# CAPITALIST MACRODYNAMICS WITHOUT CAPITALIST VALUE?

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## I. Introduction

David Laibman has the misfortune of bearing the brunt of my critique only because his recent Capitalist Macrodynamics: A systematic introduction is the immediate focus of discussion. The substance of the critique has almost nothing to do with the particulars of his book, but with its overall theoretical approach, an approach which he shares with many, many others.

The approach in question attempts to make physical input-output relations the primary determinant of value, price, and profit. One variant of that approach, the one to which Laibman subscribes, also purports to combine it with some sort of theory in which value (and thus price and profit) is determined by labor-time.

The first aim of my paper is to show that this variant is self-contradictory; the source of the problem, of course, is that something is either determined by physical relations, or it is determined by labor-time, but not by both. I uncover the contradiction as it appears in Laibman's book, and as a contradiction between the physical and (labor-time-determined) value profit rates, which can move in opposite directions. I then confront the question of whether the tendency of the latter matters at all. Being Jewish, however, I answer it with another question: does the physical profit rate matter (or, more precisely, do its counterparts in a multi-sector economy, the profit rate measured in terms of a money commodity or numéraire, matter)?

The second aim of my paper is to show that they do not or, at least, had better not, because they lead to arbitrary and self-contradictory results. I first show that the level of the profit rate, even a uniform profit rate in the long-run, can depend on the specific good that serves as the money commodity or numéraire. Just as use-values themselves are heterogeneous, so are the profit rates measured in terms of them. This demonstration is followed by one which shows that this phenomenon can result in one and the same economy having different dynamic paths under different monies or numéraires.

## II. The Contradiction between Value and Use-Value

Laibman asserts three propositions which, taken together, are incompatible. The propositions are important ones, so their incompatibility vitiates his attempt to construct a dynamic theory of profitability and capital accumulation which amalgamates two opposed theoretical frameworks —— the physical quantities approach and the theory that value is determined by labor time. The three propositions are

A. Commodities' unit values fall as labor productivity rises (Laibman 1997:28-29). This proposition follows from the notion that value is determined by labor-time.

B. In a one-commodity world, the value rate of profit and the physical rate of profit, physical surplus divided by physical input, are identical (Laibman 1997:23).

C. The growth rate, or rate of accumulation, of capital is by definition the product of two ratios, the ratio of net investment to profit and the ratio of profit to capital, i.e., the rate of profit (Laibman 1997:63-64). Laibman (1997:23) correctly notes that this identity implies that the profit rate is capital's "potential rate of self-expansion." "Potential" in this context means maximum: when all profit is reinvested, the ratio of net investment to profit equals unity and thus the growth rate of capital equals the profit rate.

Any pair of these claims can be consistently maintained, but then the third must be rejected. Their incompatibility stems from the fact that the physical and value rates of profit are identical only when the value rate is computed on the basis of the replacement cost of inputs rather than the value of capital advanced. Yet if value is determined by labor-time, the replacement cost profit rate is simply not the maximum rate of growth of capital-value, because the latter is precisely the percentage increase in the sum of value which the capitalists hold after production over the sum of value they actually advanced before production.

The matter can also be put as follows: if value is determined by labor-time, then, when productivity increases, the potential rate of self-expansion of capital-value must be lower than the physical profit rate. This must be the case however one "defines" the value rate of profit. If one equates the value rate of profit with the rate of self-expansion of value over the course of the production period, as Marx (1971:131) did:

> The relation between the value antecedent to production and the value which results from it —— capital as antecedent value is capital in contrast to profit —— constitutes the all-embracing and decisive factor in the whole process of capitalist production.

then the value rate of profit must fall below the physical profit rate whenever productivity rises. Hence, if the rise in productivity raises the physical rate, the value rate can nonetheless fall, as Marx held and as the Okishio (1961) theorem has denied.

If, conversely, one equates the value and physical rates of profit, then one breaks the link between the value rate of profit and the rate of capital accumulation in value terms. The former no longer governs the latter in any fundamental sense.

Such controversial assertions obviously require proof. Assume a one-commodity world. Denoting capital as K, its rate of growth as $\%\Delta K$, the ratio of net investment to profit as $\alpha$ (Laibman's "accumulation ratio"), and the rate of profit as r, proposition C means that $\%\Delta K_v \equiv \alpha_v r_v$ and $\%\Delta K_p \equiv \alpha_p r_p$, where the v and p subscripts denote value and physical terms, respectively. Dividing the former identity by the latter, one obtains

$$(\%\Delta K_v)/(\%\Delta K_p) \equiv (\alpha_v/\alpha_p)(r_v/r_p). \quad (1)$$

To avoid complications, assume that all (gross) output is reinvested. Then $\alpha_v = \alpha_p = 1$,[i] and proposition C therefore implies that

$$(\%\Delta K_v)/(\%\Delta K_p) \equiv (r_v/r_p). \quad (1')$$

To avoid another complication, assume that all capital is constant capital (the wage rate equals zero). $\%\Delta K_v$ and $\%\Delta K_p$ then denote the growth rates of constant capital-value and means of production, respectively.

Now at risk of being tagged as an advocate of a "'new orthodoxy'" (Laibman 1997:24), I will seek to discover the implications of identity (1') for the relationship between the value and physical rates of profit. Laibman's proposition B asserts that $r_v = r_p$. Taken together, propositions B and C (by means of (1')) therefore imply that the growth rates of constant capital-value ($\%\Delta K_v$) and means of production ($\%\Delta K_p$) are equal. This, however, contradicts claim A. Imagine that labor productivity rises. According to claim A, the unit value of the commodity falls. If A is true, then the value of constant capital must therefore grow more slowly than does the mass of means of production (Laibman 1997:28-29); $\%\Delta K_v$ must be less than $\%\Delta K_p$. Hence, propositions B and C can both be true only if value is not determined by labor-time.[ii]

If, however, proposition A is true, then increases in productivity cheapen the elements of constant capital; $\%\Delta K_v < \%\Delta K_p$. If proposition C and therefore identity (1') are also true, then $r_v$ must be lower than $r_p$! Proposition B is negated. Increases in productivity therefore not only cheapen the elements of constant capital, they likewise produce a tendency for the rate of profit to fall, exactly as Marx claimed. Finally, since we have seen that, if proposition C is true, then propositions A and B cannot both be true, if both A and B are true then C is false.

The following numerical example illustrates these points. Again, the wage rate is zero and all gross output (X) is reinvested. Therefore the total value of output (V) is reinvested. The example also abstracts from fixed capital, so V is likewise the sum of value that capitalists possess at the end

Table 1: PHYSICAL QUANTITIES

| Period | L | $K_p$ | X | $r_p = X/K_p - 1$ | $\%\Delta K_p$ |
|---|---|---|---|---|---|
| 1 | 8 | 2 | 3 | 50% | 50% |
| 2 | 8 | 3 | 5 | 67 | 67 |
| 3 | 8 | 5 | 9 | 80 | 80 |
| 4 | 8 | 9 | 17 | 89 | -- |

of the period. In Table 1, the figures for L (living labor), $K_p$, and X are assumed; the others are derived. The physical profit rate and rate of accumulation rise handsomely.

Using the same physical figures, I will compute V in two different ways. First, according to the temporal single-system interpretation of Marx's value theory (see Freeman and Carchedi (eds.) 1996; Kliman and McGlone 1997). This interpretation holds that, when there is no fixed capital, V in labor-time terms is the sum of the capital-value advanced ($K_{va}$) plus the living labor extracted. Note that $K_{va}$ in any period equals the V of the prior period, since the whole value of output is reinvested; period 1's $K_{va}$, however, is given as an initial condition. The rate of profit ($r_{va}$) is computed on the basis of capital-value advanced.

Table 2: TEMPORALIST VALUE SCHEME

| Per-iod | $K_{va}$ | L | V = $K_{va}$+L | $r_{va}$ = $V/K_{va}$ - 1 | $\%\Delta K_{va}$ |
|---|---|---|---|---|---|
| 1 | 16 | 8 | 24 | 50% | 50% |
| 2 | 24 | 8 | 32 | 33 | 33 |
| 3 | 32 | 8 | 40 | 25 | 25 |
| 4 | 40 | 8 | 48 | 20 | -- |

In contrast to their physical counterparts, the value rate of profit and the rate of capital accumulation fall sharply.

Next , I compute V according to the simultaneist interpretations of Marx's value theory, which hold that V is the sum of the replacement value of the means of production ($K_{vr}$) plus the living labor extracted. $K_{vr}$ is found by multiplying $K_p$ by the ratio of living labor to net product ($L/[X - K_p]$). $K_{va}$ in any period still equals the V of the prior period, since the whole value of output is reinvested. The $K_{va}$ and $K_{vr}$ of period 1 are assumed to be equal. Profit rates and rates of accumulation are computed on the basis of both $K_{va}$ and $K_{vr}$.

Table 3: SIMULTANEIST VALUE SCHEME

| Per-iod | $K_{va}$ | $K_{vr}$ | L | V = $K_{vr}$+L | $r_{vr}$ = $V/K_{vr}$ - 1 | $\%\Delta K_{vr}$ | $r_{va}$ = $V/K_{va}$ - 1 | $\%\Delta K_{va}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 16 | 16 | 8 | 24 | 50% | -25% | 50% | 50% |
| 2 | 24 | 12 | 8 | 20 | 67 | -17 | -17 | -17 |
| 3 | 20 | 10 | 8 | 18 | 80 | -10 | -10 | -10 |
| 4 | 18 | 9 | 8 | 17 | 89 | -- | -6 | -- |

The replacement cost profit rate ($r_{vr}$) rises handsomely and matches the physical profit rate. The associated rate of accumulation of capital-value ($\%\Delta K_{vr}$), however, is consistently negative! This of course violates Laibman's proposition C, since the two rates should be equal if all surplus-value is re-invested. Moreover, the gap between the physical and replacement cost rates of accumulation grows ever wider.

The value rate of profit computed on the basis of capital advanced and its associated rate of capital accumulation are equal, in accordance with proposition C. Yet from the second period onward, both are much lower than the corresponding physical rates, and the gap between physical and value rates again grows ever wider! And once proposition C is satisfied, we see that, even under simultaneous valuation, the value rate of profit falls sharply between periods 1 and 2! It then begins to rise, but remains negative.[iii]

Replacement cost valuation therefore only hides, but cannot abolish, the contradiction between value and use-value. It suppresses the contradiction between the physical and value rates of profit. Yet the contradiction between use-value and value then resurfaces in the form of ever-increasing deviations between the replacement cost rate of profit, on the one hand, and the growth rate of capital-value and the profit rate on capital advanced on the other.

Those who have thought carefully about these issues have therefore concluded that replacement cost valuation is incompatible with any dynamic analysis based on the determination of value by labor-time. Mirowski (1989:184) writes that "the real-cost method, devoid of explicit invariants, can only calculate a sequence of static equilibria in which the labor-value unit is not comparable from one calculation to the next." From the other side, Duménil and Lévy (1997:15-16), advocates of replacement cost valuation who are widely recognized for their contributions to dynamic microanalysis, have conceded that the simultaneist "labor theory of value does not provide the framework to account for disequilibrium and dynamics in capitalism," or for "the theory of crisis or of historical tendencies."

I suspect that Laibman does not reach the same conclusion only because, although his physical quantities briefly masquerade as social relations (Laibman 1997:21-23), when they venture out to do their ghostwalking, they do so as mere things. Since use-value and value never come into contact in a dynamic setting, he is never forced to confront them as a contradictory unity.

## III. Why Does It Matter?

I doubt that this contradiction troubles Laibman much. He seems to suggest, as others have, that the falling value rate of profit (computed on capital advanced) is irrelevant in the long-term because it does not impede the accumulation of use-value (Laibman 1997:76-77). (This cannot be inferred from the example above, which merely assumed that capitalists reinvest all output in the face of a falling value rate of profit. Whether they will actually do so is precisely the question at hand.) Productivity is rising and they can therefore lay hold of ever-increasing quantities of the good.[iv] Yet why should we believe that the goal of capitalists is the acquisition of use-value, rather than the self-expansion of the value they possess (as Marx, for one, incessantly repeated)?

It is possible to pose the question in reverse, of course, so we seem to be at an impasse. Yet the critics of Marx's theory of value and accumulation are not finished. They note that the falling value rate of profit (computed on capital advanced) need not impede capital accumulation in "price" terms (which, as they incessantly repeat, is what capitalists care about). If the price of the commodity in the present example is set equal to 1 (or any constant), then the price rate of profit and the rate of accumulation in price terms will always match the corresponding physical rates.

The critics, in other words, are noting quite rightly that propositions B and C are compatible once proposition A (the determination of value by labor-time) is discarded. I am not sure that Laibman will want to play this gambit. I shall now develop a response to it anyway, because the specific nature of my response is very relevant to his attempt to construct a theory of capitalist macrodynamics founded on physical quantities.

Note that the critics' appeal to price is an appeal to valuation in terms of a money commodity or numéraire, the two being identical for present purposes. Laibman has no need for this, because he assumes a one-good world. Yet he states his "belie[f]" that his theoretical results apply to "a multi-sector economy ... without essential loss in either the political-economic or quantitative dimensions" (Laibman 1997:23, ftn. 1) and, to make them apply, he will certainly need a money commodity or numéraire.

Now, then, what I will demonstrate in the next two sections is that the price/money commodity/numéraire argument does not hold water. Once we move from the one-good world to the multi-good real world, the measurement of profit rates in terms of some use-value is incoherent and it leads to incoherent dynamics. Just as use-values are heterogeneous, so are the profit rates measured in different use-values, and therefore so are the intertemporal paths of economies in which profit rates are determinants of capitalists' behavior. Thus, if one wishes to deny that the falling value rate of profit matters and to argue that the money/numéraire profit rate is instead what matters, one must then answer the unanswerable question: "which one?"

## IV. ¡Frijoles Para Todos!

ÊυÜμων ¢πÝχου —— Pythagoras, c. 500 B.C.[v]

¡Mucho dinero!
¡Poco trabajo!
¡Frijoles Para Todos!
¡Viva Zapata!
—— Mexican campesinos' chant, c. 1900

Assume an economy in which the "augmented" input-output matrix, "augmented" meaning that it includes wage goods, rounded to five decimal places, is

$$\mathbf{A} = \begin{matrix} .87719 & .08754 & .001 & .001 & .001 \\ 0 & .89286 & .00315 & .02446 & .00147 \\ 0 & 0 & .90909 & .001 & .001 \\ 0 & 0 & 0 & .92593 & .001 \\ 0 & 0 & 0 & 0 & .94340 \end{matrix}$$

The element in the second row, fifth column, for instance, indicates that .00147 units of good 2 is required to produce 1 unit of good 5. The sum of entries in each row is less than 1, which means that if one unit of each good is produced, then so is a surplus of each; the economy is "viable."

If we constrain input prices to equal output prices, and seek to find a set of prices that results in an equalized rate of profit, the solution must satisfy

$$\mathbf{pA}(1+r) = \mathbf{p} \qquad (2)$$

where **p** is the row vector of stationary prices and r is the uniform profit rate. Yet no solution to (2) results in strictly positive prices. Either all prices are zero, or the determinant of **A** equals zero. In the latter case, there are five solutions for 1+r, namely the reciprocals of **A**'s main diagonal elements. However, four of these solutions make some prices negative, while the fifth, 1+r = 1/.94340 = 1.06, makes the relative prices of goods 1-4 (in terms of good 5) equal to zero.

This is an example of an economy in which "self-reproducing non-basics" (SRNBs) exist, Sraffa's (1960:90-91) term for goods that enter into their own production, but not into the production of all goods. If, in the associated system of basic goods, the all-positive price solution for 1+r is larger than the output-input ratio of any SRNB (the reciprocal of its main diagonal element in **A**) —— the "own-rate of reproduction" of the SRNB is less than that of the basic system —— then no all-positive price solution to (2) exists. Let us call this the low own-rate of reproduction SRNB, or LORRSRNB, case.

Because no all-positive price solution to (2) exists in this case, some Sraffian authors have suggested that profit rates cannot equalize. Sraffa himself, however, stressed that the assumption of stationary prices in his Production of Commodities was merely an assumption. He therefore noted that when a LORRSRNB (his "beans") exists, there is another possibility, a normal (uniform) profit rate but nonstationary prices. "The 'beans' could however still be produced and marketed so as to show a normal profit if the producer sold them at a higher price than the one which, in his book-keeping, he attributes to them as a means of production" (Sraffa 1960:91)

Let us study this possibility. Assume that the prices which producers "attribute" to means of production are their prices at the time they become inputs. Thus, to have a uniform profit rate, input prices and output prices must differ. System (2) becomes:

$$\mathbf{p_t A}(1+r_{[t,t+1]}) = \mathbf{p_{t+1}} \qquad (2')$$

In our 5-good example, (2') consists of 5 equations in 11 unknowns. Specifying initial conditions (5 prices for t = 0) leaves us with 6 unknowns. To eliminate 1 more unknown, and thus make (2') determinate, choose 1 good as a numéraire or money commodity. Its price equals 1 throughout all time.

It then turns out that

(a) if all prices are initially positive, then they always remain positive —— the apparent impossibility of having a uniform profit rate and all-positive prices in this economy was merely an artifact of the stationary price postulate;

(b) the goods' relative prices are not affected by the choice of money commodity;

(c) money prices converge to a moving equilibrium level in which the rate of change in good k's price, $(P_{kt+1} - P_{kt})/P_{kt}$, converges on $a_{kk}/a_{mm} - 1$, where $a_{kk}$ and $a_{mm}$ are the "own" input-output ratios of good k and the money commodity. In the present example, when good 3 is the money commodity, the five prices' rates of change converge on -3.6%, - 1.8%, 0%, 1.9%, and 3.8%.

To avoid unnecessary pedantry, I omit the proof of these propositions, though they are true for all cases of this type.[vi]

Now, to get to the real point of this exercise, what is the level of the economy's uniform profit rate? The answer depends on the choice of money commodity. The uniform profit rates associated with different money commodities differ, not only during an initial period of "disequilibrium," but throughout all time! This is so even though relative prices are invariant to the choice of money commodity. The level of the uniform profit rate converges to $r_{[t,t+1]} = 1/a_{mm} - 1$, the money commodity's own-rate of reproduction. Again, I omit the proof, though the result holds for all such cases.[vii] Since there are five possible monies in the present example, there are five different long-run profit rates: 14%, 12%, 10%, 8%, and 6% (see Figure 1).[viii]

Advocates of valuation in terms of a numéraire typically claim that the choice of numéraire is "arbitrary," by which they mean that, if one chooses a different numéraire, one does not alter any significant results. Yet the present example makes clear that the opposite is the case. The choice of the numéraire is truly arbitrary —— it leads to profit rates of arbitrary size! This conclusion is particularly damaging to those such as Laibman (1997:23) who emphasize the importance of the size of the profit rate to capitalists' behavior and the system's dynamics: "the ratio of primary importance to the capitalists themselves, the ... rate of profit, ... is the central measure of the effectiveness of capitalist production from the point of view of capital: its potential rate of self-expansion." Indeed, the central problematic of his book is the determination of the profit rate. But which one? Just what is the potential rate of capital's self-expansion in the present case; 14%?, 12%?, 10%?, 8%?, 6%?

Yet the problem is not only a quantitative one; it is conceptual as well. If we are to accept the use of input-output relations and valuation in terms of a numéraire or money commodity as the basis for a theory of macrodynamics, then we must believe that the trajectory of the system will be altered fundamentally, merely because people (or, perhaps, only the theoreticians) suddenly decide to think of their coats as being worth *y* ounces of silver instead of *x* ounces of gold.

It is therefore not the case that the results of Laibman's model apply "without essential loss in either the political-economic or quantitative dimensions" to a multi-sector economy. The moment a second sector is introduced, so are exchange-values, and so is the arbitrariness of the profit rate in the absence of an immanent measure of value, something which is not itself a commodity but instead "constitutes value," i.e., is the value substance (Marx 1971:155).

Yet perhaps this is a tempest in a teapot. Both Sraffa and the Sraffians have been at pains to argue that LORRSRNBs are "rare" (Sraffa 1962:426). As Bradley and Howard (1982:248) have noted, however, such claims are made without being supported by any empirical evidence.

Rather, Sraffa offered only the very weak argument that it is unlikely that a single good could have an own-rate of reproduction lower than that of the basic system, in which large numbers of goods are directly and indirectly needed to reproduce the basics. Yet systems of SRNBs, not just single SRNBs, can also exist; sturgeon enter into the reproduction of caviar, and caviar into the reproduction of sturgeon. The number of commodities needed for reproduction, moreover, is a very poor proxy for the own-rate of reproduction. No matter how many goods there are in the basic system, their own-rate cannot fall below unity if the system is viable, and the more productive the system is, the higher the basics' own-rate will be. Imagine, for instance, that the profit rate of the basic system is 25% per annum. If, on average, every 10 racehorses breed a respectable 2 net offspring each year which not only live and are healthy but are able to compete as racehorses, then the economy-wide profit rate will be only 20%, not 25%, if racehorses are chosen as the money commodity or numéraire.

In any case, it is not the rarity of LORRSRNBs that is at issue here, but their existence. The existence of even one such good is sufficient to demolish the determinacy of all theories of profitability and accumulation based on physical relations (including all theories based on commodity money). Imagine, then, that only 1% of all commodities are non-basics, only 1% of non-basics are SRNBs, and only 1% of SRNB's are LORRSRNBs. Then only one commodity in a million is of this last misbehaved type. Yet if 1 million different commodities are produced,[ix] then a LORRSRNB does exist, along with two different uniform physical profit rates.

Hence, even if the probability is extremely low that any particular good is a LORRSRNB, it seems very probable that some good in the economy misbehaves in this way. At the very minimum, the burden of disproof falls on the proponents of physical quantities-based theories of profitability and accumulation. Or will they perhaps take refuge in the claim that theirs is a Samuelsonian "parable" theory, internally incoherent but handy enough as a tool for the propagation of their "faith"?

## V. Two Economic "Twins Paradoxes"

Even in the absence of LORRSRNBs, it is impossible to construct a theory of capitalist macrodynamics on the basis of physical quantities that is both coherent and passably realistic. One reason it isn't possible is that, as Arrow (1981:140) emphasizes, "The view that only real [i.e., physical] magnitudes matter can be defended only if it is assumed that the labor market (and all other markets) always clear." I doubt this is a corner into which "20th-century Marxists" wish to paint themselves. Once this crucial postulate of neoclassical general equilibrium theory is relaxed, however, "Shifting from one numéraire to another [will] affect the direction in which resources are allocated" (Arrow 1981:141).

Arrow substantiates his claim in two main ways. First, he notes that in the absence of complete and instantaneous market-clearing, the allocation of resources between the present and the future will be affected by the choice of numéraire (Arrow 1981:142-44). If one lends by purchasing a bond denominated (and thus payable) in terms of the numéraire, and there is an excess demand for other goods when the bond matures, then one may not be able to use the proceeds from the bond to purchase the other goods one wants. Or, if an excess supply of the numéraire exists, one may be unable to exchange one's proceeds (some quantity of the numéraire) for those other goods. Similarly, if the bonds themselves are in excess supply, then one may be unable to sell them before maturity. The greater the prior probability that any of this will occur, the smaller the volume of resources allocated to the future; but the probability depends on which good is the numéraire.

This problem may not arise in an economy in which the good serving as numéraire also serves as a true money commodity, i.e., as a universally accepted equivalent. Arrow's second demonstration, however, applies even when the numéraire is a true money commodity. He offers an economic analogue to Einstein's "Twins Paradox" —— although Arrow's (1981:142) really is a paradox. Imagine that excess demand for both gold and silver exist. If we accept that a good's money (or numéraire) price will rise when excess demand for it exists, then the price of silver in terms of gold will rise if gold is money. Likewise the price of gold in terms of silver will rise if silver is money. In the first case, we have $(Ps/Pg)\uparrow$; in the second, $(Pg/Ps)\uparrow$, which means, however, that $(Ps/Pg)\downarrow$. Hence, unless markets clear at every instant, the constantly repeated refrain that the choice of numéraire affects only absolute prices, but not relative prices, is false.

I will now present a somewhat similar paradox, one which, however, does not even preclude complete and instantaneous market-clearing! Even in the absence of LORRSRNBs, the level of the general (economy-wide average) profit rate depends on the choice of money commodity and, given different money commodities, one and the same change in relative prices can cause the general profit rate to either rise or fall.

Imagine that profit rates are initially equalized. In the next period, inputs are purchased at the prices which equalized profit rates, and the same amount of outputs are produced and sold but, at the end of the period, the relative price of gold in terms of silver rises. If gold is the money commodity (or numéraire), then the output price of gold is unchanged, and therefore so is the profit rate of the gold industry. The output price of silver declines, and therefore so does the profit rate of the silver industry. The general profit rate therefore falls as well.

If, however, silver is the money commodity, then the output price of gold rises, as does the profit rate of the gold industry. The output price of silver remains unchanged, as does the profit rate of the silver industry. The general profit rate therefore rises. Everything is the same in these two cases except the commodity which serves as unit of account, but the level of the general rate of profit and the direction in which it has changed differ!

Once again we see how the choice of an "arbitrary" numéraire is arbitrary in a sense diametrically opposite to that intended by those who use it as a substitute for a value theory. This last paradox, moreover, has important implications for any theory of accumulation, such as Laibman's, which holds that the rate of accumulation depends on the levels of profit rates.

To help clarify this point, I will make some rough-and-ready assumptions, meant to be illustrative rather than a "model" of any economy. First, there are two goods. Second, demand for each is unitary elastic. Third, markets clear. Hence,

$$p_{1t}X_{1t} = p_{2t}X_{2t} \quad (3)$$

where the p's are unit prices and the X's are output levels. Fourth, the output of each good in any period depends on the difference between the two industries' profit rates in the immediately prior period, and it also depends on the (simple) average profit rate in the economy in the immediately prior period. Producers thus tend to allocate their capital to the most profitable industry, and they also respond to the overall economic climate. To illustrate such behavior, I assume the following functional form:

$$X_{jt+1} = 36.72(r_{jt} - r_{kt}) + 400([r_{jt} + r_{kt}]/2). \quad (4)$$

Fifth, each industry requires .4 units of its product and .4 units of the other product to produce 1 unit of its product. The profit rates of the two industries are therefore

$$r_{jt} = p_{jt}/(.4p_{jt-1} + .4p_{kt-1}) - 1. \quad (5)$$

Sixth, I assume an initial equilibrium, in which both goods' prices, both input and output prices, equal 1, each industry's profit rate is 25%, and 100 units of each good is produced. The reader can verify that eqs. (3) through (5) all check out.

Finally, I assume that, for whatever reason, the output of good 1 increases in the next period by 10%, from 100 to 110. How does the economy respond to this supply shock?

Again, it depends on the choice of the money commodity, i.e., the commodity the price of which remains equal to 1 throughout time. When good 1 is the money commodity, output levels, profit rates, and relative prices oscillate from period to period, but the oscillations become dampened and eventually the variables all converge on their original equilibrium levels. When good 2 is the money commodity, the variables also oscillate, but the oscillations are explosive. In the 30th period, both industries' profit rates are negative, so that in the next period, negative outputs of both goods are produced. (See Figures 2 and 3, which trace the output and profit rate of industry 1 under the two numéraires.) Relative prices also differ under the two numéraires and the oscillations in relative prices are, again, dampened when good 1 is the numéraire and explosive when good 2 is the numéraire. These drastically different effects of the supply shock emerge from the exact same set of “underlying determinants” and behavioral relations. Only the unit of account differs!

Different parameter values for the supply functions (4) will give rise to cases in which, under either numéraire, the economy reacts in the same way, either converging to equilibrium or crashing. A whole range of parameter values, however, give rise to cases in which the economy converges when good 1 is the numéraire and crashes when good 2 is the numéraire, but not, apparently, the opposite. I have not yet been able to determine why this is so.

More importantly, I cannot deduce any economic rationale for the divergent reactions to the supply shock. The equations governing the two industries’ output levels, prices, and profit rates are symmetrical in every respect. Apart from the switching of the numéraire, the economic system is exactly the same in the two cases. The conclusion seems clear: by shifting from one money commodity or numéraire to another, spurious differences in profit rates are created and spurious behavioral reactions follow. Because, however, there is no objective basis for deciding which numéraire is correct or which money is the “real” one —— in this sense as well the choice is an arbitrary one —— the physical quantities approach to valuation, profitability, and accumulation is fatally flawed. Again, macrodynamics requires an immanent measure of value, something that is not subject to changes in value, and therefore something other than a commodity.

## VI. Summary and Conclusions

This paper has shown that, due to the contradiction between use-value and value, it is impossible consistently to affirm simultaneously that value is determined by labor-time; that value and physical profit rates are identical (in a one-good world); and that the rate of capital’s self-expansion in value terms is governed fundamentally by the profit rate. Two key consequences of the incompatibility of these propositions were highlighted: in <u>any</u> theory in which value is determined by labor-time, increases in productivity imply that (a) the rate of capital accumulation in value terms must be lower than the corresponding physical rate, and (b) the rate of self-expansion of value must lag behind the physical profit rate.

The paper has also produced a novel argument against the claims that the value rate of profit and rate of self-expansion of value do not matter. It has demonstrated that the alternatives offered by those who make these claims —— valuation in terms of money commodities and numéraires —— lead to arbitrary measurement and arbitrary dynamics in a multi-good world. In short, the vulgar materialist attempt to make physical quantities the foundation of economic theory is incoherent in its very fundamentals. Of course, Malthus pointed this out to Ricardo nearly two centuries ago, and Ricardo was wise enough to see the point and abandon his attempt to determine “the rate of profits ... independently of value” (Sraffa 1960:93).

Anticipating the demise of the physical quantities approach, we may survey the remaining alternatives. First, one may deny that value exists, an approach first developed by Samuel Bailey, an ardent anti-Ricardian. Its modern form is that of high neoclassical general equilibrium theory, which has abandoned attempts to understand the average rate of profit (or interest) and its tendency. Indeed, it is forced to refer instead to an interminable series of own-rates of return on lathes, dental floss, chickens, etc., etc.

Second, one can assert that non-commodity money is the substance of value. This seems to be the approach underlying post-Keynesian theory, and Mirowski (1990) has also tried to develop it rigorously. Such theories must, strictly speaking, deny the existence of inflation —— the nominal value and the real value of anything are the same. No one finds this plausible, but, the argument goes, nothing else is the substance of value (here the ghost of Bailey reappears), and we make do with what we have. Yet we do not! Every one of us attempts, however imperfectly, to "adjust" the nominal value of things in order to ascertain their real value.

And is it true that nothing else is the substance of value? What has given this claim superficial credibility is the alleged internal inconsistency of Marx's value theory, in which labor is the substance of value. Yet during the past two decades, advocates of the temporal single-system interpretation of that theory have exposed the "proofs" of internal inconsistency as false (see Freeman and Carchedi (eds.) 1996; Kliman and McGlone 1997). The "proofs" all depend crucially on simultaneist interpretations of Marx's theory, which assimilate labor-time to physical quantities. That assimilation is what creates most of the inconsistency, precisely because value and use-value are contradictory. Hence, the death of the theory that value is determined by labor-time, like the death of Marx, has been greatly exaggerated, but its continued life will require deeper comprehension of the value/use-value contradiction, in opposition to the long legacy of attempts to efface it.

## REFERENCES

Arrow, Kenneth J. 1981. "Real and Nominal Magnitudes in Economics," in Daniel Bell and Irving Kristol (eds.), The Crisis in Economic Theory (New York: Basic Books).

Bradley, Ian and Michael Howard. 1982. "'Production of Commodities by Means of Commodities' and the Rehabilitation of Classical and Marxian Political Economy," in Ian Bradley and Michael Howard (eds.), Classical and Marxian Political Economy: Essays in honor of Ronald L. Meek (New York: St. Martin's Press).

Duménil, Gérard and Dominique Lévy. 1997. "The Conservation of Value: A rejoinder to Alan Freeman." Submitted to the International Working Group in Value Theory miniconference, Eastern Economic Association conference, Washington, D.C., April.

Farjoun, Emmanuel. 1984. "The Production of Commodities by Means of What?," in Ernest Mandel and Alan Freeman (eds.), Ricardo, Marx, Sraffa: The Langston memorial volume (London: Verso).

Foley, Duncan K. 1997. "Recent Developments in the Labor Theory of Value." Presented at the International Working Group in Value Theory miniconference, Eastern Economic Association conference, Washington, D.C., April.

Freeman, Alan and Guglielmo Carchedi (eds.). 1996. Marx and Non-equilibrium Economics (Cheltenham, U.K.: Edward Elgar).

Kliman, Andrew. 1997. "A Contribution to the Ongoing Inquiry into the Existence of Marx's Marxism." Submitted to the International Working Group in Value Theory miniconference, Eastern Economic Association conference, Washington, D.C., April.

__________ and Ted McGlone. 1997. "A Temporal, Single-System, Interpretation of Marx's Value Theory," forthcoming in Review of Political Economy.

Laibman, David. 1997. Capitalist Macrodynamics: A systematic introduction (Houndmills and London: Macmillan Press).

Marx, Karl. 1971. Theories of Surplus-Value, Part III (Moscow: Progress Publishers).

Mirowski, Philip. 1990. "Learning the Meaning of a Dollar: Conservation principles and the social theory of value in economic theory, Social Research 57:3.

__________. 1989. More Heat Than Light: Economics as nature's physics, physics as nature's economics (Cambridge: Harvard Univ. Press).

Okishio, Nobuo. 1961. "Technical Changes and the Rate of Profit," Kobe University Economic Review 7.

Schefold, Bertram. 1997. Normal Prices, Technical Change and Accumulation (New York: St. Martin's Press).

Sraffa, Piero. 1960. Production of Commodities by Means of Commodities: Prelude to a critique of economic theory (Cambridge: Cambridge Univ. Press).

__________. 1962. Letter to Peter Newman, 4th June. Published in Appendix to Krishna Bharadwaj, "On the Maximum Number of Switches Between Two Production Systems," Schweizerische Zeitschrift für Volkswirtschaft und Statistik 106:4, December.

## NOTES

i When all output is reinvested, $\Delta K_p$ equals output minus used-up physical capital (fixed and circulating, constant and variable). Physical "profit" ($P_p$) is defined as gross output minus used-up physical capital. $\alpha_p$ is the ratio of $\Delta K_p$ to $P_p$, so it equals 1. Whether valuation is simultaneous or temporal, $\alpha_v$ must also equal 1. $\Delta K_v$ is, by definition, the new sum of value invested minus the sum of circulating capital and physically depreciated fixed capital. Surplus-value (s) is defined as the value of output minus the minus the sum of circulating capital and physically depreciated fixed capital. When all output is reinvested, the new sum of value invested equals the value of output. Hence, $\Delta K_v$ = s, and since $\alpha_v$ is defined as the ratio of $\Delta K_v$ to s, it equals 1.

ii For instance, in order to claim that $r_v = r_p$, Foley (1997:27) suggests that labors of different "vintages" produce different amounts of value. If the value produced by the different vintages is proportional to the amounts of use-value they yield, then $r_v$ does equal $r_p$, and proposition C holds, but value cannot be determined by labor-time (see Kliman 1997). One unit of labor at times t and t+1 produce $X_t$ and $X_{t+1}$ units of the commodity, respectively. The sum of value (V) generated by each vintage of labor is proportional to its productivity, so $V_t/V_{t+1} = X_t/X_{t+1}$. Multiplying through by $V_{t+1}/X_t$, we obtain $V_t/X_t = V_{t+1}/X_{t+1}$. The unit value of the commodity is therefore constant over time, all changes in productivity notwithstanding.

[iii] If the above process continues —— living labor extraction stagnating and net output doubling each period —— then the profit rate on capital advanced and the two rates of accumulation of capital-value will all approach zero from below. The temporalist profit rate and rate of accumulation of capital-value will approach zero from above. The physical profit rate and rate of accumulation will approach 100%.

[iv] Laibman couches the point in terms of technically advanced capitals outcompeting backward ones. In the example above, however, no backward capitals exist. There was no fixed capital, and therefore all capitals began each new period with the cutting-edge technique just made available. In the absence of productivity differences, his point reduces to the one stated in the text.

[v] Quoted in Schefold (1997:197).

[vi] Rank goods from “higher-order” to “lower-order,” with basics (which enter into the production of all goods) being highest-order and goods that enter into the reproduction of no goods but themselves are lowest-order. Proposition (c) holds in all cases in which there is a single good in each group, and each good has a lower own-rate of reproduction than the next-highest-order good. Where groups contain multiple goods and/or some SRNBs have higher own-rates of reproduction than the next-highest-order good(s), more complex but similar conclusions hold.

[vii] Once again, where the groups defined in footnote 6 contain multiple goods and/or some SRNBs have higher own-rates of reproduction than the next-highest-order good(s), more complex but similar conclusions hold.

[viii] The profit rates of Figure 1 are based on the assumption that, in every case, each initial input price equals 1.

[ix] Since even slightly differentiated products have different prices, any theory that seeks to determine prices must count them as distinct commodities. One million then seems to be an extremely conservative estimate of the number of commodities. Farjoun (1984:16) notes that about 60,000 different chemicals alone are produced in the United States.