Value from Nowhere: a response to Dumenil and Levy (second submission)

Freeman, Alan

the University of Greenwich

8 August 2004

VALUE FROM NOWHERE: A RESPONSE TO DUMÉNIL AND LÉVY

Alan Freeman

The University of Greenwich

afreeman@iwgvt.org

Abstract

This paper was submitted to the *Review of Radical Political Economics* in response to 'The conservation of value: a rejoinder to Alan Freeman', by Gérard Duménil and Dominique Lévy (DL), published in *Review of Radical Political Economics* in 1999. The response was rejected by the Editorial Board.

The paper demonstrates that within DL's framework, either value is created in circulation or is proportional not to the magnitude of labour time that creates the product, but to the physical magnitude or use-value of the product. It shows that within the TSSI framework value is uniquely determined by the magnitude of labour time, and that the contradictions alleged by DL do not exist.

This is the second of two rejected responses. The first has been placed in the public domain at the same time as this one.

Keywords: TSSI, value, Marx, corruption

JEL codes: B50, B51

VALUE FROM NOWHERE: A RESPONSE TO DUMÉNIL AND LÉVY

Alan Freeman, University of Greenwich

afreeman@iwgvt.org

Introduction

'The conservation of value: a rejoinder to Alan Freeman' by Gérard Duménil and Dominique Lévy (2000) – henceforth DL – is a welcome response to the *Temporal Single-System interpretation* (TSSI) of Marx's concept of value. DL critique this from a standpoint they term the 'traditional concept of value', originating in von Bortkiewicz (1984)'s interpretation of Marx's value theory. This determines the value transmitted to the product, by any consumed commodity, *simultaneously* with the value of that commodity when subsequently produced, constraining the two to be equal. For TSSI this value, being transmitted *temporally*, is determined wholly at the time of consumption, independent of all subsequent magnitudes.[1]

Since Steedman (1977) simultaneism has divided. The *simultaneist-physicalist* (SP)[2] view says that the simultaneously-determined magnitude of the value of a product cannot in general equal the labour time required to produce it, being given by the use-value or 'physical size' of the inputs and outputs to production. TSSI authors agree with this. The *simultaneist-Marxist* (SM) interpretation of Marx says that the magnitude of value is in some sense given by labour time even under simultaneous valuation.[3] TSSI authors disagree with this.

TSSI however shows that the magnitude of value can be determined by labour time, generally and without contradiction, under temporal valuation. In sum, TSSI denies both the SM claim that it the magnitude of value can be determined by labour time under simultaneous valuation, and the SP claim that it cannot be determined by labour time at all.

DL's own chosen examples permit us to address both issues head-on. Section 1 deals with their core critique: rejection of the *conservation of value in circulation*, the logical cornerstone of Marx's treatment of the price-value relation. Marx argued that the total value in society cannot be modified by a mere change in prices or exchange of titles to goods in which no use-values are consumed, as is first spelt out in chapter 5, the lynchpin of Volume I:

> The sum of values in circulation clearly cannot be augmented by any change in their distribution…the capitalist class of a given country, taken as a whole, cannot defraud itself.

---

[1] DL refer to 'Freeman's sequential approach'. The terms 'temporal' and 'single-system' are now more general. TSS was discovered independently by several authors. See Freeman and Carchedi (1996); since this book, the work of Eduardo Maldonado Filho, Sungur Savran, Michel Husson and Brian Pinkstone in a similar framework has come to light.

[2] cf Mongiovi (2002). The term 'physicalist' was proposed by Ian Steedman (1977:72, 216-17)

[3] This comprises writers who work with Bortkiewicz's initial formulations (cf Laibman 1980, Shaikh 1981), the New Interpretation view upheld by DL and 'Simultaneous Single-system' approaches (cf Wolff, Callari and Roberts 1982, Moseley 1992)

> However much we twist and turn, the final conclusion remains the same, if equivalents are exchanged, no surplus-value results, and *if non-equivalents are exchanged*, we still have no surplus-value. Circulation, or the exchange of commodities, creates no value (Marx 1976:265-6, my emphasis)

He thus treated total value as an *invariant* of circulation, a principle that SM violates as we will show and as DL recognise. Under rising productivity – the normal progress of capitalism – this is not a problem because total SM value falls in circulation. But under the very conditions that DL single out as paradoxical for TSSI, SM value *rises* in circulation. That is, circulation creates value. Production cannot then be the sole source of value. Moreover even when productivity is rising, although simultaneous value added in a single period is equal to labour time, the total added over more than one period is not.

Section 2 shows that production can be made the sole source of value, consistent with simultaneously-calculated value ratios. The total value added over any more than one period is then, however, not then equal to the time worked but to the use-value created. SM therefore has two options. *Either* circulation is a secondary source of value – *or* the value added in production is given by use-value. In neither case can the magnitude of labour be determined by labour time.

In its general form, this contradiction becomes clearest on the terrain which DL prioritise, namely fixed capital, the subject of the section 3. The SP joint production treatment has never achieved a contradiction-free treatment of fixed capital, whereas temporal valuation, combined with a consistent treatment of use-value, determines the magnitude of value rigorously by labour time and provides a coherent account of moral depreciation.

1.   Value from nowhere

The core of DL's response is their 'productivity paradox' (2000:128), in which values rise while unit inputs fall.

They do not make clear exactly what they mean by a paradox. They may mean that TSSI is internally inconsistent. They would then need to show a contradiction between two propositions from TSSI itself. But they do not do this; they confront a temporal result, that values depend on history, with a simultaneist requirement, that values do not depend on history. They may mean that this TSSI result conflicts with Marx's own view. But they would then need to show that Marx's conclusions conflict with ours. They do not do this either. They may mean what they actually say, which is that TSSI values are unable "to account for some of the basic features of capitalism, in particular the analysis of technical change and historical tendencies." They would then need to show that in reality, values never rise while unit inputs fall. Neither do they do this.

Instead, they present a graph comparing TSSI predictions and SM predictions, comparing them neither with Marx's results nor with any observed phenomenon. As

it stands, this is not actually a proof of anything, so much as a sophisticated way of expressing discomfort.

The questions to ask are: first, what exactly are the circumstances that give rise to the TSSI result which DL consider paradoxical? Second, what results obtain for the SM value concept under these same circumstances? Third, which results correspond most closely to Marx's? Fourth, which corresponds most closely to empirical reality?

1.1. Fluctuating productivity

DL exhibit a situation where TSSI values rise continuously, despite continuously rising productivity of direct (but not indirect) labour. The problem can be examined in its simplest form by considering only two periods. It will then be seen that a third, prior period is implicit in their figures; the situation they examine could not have arisen otherwise.

DL consider a single-product economy in which the unit value is λ_t at time t. To clarify the basic issues I modify their presentation in two ways. First, I present the total quantities produced and consumed, not just the technical coefficients given by DL. In period t, living labour L_t transforms C_t units of the good into X_t units of the same good. Second, without loss of generality I suppose a zero wage and zero capitalist consumption, so that the whole output of one period passes as an input into the next. This eliminates secondary sources of variation, such as personal consumption, which do not affect the magnitude of value, isolating the effect of production and circulation. This not a hidden presupposition and all results can be reproduced without it.

In other words, I reconstruct the actual quantities consumed and produced in their example, on the premise that all outputs are consumed as inputs. To fix the quantities and provide rounded numbers, I suppose that the initial labour applied in period 1 is 44 units. This gives table 1.

Period	Consumed(C)	Labour applied (L)		Produced (X)
1	22	44	$\Rightarrow$	44
2	44	96	$\Rightarrow$	100

Table 1: Use-value consumption and output over two periods, DL's example

'Productivity' – defined either as the ratio of outputs to direct inputs or to labour – is thus rising. Under certain circumstances, TSSI values nevertheless fall, and this is what gives rise to DL's disquiet. What are these circumstances? TSSI values are determined temporally and therefore, as with all temporal determination, they depend on the initial value. We must therefore first specify the the value of the inputs consumed in period 1.

DL create their paradox by a special choice of *initial value* λ_1 which they give as 1.2. This means that the 22 units consumed in period 1 are worth

$$C_1 = 22\lambda_1 = 26.4 \qquad (1)$$

The TSSI calculation then proceeds as follows: the value of the product X_1 is equal to this dead labour 26.4, plus the living labour 44, giving a total of 70.4. The unit value of this at the end of period 1 is then given by

$$44\lambda_2 = 70.4 \qquad (2)$$

whence $\qquad\qquad\qquad\qquad \lambda_2 = 1.6 \qquad\qquad\qquad\qquad\qquad (3)$

In the temporal calculation this unit value is unmodified in circulation, likewise the total value $X_1 = 70.4$, which then enters production in the next period as constant capital C_2. The value of the output of the second period X_2 is then equal to this dead labour 70.4, plus the living labour 96, giving a total of 166.4. The unit value of this at the end of period 2 is then given by

$$100\lambda_3 = 166.4 \qquad (4)$$

giving $\qquad\qquad\qquad\qquad \lambda_3 = 1.664 \qquad\qquad\qquad\qquad\qquad (5)$

which is higher than λ_2. Thus temporal values rise while unit inputs are falling: DL's 'paradox'.

But what does the choice of $\lambda_1 = 1.2$ imply? Actually, it could not have been produced by either of the given technologies. It is lower than both λ_2 and λ_3 and thus must correspond to a hidden, historically prior, technology which must have been more productive than either of them. What could this technology be? The preceding period, which we can call period 0, would have had to produce 22 units of output with a unit value of 1.2 and total value of 26.4.

A variety of combinations of L_0 and C_0 can produce such a unit value. However a small amount of arithmetic shows that outputs per unit must be *less* than for period 1 for at least one of C_0 or L_0. Thus over the whole course of the example studied by DL, productivity is not unambiguously rising. It first falls, and then rises. These are the circumstances which produce what DL consider to be a paradox.

My results follow no matter which value of C_0 and L_0 is selected since the output of this period must be 26.4 value units. For illustration we suppose

$$C_0 = 11; L_0 = 13.2 \qquad (6)$$

in which case table 2 summarises the TSSI calculation.

Period	Consumed (C)	Labour applied (L)		Produced (X)	Output per unit of direct labour (X/L)	TSSI value per unit	TSSI total value
0	11	13.2	⇒	22	1.67	1.2	26.4
1	22	44	⇒	44	1	1.6	70.4
2	44	96	⇒	100	1.04	1.664	166.4

Table 2: Use-value consumption and output over three periods, DL's example

On the basis of table 2 we now compare the TSS value calculation with the SM value calculation. First, I want to draw attention to the key logical property at stake as shown in table 3. At the start of period 0, the dead labour inherited from the past was $11 \times 1.2 = 13.2$; the total living labour in all periods was $13.2 + 44 + 96 = 153.2$, and this is exactly equal to the value added to the final product which, at 166.4, is the original 13.2 + the 153.2 living labour.

Period	Consumed (C)		Labour applied (L)		TSSI total value
0	13.2	+	13.2	=	26.4
1	26.4	+	44	=	70.4
2	70.4	+	96	=	166.4
0 thru 1	13.2	+	57.2	=	70.4
0 thru 2	13.2	+	153.2	=	166.4

Table 3: Value consumption and output, TSSI calculation

The magnitude of the total value added over any succession of circuits of capital is the actual labour time employed over these periods, which therefore adds the same value, no matter when it was discharged. Its value-creating capacity is not a function of either time or productivity. As Marx (1977:137) puts it:

> The same labour, therefore, performed for the same length of time, always yields the same amount of value, independently of any variations in productivity.

Inductively, provided the magnitude of the initial value contributed at the beginning of the process is determined by labour time, it follows that the magnitude of total value is determined by labour time and hence that unit values are likewise so determined.

1.2. Value from circulation

I now ask a question DL did not, namely, what arises when these *same* circumstances are interpreted in the SM framework? Consider again table 2. What happens to total value between the start of period 0 and the end of period 1?

To labour the point: the requirement of the temporal calculation was that the unit value of X_0 should be the same as the unit value of C_1, that is, the value of period 0

passes unchanged into period 1. For SM, the unit value of X_0 must be the same as the unit value of C_0, not C_1. This leads to the same unit value for period 0, but for period 1

$$22\lambda_1 + 44 = 44\lambda_1 \tag{7}$$

whence $$\lambda_1 = 2 \tag{8}$$

giving $$X_1 = 88 \tag{9}$$

as the value of X_1. This simultaneous valuation is summarised in table 4

Period	Consumed (C)		Labour applied (L)		PS total value (X)
0	13.2	+	13.2	=	26.4
1	44	+	44	=	88
0 and 1	13.2	+	55.2	<	88

Table 4: Value consumption and output, SM calculation

This leads to the following conclusion: beginning at the start of period 0 with 13.2 hours of dead labour, contained in the initial inputs, $13.2 + 44 = 57.2$ hours of living labour were applied until the end of period 1. But the value of the resulting product is 88 hours. Value totalling 17.2 hours has appeared from nowhere, even though output per unit of labour has decreased. Indeed, the less labour is employed in the past, the more value-from-nowhere is created in the present.

The value added by labour in each period taken separately is proportional to the time of that labour, which is the basis of SM's claims. But when we consider several periods in succession, the total value added over all such periods is no longer given by the time worked. In particular over periods 0-1 it is greater.

This new value arose neither during period 0 nor during period 1 but between the two, when the 26.4 hours leaving the first period entered the second as 44 hours. This is because, under simultaneous valuation, prices cannot change during production. They must therefore change in circulation, which means that goods leave one period with a value different from that with which they enter the next. Circulation therefore becomes a secondary locus for variations in aggregate value. In the specific case of falling productivity, it becomes a *source* of value.

To show this, we consider in more detail the transitions from period 0 to period 1, adding also the transition from period 1 to period 2, but distinguishing the two main phases of Marx's circuit of capital, namely production (…P…) and circulation (C – M – C).

	C	…P…	C' – M – C	…P…	C' – M – C	…P…	C
	Period 0		**Period 1**		**Period 2**		
Period 0	*13.2*	*13.2*	*26.4*				
Period 1			*44*	*44*	*88*		
Period 2					*75.4*	*96*	*171.4*
Table 5: the full circuit of capital over three periods with SM valuation							

In each period of production taken separately, simultaneous calculation indeed preserves the identities of Marx's labour process. The value of the output of period 0 is equal to the sum of consumed constant capital (13.2) and living labour (also 13.2). The same is true in period 1. But in circulation, the 26.4 hours created in period 0 expand into 44 hours without any additional human labour and without destroying or creating any use value.

DL are untroubled by this possibility because they consider only rises in productivity. In moving from period 1 to period 2, 88 hours are reduced to 75.4 hours, a loss of 4.6 hours. DL suppose this presents no problems because value has been destroyed, claiming that 'Within the traditional concept of value, the extra labor embodied in the past is no longer acknowledged as socially necessary labor time, and vanishes.' (2000:130).

Like many qualitatively plausible accounts, this falls apart as soon as we examine the numbers; when productivity is falling this same concept gratuitously acknowledges, as socially necessary, labour that has not even happened.

1.3.   Marx, productivity, and changes in value

In summary, what DL have identified is not a paradox but a scientific choice: depending on the interpretation adopted either

Choice 1: values can indeed rise from a historically-low starting point when inputs are falling

or

Choice 2: circulation is a source of value.

This highlights the real thrust of DL's critique. In real life, of course values rise while unit inputs are falling, under the precise circumstances DL suppose: when input costs suddenly rise. This is why computer prices go up following a hike in chip costs, or manufactures following a rise in the cost of basics. *History matters*. The 'paradox' is that TSSI explains what really happens, while both SP and SM make it literally impossible.

But this is not the real point. The thrust of DL's case is not that TSSI contradicts reality but that it contradict Marx; to be precise, it conflicts with what their tradition

believes and claims Marx to be saying. As with all entrenched beliefs and all dogmatic claims, evidence is a salutory antidote. What did Marx (1977:131) actually say?

> In general, the greater the productivity of labour, the less the labour-time required to produce an article, the less the mass of labour crystallised in that article, and the less its value. Inversely, the less the productivity of labour, the greater the labour-time necessary to produce an article, and the greater its value. The value of a commodity, therefore, varies directly as the quantity, and inversely as the productivity, of the labour which finds its realization within the commodity.

Note in parenthesis that 'productivity' for Marx is a relation between labour and its product and has little to do with any other inputs. Still more central, it refers to the whole labour-time required to produce the article, not just that of the present period. It is the simple inverse of value: higher productivity is a smaller 'mass of labour crystallised in the article.' I find no evidence that Marx held values must track the productivity of living labour; there is no statute of limitation on the period over which the labour is discharged. Indeed otherwise productivity would depend on a statistical artifact, namely the period of time that we arbitrarily choose to study. The purpose of Freeman (1995) was to overcome this artificial limitation with a formulation independent of the period considered, a point DL do not address.

Choice 1 above thus conforms to a very reasonable approach to productivity that also 'makes sense of Marx'. Things are otherwise for choice 2, which implies something inconceivable for Marx and uncomfortable even for SP: circulation is a source of value.

2.   Joined-up circulation

DL's example thus reveals no contradiction within TSSI, between TSSI and Marx, or between TSSI and reality. It does reveal severe contradictions within SM. The underlying reason is that neither simultaneous values nor simultaneous prices can actually be the basis of exchange. Simultaneist authors never join up the dots. Everything happens in a single period; they never ask how outputs get from the producers of one period, in which one set of simultaneous prices reign, into the consumption of the next period when another set of prices reign. They do not consider the circuit of capital as a whole, as an alternating succession of periods of production mediated by exchange.

The dots can be joined up. We can replace the disconnected values of each period with exchange-compatible values that preserve simultaneous magnitudes. Then, however, we find that the magnitude of the value created over the totality of the circuit of capital is proportional not to the total time expended but to its physical product.

2.1. Value and exchange in the simultaneous Marxist interpretation

It is central to the SM approach that value is a special kind of price; that it furnishes a set of exchange ratios which hold under certain ideal or, in some variants, historically-existing conditions such as the immobility of capital. Hence for example:

> Let us consider an imaginary society of simple non-capitalistic production (i.e. Marx's 'Simple Commodity Production')…prices or exchange ratios between commodities must in the state of equilibrium be equal to the relative values. (Morishima 1973:28)

> Commodities exchange against each other on the market in certain definite proportions; they absorb a certain definite quantity (measured in time units) of society's total available labour force. What is the relation between these two facts? As a first approximation Marx assumes that there is an exact correspondence between exchange ratios and labour-time ratios. (Sweezy 1970:42)

But from table 5, goods cannot actually exchange at SM values. The capitalists in ending period 0 would receive 26.4 hours for their product, but at the very same time would shell out 44 hours to start period 1. If Marx made Sweezy's assumption, he was somewhat wide of the mark: 26.4 = 44 is not an approximation but a false statement.

This is not the end of the matter. For DL's single-sector example, prices of production are the same as values. And in same problem recurs with added contradictions for prices of production in the multi-sector case (see Freeman 1998) Thus in both SM and SP, *price* cannot function as price.

The simultaneous tradition has focussed so single-mindedly on how prices are determined that it has lost sight of what they do. Their function is to circulate the results of production, that is, to pass them from seller to buyer. But simultaneously-calculated prices cannot serve this purpose. A product cannot have two prices at the same time, one for the buyer and another for the seller; circulation imposes a determination omitted by simultaneism. Is this compatible with simultaneous valuation? Not if value is determined by labour time. If exchange relations are to sustain production relations such as those in table 5, the 44 hours entering period 1 must really be worth the same as the 26.4 hours leaving period 0; that is, a period 1 hour is really only worth $\frac{26.4}{44}$ of a period 0 hour. The value contribution of labour in each period is then not fixed by labour time but is an unknown, fixed by the requirement that goods should sell for the same price they are bought for.

Consider table 6, which amplifies table 5 to show the circuits of production. The last row contains the 'value-product of labour' – the quantity of value added to the product as a result of the expenditure of one hour of labour time. It can be seen that the SM principle is maintained *in each period taken separately*: each hour of labour time adds one unit of value. However this principle is secured at the expense of any reasonable regulation of exchange and as a result, an additional source of value has been introduced – circulation. The capitalists of period 0 sell goods worth 26.4 but

these very same capitalists find themselves without expending any extra labour in possession of the same goods, now worth 44, when they embark on production in period 1.

Let us now specify a new value unit to try and correct this failure. We will call this, to avoid any clash with previously-existing concepts, the 'exchange-compatible-simultaneously-calculated' value or ECSC value for short. To make it fully clear what is going on, The ECSC value of period 0 is given initially by 1 value-unit = 1 use-value unit. The ECSC value of period 1 is obtained by multiplying the output value by a *numéraire* which ensures that goods exchange properly at their values (which, we remind the reader, are also their prices in a one-sector system). This yields table 7.

		C …P…		C' – M – C …P…		C' – M – C …P…		C'
		Period 0		**Period 1**		**Period 2**		
Period 0	Use-value	11	13.2	22				
	Value	*13.2*	*13.2*	*26.4*				
Period 1	Use-Value			22	44	44		
	Value			*44*	*44*	*88*		
Period 2	Use-Value					44	96	100
	Value					*75.4*	*96*	*171.4*
	Value-product of labour		1/hr		1/hr		1/hr	

Table 6: full circuit of capital over three periods with value-product of labour = 1 value-unit per hour

This is compatible with exchange, and hence conserves value in circulation – but only because the value produced by labour is different in each period: in period 0 each hour contributes 0.83 units, in period 1, 0.5 units and in period 2, 0.58 units. In each single period, labour's contribution is proportional to labour time but the proportion itself varies from one period to the next.

		C …P…		C' – M – C …P…		C' – M – C …P…		C'
		Period 0		**Period 1**		**Period 2**		
Period 0	Use-value	11	13.2	22				
	Value	*11*	*11*	*22*				
Period 1	Use-value			22	44	c44		
	Value			*22*	*22*	*44*		
Period 2	Use-value					c44	96	c100
	Value					*44*	*56*	*100*
	Value-Product of labour		0.83/hr		0.5/hr		0.58/hr	

Table 7: full circuit of capital over three periods, in exchange-compatible simultaneously-calculated units

But the resultant value contribution is simply equal to the physical size of the output. It is independent of the labour expended. It is not true that 'the same labour … performed for the same length of time, always yields the same amount of value, independently of any variations in productivity.' To the exact contrary, the value

yielded by any amount of labour is always proportional to its product, independent of any variations in human effort.

Of course simultaneist Marxists could reject the idea that their values (and their prices) can serve as the basis of exchange. In this case, they must recognise circulation as a source of value. This allows us to see the logical choices at their disposal. One of two principles must apply leading to one of two conclusions equally incompatible with Marx's determination of the magnitude of value:

Option 1: commodities cannot exchange in proportion to their simultaneously-determined prices

Leading to **Consequence 1:** value is created in circulation

Option 2: commodities can exchange in proportion to their simultaneously-determined prices

Leading to **Consequence 2:** the magnitude of the value added by living labour over any length of time is proportional to the size of the physical product.

3. Fixed capital

The contradictions of both SP and SM, discussed above, are starkest, and the strengths of temporal valuation are clearest, when it comes to the question of fixed capital which is the topic of nearly half DL's paper. This shifts the terrain of the discussion from how the magnitude of value is determined, to whether in the general case it can be determined at all.

In the first part of their paper DL defend the SM view without acknowledging the SP critique. Yet their treatment of fxed capital, which I will call *joint physical production* (JPP) is peculiar to SP having been introduced by Sraffa (1962) and developed by the post-Sraffians.

3.1. *Moral depreciation*

We begin with a concept central to DL's critique, namely moral depreciation – when goods lose their value without being consumed. DL seem to think that under TSSI this cannot happen, making it a unique virtue of simultaneism.

To the contrary, moral depreciation is probably temporalism's most central concept. Our differences reside not in *whether* commodities depreciate morally but *when*. This in turn depends on *when* values and prices vary. Under temporal determination, values vary during production – which is why output values differ from input values. Hence, moral depreciation (like material depreciation) takes place during production. Simultaneous valuation, however, asserts that neither prices nor values can change while production is taking place. Moral depreciation then has to occur in circulation, since there is nowhere else for it to happen.

For the circulating capital models introduced by Bortkiewicz, and beyond which SM presentations rarely if ever go, this issue is obscured because the change in price appears as if it were a result of exchang, when it passes from one owner to another. But fixed capital exists in several periods in the hands of the same owner, and no such refuge is possible. Under simultaneous valuation, fixed capital has to have *two prices at one and the same time*, even though it is not circulated. On leaving one period it has the price of that period; on entering the next it has a new one. But these two instants are the same instant. Driven by this contradiction, the JPP approach reconstitutes fixed capital as a special kind of circulating capital.

JPP therefore treats the same commodity, at different times, as a different use-value, even though it performs exactly the same function. DL's defend this idea without seeming to come to grips with how contradictory it is. 'Fixed capital', they write

> is represented by a machine which can be used over two production periods. Its use-value remains unaltered – the new and one-period old machines produces the same amount, *b*, of the output – but it must be discarded after two periods.

But if the use-value of an old machine is 'unaltered', it is the same commodity. DL nevertheless state that:

> In place of the traditional conception of technology in which two machines of different ages are treated as two distinct commodities, Freeman substitutes a view in which they are considered as two distinct quantities of the same good…During a production process, a 'fraction' of the machines is consumed. (2000:133,135)

The only tradition in which this idea appears is the SP tradition. Freeman substitutes nothing; he merely re-iterates Marx's own approach, which is also the standard perpetual inventory method for evaluating fixed capital stocks. It is summed up by a simple principle: the use of a thing does not depend on its age.[4] A new machine therefore performs the same function as a new machine, differing in only one respect: its remaining life is shorter, that is, there is less of it. Hence Marx treats anything that has been in use for some time as qualitatively the same but quantitatively different; the same use-value with a *fraction* of its original size depending on how long it has been in use.

> Suppose a machine to be worth £1000 and to wear out in 1,000 days. Then one-thousandth part of the value is daily transferred to the day's product. (1977: 202)

> The lifetime of an instrument of labour, therefore, is spent in the repetition of a greater or less number of similar operations…It is known by experience how long on the average a machine of a particular kind will last. Suppose its use-value, in the labour-process, to last *only six days*. Then, on the average, it loses one-sixth of its use-value each day. (1977:204, my emphasis)

---

[4] unless age changes it into something genuinely different, as when wine turns into vinegar or when iron rusts. But this is really a process of production, a chemical or natural event which changes the nature of the object in question. Otherwise there would be no difference between frozen food and rotten food.

Since their own idea is difficult to accept if applied to any kind of continuous substance such as a raw material, DL divide the world of capital into two types:[5] circulating capital which ages without changing its use-value, and fixed capital whose use-value changes in every period.

The great virtue of the Marx/perpetual inventory method is that it leads to a uniform treatment. Circulating and fixed capital are treated not as different kinds of capital, but as different forms of existence of capital. The distinction is simply that between a flow and a stock, with which economics is reasonably familiar.

The JPP alternative is a perilous source of complication. For example, *how often* does this change in use-value take place? Every year? Every month? Every second? And what happens if a machine is stored without being used? Is the change in use-value uniform, whether or not there is any wear or tear? DL do not even discuss or assess these conceptual difficulties, preferring to dismiss the alternative by the rhetorical device of speaking as if it were an eccentric deviation from an authoritative tradition.

'Freeman's line of argument in *Age Doesn't Matter* (254-255) is difficult to follow,' say DL,

> He first considers the example of an imperishable raw material: copper…However, Freeman's analysis breaks down when he extends this assumption – not a simplifying assumption, but the establishment of a new approach – to all constant capital, circulating or fixed. In our view, age matters. (2000:135)

There is nothing new or even particularly difficult in a view which simply re-iterates what Marx and the national system of accounts both take as standard. This doesn't make DL wrong but it does call for humility in presenting the alternative. When they say the analysis 'breaks down' actually they just mean they don't agree with it.

The distinction does not solve their problem. All difficulties associated with, say, a machine made of iron that lasts five years, are undiminished for a batch of iron ingots which are consumed over five years. All capital exists simultaneously as stock and flow, just as a river fills its banks in the very act of running past them. The only effective distinction is between those stocks that are exhausted within a period and those that outlast it, and in the last analysis even this is an arbitrary construct since there is no natural basis for taking the 'period' to be a year, a quarter, or a week. Thus Marx, above, is prepared to treat even six days as a period.

Just as in the treatment of value discussed in the first part of this paper, there are a basic choice to be made.

Choice 1: every commodity is a quantity, possibly fractional, of a single use-value

or

---

[5] A distinction first proposed by Walras (1984:212), who attributes it to his father.

Choice 2: everything which persists for more than one period becomes a new use-value.

Temporalism is founded on choice 1 and JPP on choice 2. It is hardly surprising that the two approaches are contradictory since they offer different definitions of the most basic object in economics, namely, what a commodity is used for. DL, as with circulating capital, claim to have found a contradiction *within* temporalism when they in fact present a difference *between* temporalism and simultaneism.

The clearest proof is that their alleged contradictions vanish once their production system is consistently temporalised on the basis of choice 1, as I will now show.

3.2.   Whose contradiction?

Before proceeding to the substance of the matter, it must be noted that DL's critical method becomes particularly disturbing at this point. JPP is by no means a working theory against which upstart alternatives can be tested Bourbaki-style as if there was nothing problematic about them. It has many contradictions of its own, including not just negative values but negative prices (cf Pasinetti 1980, Duménil and Lévy 1988). In a nutshell, it doesn't work. It is far from clear what has been established if it still doesn't work when it is temporalised.

'The problems faced by the sequential definition of values in the traditional modeling of fixed capital seem insuperable', they write (2000:134). Indeed so. However Darwin faced similar difficulties reconciling evolution with Creationism. This does not make a case against Darwinism. If two concepts are incompatible, no *a priori* principle tells us which is at fault. The only scientific way to compare two theories is to develop each *in its own terms* and then check the two results against reality.

3.3.   Paradise lost: contradictions of the JPP approach

DL present a simple model which I exhibit in table 8; I have supplied numbers to make the presentation easier to follow. There are two processes of which one uses new machines and one uses old machines. The product is also a machine. A new machine produces ¾ of a new machine and an old machine. An old machine produces ¾ of a new machine. Table 8 gives the quantities of each type of machine, and of living labour, that is consumed in each process.

Process	New	Old	Labour		New	Old
1	4		2	$\Rightarrow$	3	4
2		4	2	$\Rightarrow$	3	

Table 8: Joint production of fixed capital, JPP model

'Fixed capital,' say DL (2000:134) 'is represented by a machine which can be used over two production periods.' They then 'sequentialize' this, treating the left side as the start of a period, and the right as the end of it.

However two contradictory representations of time have now been introduced. Processes 1 and 2 both happen at once, in a single period, but process 2 uses old machines: where did it get them? They can't exist until new machines have been partly used. Do the capitalists find conveniently pre-used machines on the market? Where did they come from?

The machine as a whole, in its new and old incarnations, lasts two periods. In which period is its value determined? If in period 1, then we have a remarkable result: the values of the second period are completely determined before it even happens. But if in period 2, then the values of period 1 are determined by labour which has not yet been discharged.

Indeed it is hard to see how value in these two periods can even be determinate. If capitalists begin as is normal with a new machine, the first period should read as in table 9 and the second as in table 10:

New	Old	Labour		New	Old
4		2	$\Rightarrow$	3	4

Table 9: JPP production fixed capital, period 1

New	Old	Labour		New	Old
	4	2	$\Rightarrow$	3	

Table 10: JPP production fixed capital, period 2

But in each period there is now one equation with two unknowns. Moreover, period 2 has a negative physical net product of old machines and period 1 has a negative net product of new machines.

Simultaneous calculation is thus only possible if we abandon the fiction that a single machine lasts two periods. The JPP process described by DL is actually a one-period process using two different machines. As in intertemporal equilibrium analysis in general, *distinctions of use-value substitute for distinctions of time*. Simultaneous calculation is only possible if all vintages are simultaneously active. In reality this cannot be; a year-old machine cannot exist until a year after the first new machine. JPP avoids this by treating a year-old machine as a different machine altogether. Because real time has already been abolished, it has to be replaced with a fictitious time that has broken loose from the actual production process and embedded itself in the commodities.

This approach leads to well-known contradictions to which we are happy to add another. If an old machine really is a different "good" then why should it produce the

same unit outputs? It is very reasonable to suppose old machines produce less, for example that each old machine produces 1.2 units of output, whilst each new machines produces 1.25, giving table 11.

New	Old	Labour		New	Old
4		2	$\Rightarrow$	10	4
	4	2	$\Rightarrow$	5	

Table 11: Negative JPP values

There is a physical surplus of everything and indeed the product of the old machine is not only numerically bigger but more productive than itself. Yet it has a negative value of –0.05. By what right is such a system proposed as a standard against which to judge others?

3.4. *Paradise regained: the temporal solution*

DL develop their contradictions out of a hybrid formalism, supposing that an old machine is still a different use-value, but has a value that is half that of a new machine. They claim that

(1) Inconsistent recursion relations arise; that of the first process is different from the second ;

(2) Divergently oscillating and negative values arise; the value of old and of new machines oscillate with divergent amplitudes eventually becoming negative.

These contradictions vanish once it is recognised that old and new machines have the same unit value, whilst the two 'processes' in which they participate create different individual values. First, therefore, we must treat both machines as having the same use-value and recognise that the old machine has *half the use-value* of a new one. Any change in value is a by-product of this. Secondly, DL form the value of the old machines separately from that of new machines, which is impossible if they are the same use-value. If there is only one use-value, the average value should be formed together over the whole of this use-value.

We accordingly correct the use-values in their table to reflect the fact that an old machine is simply half a new machine. I maintain two distinct processes not because I think this is the right way to proceed, but to demonstrate that DL's alleged contradictions arise only from the imposition of a concept of use-value incompatible with the passage of time.

Process	New	Old	Labour		New	Old
1	4		2	$\Rightarrow$	3	2
2		2	2	$\Rightarrow$	3	

Table 12: Corrected JPP use-values (changes to DL shaded)

They speak as if there were two values involved, the value λ_1 of new machines and λ_2 of old machines. Actually there is only one market value which we will call λ. However the individual value transferred to the stock of machines by each process is different and can be distinguished (as they require). We adopt the following notation:

$$\lambda^1 = \text{individual value of machines created by process 1}$$

$$\lambda^2 = \text{individual value of machines created by process 2}$$

Process 1 transfers $4\lambda_t+2$ units of value to machines whose use-value totals 5, and process 2 transfers $2\lambda_t + 2$ units of value to machines whose use-value totals 3. This gives table 14

New	Old		Labour		New		Old
$4\lambda_t$		+	2	=	$3\lambda^1_{t+1}$	+	$2\lambda^1_{t+1}$
	$2\lambda_t$	+	2	=	$3\lambda^2_{t+1}$		

Table 14: Individual valuation of fixed capital

In summary:

$$5\lambda^1_{t+1} = 4\lambda_t + 2 \tag{10}$$

$$3\lambda^2_{t+1} = 2\lambda_t + 2 \tag{11}$$

and for example if $\lambda_t=1$ then $\lambda^1_1 = 1^1/_5$, $\lambda^2_1 = 1^1/_3$. The market value λ_{t+1} is given as an average over all 8 units of output thus:

$$8\lambda_{t+1} = 5\lambda^1_{t+1} + 3\lambda^2_{t+1} \tag{12}$$

$$= 5 \times 1^1/_5 + 3 \times 1^1/_3 = 10, \text{ whence } \lambda_{t+1}=1.25$$

This gives consistent recursion relations with no divergence.

3.5. *In defence of simplicity*

We have shown that choice 1 above is consistent, contrary to what DL claim. Does this make it better? In and of itself, no, since despite its limited range of applicability JPP is an approach consistent with its own assumptions. However no impartial reader can rest entirely neutral in the face of a different criterion, namely DL's *own* proposal, with which I substantially agree:

> 'Excessive complexity must be avoided. Complexity often hides important implicit assumptions. Moreover, it is typically distorted in one specific direction. (One aspect of the model is abusively developed while others are treated simplistically). A model must also be susceptible to generalization'

What could be more complex than machines whose value contribution can only be calculated from a terminally obscure branch of linear algebra which yields such

patently ridiculous answers such as negative values and prices? What more could be a more abusive development than supposing that at every instant in time every machine in the world becomes a different machine? What could be more simplistic than studying the whole of capitalist reproduction without the slightest attention to circulation? What is less susceptible to generalisation than an approach which in nearly a hundred years of development has still not made it past the first post of providing a systematic and consistent treatment of fixed capital?

The most damning objection to JPP which emerges from our analysis above is that it is *not necessary*. The TSSI approach to fixed capital is simple, general, up-to-date and generates no logical contradictions. It ain't broke; why fix it?

Most important of all – we will argue in our final section – the approach is also Marx's. The real question is, hence what is the justification for fixing *Marx*?

4.   Marx, or marxism?

A central thrust of DL's critique is the rhetorical claim that Freeman's approach to fixed capital is, as previously noted, an eccentric deviation from a well-established tradition – a tradition which, as I have shown, is really another name for one particular theory, namely SP, associated with one particular interpretation of Marx, namely SM. They thus avoid a genuinely scientific process of comparison, which would consist of fully developing each theory, and each interpretation, in its own terms, and then testing each against the evidence.

I also seek to establish in which theoretical tradition each such approach belongs, precisely because I seek such a scientific comparison. However the most essential prerequisite to this endeavour is precisely that which DL most studiously avoid, namely a proper examination of what Marx's own views were. Science is a practice that confronts reality with the whole range of theories that might explain it; for this purpose it must know what each theory actually is. In Marx's case this is not done; this theory is falsely excluded from the confrontation on the grounds that it is 'inconsistent', and what is actually subjected to test are a series of 'corrections' of Marx which are really distinct theories in their own right. The question 'which theory is under discussion?' therefore *matters*. I therefore now consider the hermeneutic question: is 'Freeman's' approach to fixed capital a valid interpretation of Marx's approach to fixed capital?

Marx treats a part-used good as a fraction of an unused good.[6] A moment's reflection reveals that this change in use-value is independent of moral depreciation, which is in turn a variation of value independent of use-value.[7] To consider Marx's six-day use-

---

[6] In general this need not be the fraction of its life which remains; if we knew that halfway through its life, a machine was one-third as useful, there is no reason not to estimate its use-value on that basis. The decisive point is that being qualitatively the same, it is quantitatively a definite fraction of the use-value of a new machine.

[7] John Ernst, on OPE and in private correspondence, adopts a different approach to valuing old machines, and there are differences also with other TSS scholars. The conception put forward here is my own.

value cited above, after three days have elapsed, one machine becomes half a machine.

Moral depreciation, a decline in value, simply applies *pro rata* in the normal way: if an unused machine was valued at £3 and after three days is worth £2, then a half-used machine (that is, half a machine) will be worth £2 × $\frac{1}{2}$ = £1.

But values are formed as an average over all individual values as Marx (1977:985) specified in the unpublished *Results of the Immediate Process of Production*, originally intended as chapter VI of volume I: the value of any commodity is the total value of all instances of this commodity, divided by the total use-value of the same. It is an obvious and reasonable extension of what Marx wrote on the subject, which contradicts nothing else in his theory or writings, to suppose that this extends to existing stocks of capital as well as newly-produced capital. If a new process comes on stream, turning out some good more cheaply, then the social value of the product is an average over the total of both the new and pre-existing stock of this good, producing a social value lower than that of the existing stocks, but higher than the individual value of new production. The more old products and the less new ones, the less the decline in value so that initially, the new goods enjoy a high social value which declines as the stock of this good is replaced by the output of the new technology. Consequently on the one hand innovators enjoy a superprofit and on the other, the holders of stocks suffer a loss.[8]

Moral depreciation is thus not an absolute loss but a transfer to the producers of the cheaper products, who sell them above what they would fetch, were there no such stocks in existence. DL (2000:123) seem uncertain about where I stand on this question:

> One problem for the value conservation approach is the possible coexistence on a market of commodities produced at different periods. This issue is not discussed clearly by Freeman, but we can surmise his view from his equations. (p3)

It certainly is discussed. (Freeman 1995:255) writes:

> Once a unified market is established, value and price emerge as an average over all the output of society. Marx concentrated his attention on the relation between individual producers and this market value. But everything he wrote logically applies to the entire stock of society; it would not make sense to exclude any portion of this on the basis of an arbitrary accounting separation which adjudges it an output of the 'last period' and therefore ineligible to take part in the formation of a uniform market price.

I think this coincides with what Marx writes on the subject of stocks:

> If an increase in the price of raw material takes place with a significant amount of finished goods already present on the market, at whatever stage of completion, then the value of these commodities rises and there is a corresponding increase in the value of the capital involved … if

---

[8] Offering a rather straightforward explanation of a not unimportant phenomenon: the systematic divergence of the average incomes of the technologically advanced and technologically deprived nations. See Freeman (1996)

there are substantial stocks of raw material in the warehouse, they counteract the price increase arising from the conditions of their production.

> The reverse is the case with a fall in the price of raw material…the smaller the amount of stock to be found *in the production sphere* and on the market at the end of the business year, at the time when raw materials are supplied afresh on a massive scale (or, in the case of agricultural production, after the harvest), the more visible the effect of a change in raw material prices.(1978:208, my emphasis)

Lest it be argued that Marx is discussing only market price fluctuations, his next remark clarifies the matter:

> Our whole investigation has proceeded from the assumption that any rise or fall in prices is an expression of real fluctuations in value. But since we are dealing here with the effect that these price fluctuations have on the profit rate, it is actually a matter of indifference what their basis might be. [9]

The conservation principle is central: the only way that value can be destroyed is through the destruction of the use-value in which it is embodied, and the only way it can be created is through the application of labour. Of course, this use-value may be destroyed wastefully as when a machine is prematurely retired from production, or when stocks are left unsold and unused.

In each production process, the value added by living labour over any period of time is added to the value transferred by consumed constant capital to create definite magnitudes of new value embodied in definite commodities. For each such commodity, this new individual value is *averaged* over all processes that create that commodity and all unconsumed stocks of that commodity. End of story.

The resulting straightforward calculation is fully developed in Freeman (1995). Value added in production is always exactly equal to the labour time worked. Negative values are impossible except under conditions that are themselves impossible such as negative labour. In short, it works, and it makes sense of Marx.

5.   Conclusion: the way to a dogma-free debate

The greatest difficulty in any debate seeking testable answers is to agree on the questions.

It may help to clarify what is not in question. 'We are familiar with [AF's] criticism,' write DL (2000:121) 'it means that all Marxist economists who used in the past, or are still using, the traditional conception of values are actually neoclassicals.' No, it doesn't mean that. The discussion is about theories, not individuals. Using a Walrasian theory does not make one a Walrasian. No TSSI author has any interest in pejorative personal labelling, not least the insulting yet widespread designations

---

[9] This remark has received less attention than it deserves: it is in my view one of the clearest indications that Marx considered the value transmitted to the product by capital to be given not by the value of constant capital but by its price, measured in hours as a claim on an aliquot part of the labour embodied in commodities. It counters DL's claim (2000:127) that TSS substitutes a 'labour-market-price' theory for Marx's value theory. Single-system determination affects only the value *transferred to the product*, to which is added living labour to give the value of the product, which is thus perfectly distinct from its price.

applied to any attempt to examine, on the basis of evidence, whether Marx's own theory makes sense – 'fundamentalist', 'orthodox', 'scholastic'. These have become a simple rhetorical device to avoid confronting this evidence, insinuating that as the work of irrational bigots, it needs no reply.

However the theories themselves do need to be characterised, not abusively but objectively. Science tests reality against a range of theories. It must therefore know what theory it is testing. Unless the theory in question really is Marx's, it is utterly illegitimate – though a stock-in-trade of both Marxist and neoclassical critics – to assert that Okishio has proven Marx's theory of the falling profit rate to be false.

Our central question is therefore the very issue which the whole of DL's 'tradition' systematically evades: *why* does simultaneous Marxism yield contradictory results? Is it because *Marx* contains contradictions or because the *SM interpretation* of Marx contains them? Actually, addressing this question is the only road away from the dogmatism, entrenched positions and turf wars that have so far dominated discussions on value. The decisive problem is not to settle in advance which theory is 'wrong' or which is 'right' but to ascertain precisely what each one says.

That is the intention of this article. At no point did I say that TSSI is necessarily right, nor that SM or SP is necessarily wrong. I did not highlight the many contradictions of the SP view except to question its adequacy as a standard from which to judge others. My aim was instead to exhibit the *logical consequences* of the two principal paradigms, temporal and simultaneous. Paramount amongst these are:

(1) The magnitude of simultaneously-determined value cannot equal labour time.

(2) The magnitude of temporally-determined value can equal labour time.[10]

Neither logical characteristic excludes anything as a theory of the world. Taken together, however, they disqualify SM as an interpretation of Marx. To put it another way Marx could not possibly have sought to assert what SM attributes to him. To draw out the central conclusion, since all disproofs of Marx's transformation procedure, and theory of the rate of profit, apply only to the SM interpretation, these proofs are themselves invalid.

Simultaneism then has two courses open to it. The first, which we have always urged, is that it can and should cease claiming to speak for Marx and come forward openly with independent theories of Marxist provenance. No TSSI author has any objection, for example, to assessing the impact of long-run equilibrium prices on observed profit rates. The issue is whether this conveys anything about the theory expounded in the pages of *Das Kapital*.

---

[10] These words are carefully chosen. There is only one possible simultaneous valuation but many different temporal valuations, of which TSSI is one. Others include Kaleckian and Austrian valuations, circuitist positions (cf Graziani 1997) with Marxist variants (cf Realfonzo and Bellofiore 1996), as well as the physical valuation exhibited above, this latter being the only possible temporalisation of the SP system.

The second alternative is to *discuss the evidence* that Bortkiewicz speaks for Marx. In this way we can resume a proper scientific agenda, debating on the one hand the evidence concerning Marx's actual views and on the other, whether these views correspond to reality.

The problem, exemplified by DL's article, is a persistent refusal to follow either of the two very reasonable courses of action that could lead to a constructive discussion. Instead, SM and SP authors alike persistently attempt to show that temporal determination of value is not possible – Since proposition (1) above is generally, albeit grudgingly, recognised to be true, this is the only way they can avoid the central conclusion of (1) and (2) taken together. The basic response to TSSI has therefore been to try and demonstrate that it is somehow unworthy of proper consideration; that its results are a fake, a concoction of smoke and mirrors with a logical black hole at the centre, an artifice of fanaticised imaginations.

No reasoned debate is possible on such a basis. Arguments and evidence cannot figure in discourse with critics who say the argument cannot exist and the evidence is not worth considering.

But there is no logical hole. There is no fakery. There is no fundamentalist crusade. There is no smoke, no mirror. There is a serious debate to be held, and far too much time has been wasted not having it. Temporalism, the evidence shows, interprets Marx's theory consistently. It shows that production can be coherently conceived both quantitatively and qualitatively as the outcome of human labour. This may be empirically wrong or it may be empirically right, but theoretically it works. Simultaneism, the evidence shows, makes it impossible to conceive of production as the outcome of human labour. This too may be wrong or right – but it is utterly unscientific to continue refusing to test both accounts, on an equal basis, as scientists since Galileo have done, against the evidence of the senses.

6. References

Papers of the International Working Group on Value Theory (IWGVT) are available on
www.greenwich.ac.uk/~fa03/iwgvt

Bortkiewicz, L. von (1984), 'On the Correction of Marx's Fundamental Theoretical Construction in the Third Volume of *Capital*', in Sweezy (1984), *Karl Marx and the Close of his System*, Philadelphia: Orion Editions

Duménil, G. and Dominique Lévy (2000), 'The conservation of value: a rejoinder to Alan Freeman', Review of Radical Political Economics, Vol. 32, No. 1, pp 119-146

_____ (1988), 'Linear Joint Production Models: Prelude to a Reassessment of the Classical Legacy'. *Political Economy: studies in the Surplus Approach* Vol 4, number 2

_____ (1989) 'Labor Values and the Imputation of Labor Contents', *Metroeconomica* 40(2):159-78

Freeman, A. and Guglielmo Carchedi (1996) (eds.) *Marx and Non-Equilibrium Economics*, Cheltenham: Elgar.

Freeman, A. (1995) 'Price, value and profit – a continuous, general, formulation' in Freeman and Carchedi (1995)

_____ (1998) 'The Limits of Ricardian Value: Law, Contingency and Motion in Economics', presented to the 1998 conference of the Eastern Economic Association

Graziani, A. (1997), 'Let's Rehabilitate the Theory of Value', *International Journal of Political Economy*, 27(2), pp. 21-5

Kliman, A. and Ted McGlone (1988), 'The Transformation non-Problem and the non-Transformation Problem', *Capital and Class*, 35, Summer, pp56-83.

Kliman, A. (1988), 'The Profit Rate Under Continuous Technological Change', *Review of Radical Political Economics*, 20:2 & 3.

Laibman, D. (1980) 'Exploitation, commodity relations and capitalism: a defence of the labor-value formulation', *Science and Society* Vol XLIV, No. 3, Fall 1980, pp274:288

Mandel, E. and Alan Freeman (eds) (1984) *Ricardo, Marx and Sraffa*. London: Verso

Marx, K. (1975) *Early Writings*. Harmandsworth: Penguin

Marx, K. (1976) *Capital* Volume 1. Harmandsworth: Penguin

Morishima, M. (1973) *Marx's Economics: a dual theory of value and growth*. Cambridge: CUP

Pasinetti, L. (1980) *Essays in the theory of Joint Production*, London and Basingstoke:McMillan

Realfonzo, R. and Riccardo Bellofiore (1996) 'Marx on Money'. Presented to the 1996 conference of the Eastern Economic Association

Shaikh, A, (1981) "The Poverty of Algebra" in I. Steedman(ed) *The Value Controversy*. London: Verso

Steedman, I. 1977. *Marx After Sraffa*. London: New Left Books.

Sraffa, P. (1962) *The Production of Commodities by Means of Commodities*. Cambridge: CUP

Walras, L. (1984) *Elements of Pure Economics or the Theory of Social Wealth*, Philadelphia: Orion Editions (l984).

Wolff, R., Bruce Roberts, B. and Antonio Callari (l982), 'Marx's (not Ricardo's) "Transformation Problem": A Radical Reconceptualization', *History of Political Economy*, Vol 14 No. 4., pp 564-582.