

## REPLY TO SOME OBJECTIONS

Alan Freeman March 10 1997

In his preface to the paperback edition of *The Death of Economics* Ormerod (1995:vii) wryly notes reactions instantly recognisable to anyone who has ever had the temerity to challenge the economics profession:

The reviews by orthodox economics have in many cases been hostile, some to the point of abuse. The nature of the criticism is twofold. First, that economists are already aware of the problems which I raise for the discipline, and indeed the reviewers themselves know far more about them than I do. Second, that the book is plain wrong. Despite the contradictory nature of these two arguments, some economists appear to subscribe to them both at the same time.

Because economics as a profession runs on doctrine, no amount of reason can shift its general stance. The matter is different with individuals within that profession. The mere fact of holding this conference testifies to a very healthy development: it is at least possible for individuals with every conceivable reading of Marx to advance their understanding in a genuine, if passionate, exchange of views. The following remarks are addressed not to the obdurate or wilfully obstructive but to try and respond to several serious and constructive objections that we have received, in the course of four years' development of our positions.

### Accumulation and the falling rate of profit

The temporal calculation confirms Marx's much-disputed theory of the tendency of the rate of profit to fall. This result is so counter-intuitive that the reaction of many critics is not to explain it, but to explain it *away*.

Yet, in money terms it is a completely reasonable and coherent idea. Accumulation, measured in money, simply means that in each time period, a certain monetary sum is added to capital. Let us suppose, for example, that a business starts with £1000 and that each year, £300 of this is turned over of which £100 is spent on raw materials and depreciation and £100 in wages, and that annual profits are £100. Suppose further that the capitalists each year consume £50. In that case in year 1 we have:

Initial stock	£1000
Less outlays	(£300)
Plus revenue	£400
Less expenses for idle rich (£50)	
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New capital stock	£1050

and as long as there is any positive investment – that is, as long as the capitalists do not disinvest in money terms – this must raise the magnitude of capital stock, measured in money. This is, moreover, true *whatever* measure of money is adopted. It does not mean that the capitalists never disaccumulate. On the contrary, that is what a slump consists of. In a slump, the capitalists do not cease producing. They merely lower the level of production to a point where in money terms, because earlier technical changes are still working their way through the system, the moral depreciation of the capital stock causes it to fall in money terms.

So it should be considered why the idea of an ever-increasing capital stock, which is intuitively quite reasonable when thought of like a business, in terms of money, appears so intuitively *unreasonable* to the neoclassical reading of Marx.<sup>1</sup>

Sherlock Holmes once remarked that, when one eliminates the impossible and is left only with the improbable, this is the answer. Having eliminated the possibility that there is a mistake in the actual arithmetic of the temporal calculation, we are left with a different alternative: something is wrong is the neoclassical intuition.

The question I place before those who say that our results are counter-intuitive from a use-value perspective is this: how do *you* square the alternative, simultaneous conclusion with the actual, very simple accounting equations imposed on normal business by the simple rule that investment always adds to stock?

## Accounting identities

A comment, rather than an objection, in Duncan Foley's (1997) review of our book is that the last chapter, where I attempt a general mathematical formalization of Marx's determination of value by labour-time, merely provides accounting identities.

I have a number of responses to this important comment. In the first instance, it is incompatible with the objection that the temporal calculation violates the conservation of value (value can be created only in production), a principle which I emphatically agree was a core aspect of Marx's concept of value. For, the accounting identities in my chapter expressed precisely this principle and demonstrated that under completely general conditions (no restrictions on the time-path use-value flows or on prices realised in circulation) value is strictly conserved. I do not quite see how one can simultaneously observe that it is a mere identity, and complain because it is violated. An identity is precisely that which cannot be violated. I think this needs to be explored further.

However I have two deeper reactions. In the intense debate on the OPE-L discussion list (which is unfortunately both closed and private, a state of affairs with which I do not agree but accept as the majority view on the list) one of the most persistent objections to Andrew Kliman's refutation of the Okishio theorem is that it depends on a particular set of assumptions. Actually, I don't think this is mathematically correct. A general theorem is disproved if even one counter-example can be exhibited in which it does not hold. Nevertheless, to avoid precisely this type of objection, I deliberately took the course of abstracting from all special assumptions and all special models. In other words, I sought to establish those laws which must hold for all models, regardless of the assumptions adopted. My own procedure is then criticised on the grounds that it does not state any assumptions.

Again, it does not seem to me both types of objection can be sustained. The objection to Kliman's refutation is that it depends on particular assumptions; the objection to Freeman's refutation is that it makes no particular assumptions. At least one of these objections cannot be

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<sup>1</sup> I am reminded of Marx's letter to Engels dated August 9th 1862 which says 'the statisticians and practical men in general have been maintaining the existence of absolute rent for the last 35 years, while the (Ricardian) theoreticians have been trying to demonstrate it out of existence by very arbitrary and theoretically feeble abstractions. Up to now in all such quarrels I have always found that the theoreticians have invariably been in the wrong.' Substitute 'falling rate of profit' for 'absolute rent' and you have something rather like the present debate. When bankers discuss falling profit rates they have no trouble with the concept at all. Increase your stock and keep your returns constant, and your rates go down.

sustainable. In my view the underlying basis of both is the same; they are rooted in an uncritical acceptance of the general tendency of economics to substitute ideal models for absent concepts. I sought, in framing certain general abstract principles of value dynamics, to escape this methodology once and for all by posing the same question that the physical sciences normally do, namely, to ask what is *invariant* with respect to an (infinite) set of possible configurations of reality.

A question that certainly springs to my mind is, why ‘accounting identities’ should be considered a lowly species of thought? Certainly any working physicist, once s/he has constructed the Hamiltonian – the physicists’ ‘energy accounting identity’ seems to believe that all problems of the universe have been solved. This is actually questionable but there is a marked contrast between the two disciplines to be explained. Certainly since Hiroshima no-one could possibly maintain that

$$E=mc^2$$

is an uninformative relationship; it is, nevertheless, precisely a ‘mere’ identity. More generally (see below) the existence of a time-invariant identity is more or less a proof of existence for core concepts such as energy or mass. In general if any object does not persist over at least some period of time, what basis is there for saying that such a thing exists? Hence if one is to argue that there *is* such a thing as value, as Mirowski points out, then it is rather important to identify the invariant relations in which it participates.

I think that there is good reason to believe this Marx himself has this approach and I think it is poorly understood by economists. I emphatically reject, for example, the idea that Marx’s concept of value in Volume I of *Capital* assumes exchange at values. Nothing in the first five chapters supports this idea and several passages, as de Brunhoff notes, explicitly deny it. Chapters 1-5 in my view make perfect sense if understood, just as Euclid’s axioms define the abstract properties of all geometries of lines and points, as an attempt to define abstractly what all commodity circulation has in common, regardless of the mode of production or stage of history. Exchange at values is introduced in chapter 7 *after* Marx has established, in chapter 5, what to me is exactly an ‘accounting identity’; that value cannot be created in simple circulation. It is precisely because of this identity that any system of exchanges is homomorphic in respect of the relation of exploitation to a system of exchange at values, and I find Marx’s procedure very mathematically coherent; since the Chapter 5 identity establishes that the total magnitude of profit is an invariant with respect to all changes in relative price and all nominal changes in the price level, it is perfectly legitimate to study the special and simplest case where commodities exchange in proportion to values, as the canonical form of all homomorphically equivalent sets of actual exchange ratios.

I sought to generalise this identity to deal with the movement of value implicit in a general dynamic stock-flow relation. Since additions to existing stock modify its value and use-value magnitudes independently, and since it cannot be assumed that unit values remain constant, any genuine value dynamics must state the relation between the growth of the use-value of stock and the growth of the value of stock; I simply applied the chapter 5 identity to the total stock of commodities of each type (type defined as a use-value) in the economy, in the same way that I think Marx deduces social from individual value in current production. The coherence of this lies in the fact that the commodities are paid for in money and the stock is value in money, and at any

given moment, a given sum of money represents a given sum of value. My identity therefore necessarily corresponds to the business identity given above.

### *Capital-circuit models and accounting identities*

What puzzles me in Duncan's objection, is that the results of this calculation are I think a true generalisation of his own (1982) capital-circuit formalisation which is indeed expressed as a series of stock-flow identities, though confined I think to value (that is, without reference to use-value, by no means a defect). In this formalisation the *further* assumption of exponential growth is added, but there is no indispensable reason for this assumption and a fruitful source of innovative research has been the work of several authors who explore alternative assumptions. However, what makes this innovation possible is precisely the framework of stock-flow identities; it is unclear therefore why mere accounting identities are held to be uninformative.

Moreover, one possible and quite reasonable assumption in the capital-circuit formalisation is a labour-force which is either constant or grows more slowly than its output is consumed, corresponding to the accumulation of value. This leads directly to a falling profit rate and hence refutes the normal refutation of Marx's TRPF argument, so that this result flows from Duncan's own formalisation and by no means depends on ours.

The deepest issue however concerns an objection raised at the last EEA by David Laibman: without simultaneous determination, in what sense is there a theory of economics? In the absence of any definite and determinate motion of the economy, how can it have any laws? But an accounting identity *is* precisely a law. It states what is invariant with respect to all possible motion. That, in my view, is what a law consists of. The 'law' of gravity cannot be understood as a definite prediction that any particular objects will move definitely up or definitely down; it is simply a description of the invariant relations that must hold between them, regardless of what they do. I think that this is the concept of a 'law' which economics has simply lost sight of.

Finally there is an ontological issue also. What objects 'exist' in a completely free-standing dynamic system? Equilibrium provides no clues. A tornado has no equilibrium, but most definitely exists. The ontological problem in a dynamic framework amounts to this: what is the basis for asserting that something persists in time? An identity for me, and I think for Marx, is precisely a statement of what persists in time and therefore has the character of a *proof of existence*; a great deal of his work goes into establishing that capital reproduces the conditions for its own existence – the two classes, the use-values it requires, the money it requires, and so on. The problem Marx sets himself is to *deduce* reproduction from the category of value. The 'standard interpretation' reverses this, taking reproduction as 'given' (to borrow, with malicious intent, a term from Fred) and from it deduce value.

### **Inventory adjustment**

I cannot see that the difference is an inventory adjustment effect. Inventory adjustment, in my understanding, refers to the item in company profit and loss accounts dealing with opening and closing stock. A trading company will normally calculate its profits from the following equation:

$$\text{Trading profits} = (\text{Revenue less Costs}) \text{ plus } (\text{Closing stock less Opening stock})$$

Now, if during trading the price of the components of stock have risen, some trading profit will arise from a purely nominal change, as can be seen if the company merely maintains its stock and carries out no trading.<sup>2</sup>

But in the model under discussion in my main paper there *is* no stock. The corn is completely consumed before production starts, and completely new corn springs from the ground. It don't think it is legitimate in accounting terms to count the harvest twice, once as sales and again as inventory. The difference arises because *the price of corn changed in the period of time between when it was planted and when new corn arose from the soil*. This term, the change in price, is a mathematical correction to the simultaneous calculation. I think this really *is* an error term and it is a trifle churlish not just to recognise it as such.

## Replacement cost

A second explanation of the difference between the simultaneous and sequential results is the argument that it arises because the temporal method values stock at historical cost whereas the simultaneous method values it at current replacement cost. In particular Fred Moseley has claimed strongly that the temporal calculation is incompatible with Marx's texts since Marx himself clearly stated that the value of new goods are determined by socially necessary labour time. This, he says, supports the principle of simultaneous valuation.

Below we give one of several cases where Marx's value calculation is clearly and explicitly temporal. This is moreover taken from one of the several places where Marx squarely confronts the issue under discussion, namely technical change from one period to the next. At the very least, therefore, if it is sustained that Marx argues elsewhere for a simultaneous calculation, then it must also be asserted that Marx was inconsistent. Having spent eighty years disposing of the profession's calumnious 'proof' of Marx's inconsistency and having discovered that its best brains got this completely wrong, I am inclined in all humility to explore other possibilities first, namely, perhaps Fred is not reading what Marx says as Marx intended it to be read.

In the first place, there is the same problem as with the inventory valuation objection. I would agree that when a change in value takes place, *existing stock* is revalued and indeed, this is the basis for the phenomenon of 'moral depreciation'. But this is not what is under discussion in normal production, particularly with the circulating elements of production such as cotton, corn, and so on. Our temporal correction refers to differences in prices between the *beginning* of production and the *end* of production. But when producing linen, for example, the cotton that

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<sup>2</sup> The UK National Accounts Sources and Methods (HMSO 1985: sections 13.14–13.32) describes the process in the UK in some detail. The relevant passage (para 13.17) is the following: "Under the FIFO convention each item in stock is valued at its purchase price and the stocks will have been bought at the range of prices that prevailed over this period. This convention gives a book value level of stocks. This level is then reduced to constant, base year prices; that is each item in stock is valued at its average price during the base year. This revaluation is made by the *book value stocks price index* that measures change in the historic cost of stocks; it is described in more detail below. The difference between constant price levels at two moments gives stockbuilding at constant prices over the intervening period. Stockbuilding at constant prices is revalued to give stockbuilding at current prices. This revaluation is by the *current price stocks price index* that measures changes in the current replacement cost of stocks. Finally stockbuilding at current prices is subtracted from the book value change over the same period to give stock appreciation." The purpose of the exercise is to separate two measures of stock building, one due to an actual growth in the 'real value' (constant prices) of stock and one due to monetary changes. Stock appreciation is the difference between the two, the purely monetary effect. However, first of all the measure clearly depends on the mentioned indexes, which are hedonic (use-value based) and therefore neoclassical; second, the revaluation applies only to stocks *in existence during the year* which here is the accounting period of observation. In the case of our corn economy, stocks were ploughed in at the beginning of the period of observation and vanished from the accounts. New stocks were then produced at the end, but the revenue from these stocks is *sales revenue* and it would be entirely wrong to treat them twice, once as sold goods and again as inventory. An application of the calculation method provided by the statisticians on p207 of this book to the corn model yields stocks, in both current and constant prices, of zero, and a stock appreciation of zero.

was bought at the end of production *no longer exists*. It has been used up in production. How can it be revalued after it has been used? If this principle were applied logically, then also everything that had ever entered production from the beginning of time should be revalued *retrospectively*, and I don't think anything Marx says supports this idea. I think the idea is entirely neoclassical in origin and finds no support in Marx.

Turning now to the process of revaluation that takes place *before* the cotton is consumed I of course agree that it is revalued if new and cheaper cotton arrives on the market. The question is, however, whether it is revalued *completely* to the individual value of the new cotton as soon as one ounce of this hits the market, or whether there is a time-based process so that, as more and more cotton arrives on the market, the existing stock becomes *progressively* cheaper. That is as indicated above, the problem is to state clearly the stock-flow identity that governs the *process* of cheapening of the cotton.

To justify Fred's reading it would have to be shown that Marx held that the revaluation of the cotton was independent of the *volume* of new cotton on the market. But Marx explicitly denies this in his Volume III, chapter 6 remarks on the release and tie-up of capital:

Thus 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. The same applies to stocks of raw material, etc. in the hands of the producers. This revaluation can compensate the individual capitalist, or a whole particular sphere of capitalist production – even more than compensate, perhaps – for the fall in the rate of profit that follows from the raw material's rise in price. Without going into the detailed effects of competition here, we may remark for the sake of completeness that (1) if there are substantial stocks of raw material in the warehouse, they counteract the price increase arising from the conditions of their production; (2) if the semi-finished or finished goods on the market press heavily on the supply, they may prevent the price of these goods from rising in proportion to the price of their 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 (Capital III:208)

But this is incompatible with the idea that the value or price of production of *new goods* completely determines the value of the commodity, which is the replacement cost hypothesis. It says, on the contrary, that as cheaper goods enter the market there is an averaging process so that, the more fresh goods there are and the less stock, the greater the revaluation; *au contraire* the less fresh goods and the more stock, the lesser the revaluation. Thus goods are *not* revalued to the replacement cost, though they *are* revalued.

In my last chapter of our book, what I set out to do is to discover whether the above argument could be rendered consistent by treating the revaluation process as a *strict averaging*, analogous to the formation of social from individual value. This is I think not only consistent with Marx's general approach to the formation of market or social values from individual values, but fits with all his writings on revaluation, moral depreciation, etc. Indeed it shows, as a by-product, that moral depreciation is a definite and measurable dynamic term in the value equations that is omitted from the static calculation. I discovered that this interpretation rigorously confirms all Marx's contested results and preserves the principle of value conservation; and so far, I have read nothing in Marx that seriously conflicts with it.

### *Marx's temporal calculation*

The difference between historical and replacement cost is discussed in and accounted for in chapter 6 of Volume III of *Capital* under the heading of the 'release and tie-up of constant capital'. Marx first encounters the problem in discussing Ramsay on pp340-344 of the *Theories of Surplus Value*. He concludes a discussion of Ramsay's corn-model by considering a cotton manufacturer with a constant capital of £100 of which £80 is spent on cotton:

Let us consider the manufacturer. Let us assume that he has laid out £10 in cotton twist and made a profit of £20. The product therefore amounts to £120. It is assumed that £80 out of the outlay of £100 has been paid for cotton. If the price of cotton falls by half, he will now need to spend only £40 on the cotton and £20 on the rest, that is £60 in all (instead of £100) and the profit will be £20 as previously, the total product will amount to £80 (if he does not increase the scale of his production). £40 thus remains in his pocket. He can either spend it or invest it as additional capital. If he invests it, he will lay out [an additional] £26<sup>2</sup>/<sub>3</sub> on cotton and £13<sup>1</sup>/<sub>3</sub> on labour, etc. On the new scale. The profit [will amount to] £13<sup>1</sup>/<sub>3</sub>. The total product will now be 60+40+33<sup>1</sup>/<sub>3</sub> or £133<sup>1</sup>/<sub>3</sub>.

Thus it is not the fact that the farmer replaces his seed corn in mind which is the key, for the manufacturer buys his cotton and does not replace it out of his own product. What this phenomenon amounts to is this: release of a portion of the capital previously tied up in constant capital, or the conversion of a portion of the capital into revenue. If exactly the same amount of capital is laid out in the reproduction process as previously, then it is the same as if additional capital had been employed on the old scale of production. This is therefore a kind of accumulation which arises from the increased productivity of those branches of industry which supply the productive ingredients of capital. (TSV III:345)

This is a noteworthy passage. Let us just summarise what is going on. In period 1 we have in use-value terms:

80 units of cotton twist + 20 units of labour => 120 units of woven cotton

and in money

£80 cotton twist + £40 added by labour => £120 woven cotton

In the next period cotton's price falls by half. We now have two options discussed by Marx. One is replacement in kind, the other is replacement in value. If the cotton is replaced in kind (the first option) then since cotton is cheaper, the capitalist can maintain production for less money. We have

£40 + £40 added by labour => £80 woven cotton

but the capitalist has 'pocketed £40', that is, of his revenue from period 1 of £120 only £40 was re-invested and his money profit is £20 normal profit plus £40 *released capital*. The value of linen will thus sink to £80 for 120 units, namely £<sup>2</sup>/<sub>3</sub> per unit.

If now the capitalist invests this £40 (the normal mode of capitalist accumulation), Marx assumes the technical proportions in the cotton-weaving industry do not change and so it must be split between additional cotton twist and additional labour. Now we have these money outlays:

(£40 + £26<sup>2</sup>/<sub>3</sub> = £66<sup>2</sup>/<sub>3</sub>) twist + (£20 + £13<sup>1</sup>/<sub>3</sub> = £33<sup>1</sup>/<sub>3</sub>)

an expansion in production by the factor <sup>2</sup>/<sub>3</sub>. In use-value terms everything expands by <sup>2</sup>/<sub>3</sub> giving 133<sup>1</sup>/<sub>3</sub> units of cotton twist + £33<sup>2</sup>/<sub>3</sub> units of labour => 200 units of woven cotton

### *Release and tie-up of capital*

The *categories* which Marx uses to describe this relate precisely to the time-difference between the price (value) of cotton at the start of the first period and the start of the second. The term ‘release of constant capital’ refers to the difference between the cost of reproducing on the same scale at the old price and the cost of reproducing on the same scale at the new price. That is the £40 that the ‘capitalist pockets’.

If the principle of ‘replacement cost valuation’ were applied to the output of cotton, then we should make the following observation. This woven cotton, the output of Marx’s manufacturer, is also the input to some other manufacturer, for example the shirtmakers. But according to the principle of replacement costing as defined by our critics, replacement valuation must be applied across the board throughout the whole of industry. As far as the shirtmakers are concerned, from the moment that the cotton gets cheaper, the value of linen sinks to its replacement value, namely £80. But in this case, since the shirtmakers must pay exactly the same sum of money that the cotton-weavers receive, Marx would have had to conclude that the sales of the first period were only £80 and consequently that profits were zero, exactly as we encountered in the case of our Landlords applying the Friedman theory of value.

What I tried to do in the last chapter of *Marx and non-Equilibrium Economics* is extend this concept, of the release and tie-up of capital to the evaluation of stock, using the pointers that are to be found in chapter 6 of Volume III of *Capital*. Whether this precisely corresponds with Marx is something for further discussion. What is certainly true is this: by a very logical application of the conceptual structure just outlined we find that not just one of the propositions associated with Marx outlined at the beginning of this article, but *all* of them, can be sustained and in such a way that a logical foundation now exists to apply these results so as to show exactly what is wrong, both quantitatively and qualitatively, with the neoclassical treatments of the same themes – and produce alternative empirical representations with greater explanatory power.

There is an argument to be had, still, over a number of important issues, for example replacement costs, moral depreciation, the exact calculation of the monetary expression of labour time and hence the exact way to do Marx’s calculation for the farmworkers above, the proper way to distinguish productive from unproductive labour, the incorporation of domestic labour, and so on and so on. But the crucial point is this: on all the issues at dispute between Marx and neoclassical economics, the analysis confirms Marx and refutes neoclassical economics.

### **Violation of labour conservation**

Finally it has been argued that the temporal calculation results in value being created or destroyed independent of the use of the labour-time of the workers. This seems to me misinformed. On the contrary, the calculations we attribute to Marx follow the strict principle that each year, value should increase only by an amount equal to the living labour of the workers and diminish only by an amount equal to the current value of consumed goods. As I said above, this is an ‘accounting identity’ and value cannot but be conserved.

However the reverse is the case: simultaneous valuation *does* lead to the creation of value in circulation and this can be seen by considering a circumstances Marx discussed on a number of occasions, namely declining productivity – for example due to bad harvests.

Consider the following sequence



Year 1 10 corn + 10 labour -> 20 corn  
 Year 2 10 corn + 10 labour -> 15 corn  
 Year 3 10 corn + 10 labour -> 12 corn

This gives prices as follows

Year 1,  $10p + 10 = 20p$ ; hence  $p = \$1.00$   
 Year 2,  $10p + 10 = 15p$ ; hence  $p = \$2.00$   
 Year 3,  $10p + 10 = 12p$ ; hence  $p = \$5.00$

By the end of the sequence, society is producing 12 units of corn with a total value of \$60. But it started with \$10 and it has only added \$30 in value. Where has the extra \$20 come from? Moreover this society is getting *less* productive. How can it be creating *more* value?

It is difficult to track this process because the simultaneous approach makes it impossible to draw up meaningful year-on-year trading accounts. In year 1 the product of 20 bushels is supposed to *sell* for year 1 prices, that is, \$1.00 per year. But in year 2 it is *bought* at year 2 prices, that is \$2. To make sense of this logically incoherent idea<sup>3</sup> one would have to suppose it was bought by an intermediary, for example the bank which might, for example, provide warehousing so that it bought the corn at year 1 prices, stored it, and sold it at year 2 prices.<sup>4</sup> Suppose for simplicity that each year the entire surplus is sold to workers at end-of-year prices (or capitalists, it makes no difference)

The bank's accounts, assuming an initial capital of \$20 for it to buy the harvest, would read as follows for the period between the year 1 harvest and the year 2 planting:

Bank capital	\$20
Purchases of corn at end year 1	
20 bushels at \$1	(\$20)
Sales of corn during year 1	
10 bushels at \$1	\$10
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Reserves at end year 1	\$10
Sales of corn at beginning year 2	
10 bushels to landlords at \$2	\$20
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Reserves at beginning year 2	\$30

It can now be seen that the bank's capital has *risen by \$10 for the expenditure of no extra labour*, as has that of society as a whole. The holders of circulation stocks in a simultaneous model *really do benefit* from inventory appreciation in price terms; a price increase which, however, if we seek a measure that conserves value (that is, which does not allow value to arise in circulation) must be accounted as a nominal increase in prices.

The temporal account of the same sequence reads like this, supposing corn to start at one labour-dollar per unit and measuring in constant labour-dollars:

Year 1 \$10 corn + \$10 labour -> \$20 embodied in 20 corn; new price of corn is \$1

<sup>3</sup> A logically incoherent idea which is, however, at the heart of Bortkiewicz's construction and constitutes the principal logical error in the refutation of Marx's results for eighty years

<sup>4</sup> I acknowledge many useful discussions with Riccardo Bellofiore for the origin of this presentation.

Year 2 \$10 corn + \$10 labour -> \$20 embodied in 15 corn; new price of corn is \$1.33

Year 3 \$13.33 corn + \$10 labour -> \$23.33 embodied in 12 corn; new price is \$1.94

If the bank, as before, purchased the entire output at the end of each year and sold it back at the end, we would find for example between the year 1 harvest and the year 2 planting

Bank capital	\$20
Purchases of corn at end year 1	
20 bushels at \$1	(\$20)
Sales of corn during year 1	
10 bushels at \$1	\$10
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Reserves at end year 1	\$10
Sales of corn at beginning year 2	
10 bushels to landlords at \$1	\$10
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Reserves at beginning year 2	\$20

For the next year this reads

Bank capital	\$20
Purchases of corn at end year 2	
15 bushels at \$1.33	(\$20)
Sales of corn during year 2	
5 bushels at \$1.33	\$6.67
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Reserves at end year 1	\$6.67
Sales of corn at beginning year 2	
10 to landlords at \$1.33	\$13.33
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Reserves at beginning year 2	\$20

and so on. At the end of year 3 the bank would have insufficient capital to buy the output but we could either assume it starts with a larger capital, or, as I am sure Riccardo would agree, suppose that it can create some credit. The crucial point is that it cannot augment its capital by the mere purchase and sale of corn. If the simultaneous calculation is applied, it can and does and so value is created in pure circulation.

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