Numerical analysis in this field of economics was usual practice until the work of Kalecki (this is set out by Boumans, 1997).

30. Moreover this conclusion is not inconsistent with the view of Marx adopting a 'historical materialist' method of inquiry or a 'historical dialectics'. Historical materialism or historical dialectics might affect (1) the frame within which one places *Capital*, that is, this study of capitalism; (2) the particular questions addressed by Marx; (3) the way of attacking those questions (see, for example, the discussion about a given accumulation of capital and the prevailing ownership of means of production within the context of the degree of freedom in the models of simple and expanded reproduction, as well as the priority given to department I within the dynamics of the latter model on pp. 216–7 above); (4) his ontological and epistemological views; and (5) the categories he adopts (historically specific). All these, however, need not affect his method of reasoning, verification and presentation.
31. Many Marxian scholars, though certainly not all, would hesitate to adopt the term 'model' for Marx's or perhaps their own work, *even if* they do not consider Marx or themselves as working in a systematic–dialectical tradition. This is because they seem to identify economic modelling with some of the modern 'analytical' exaggerations of starting by just 'any' set of assumptions and playing on it with a mathematical tool kit.
32. See Arthur (1993). This reference to Arthur is not meant to imply that he shares this view of models. Of course these issues can be taken separately. One can hold that Hegelian dialectics is the proper logic for capitalism, while denying that it is compatible with 'modelling'.
33. Note that economists, and perhaps scientists generally, trained in mathematical and formal logical traditions of thought, may find it difficult that dialectical sub-models from different layers (levels of abstraction) are *conceptually different* from each other. To put it in orthodox language: if chapter 1 of a systematic–dialectical work, seemingly, defines money, the term 'money' may have a *different* meaning (richer, less abstract) some chapters later on. Thus in fact 'definitions' are not fixed in a dialectical method.
34. Even if that chapter in particular is a major achievement, one may have some dialectical complaints to make about it (see Reuten, 1993).
35. Note that systematic dialectics may not be inconsistent with historical dialectics in the same five ways as indicated in note 30. However, in this case, these five issues *cannot* be isolated from the specific systematic–dialectical reasoning, verification and presentation (starting-point, contradiction, conceptual development, levels of abstraction, and so on).

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Note: All years in brackets are the original dates of publication as referred to in the text; editions quoted from may differ and are provided where appropriate.

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