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Value Production and Economic Crisis: A Temporal Analysis

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During the past few years, an economic crisis threatened to destabilize the global economy as it spread from East Asia to Russia, Brazil, and elsewhere. Argentina went into a deep, accelerating collapse, and has not recovered. Meanwhile, the 12-year-long deterioration of Japan's economy has intensified, bringing on serious deflation. And shortly on the heels of one worldwide recession, another slump, potentially more severe, may be looming on the horizon, along with worldwide deflation. Globally, share prices have fallen by almost one-half since early 2000, and the current growth path of the United States appears unsustainable, given its whopping current account deficit, negative private saving rate, and real estate market bubble.

Owing to policy makers' adroitness – or perhaps luck – their interventions have thus far succeeded in holding the global economy together. Yet the crises keep erupting. It should thus be clear that the interventions have been *ad hoc* 'quick fixes,' not solutions to capitalism's crisis tendencies.

The fundamental reason why capitalism cannot resolve its crisis tendencies, I suggest below, is that the capitalist mode of production is founded on an unsolvable contradiction between the production of use-values (physical goods and services) and the production of value. *As physical productivity rises, commodities' values fall*. In other words, costs of production fall, and prices tend to fall as a result. This failure of value to 'self-expand' sufficiently leads to slumps in physical production because physical production under capitalism is always tied to value production and engaged in only insofar as it expands value.

Demand-side theories, in contrast, attribute economic crises to inadequate demand (or 'overproduction') and debt crises to excessive debt expansion. *Yet why is demand inadequate? What has made the volume of debt excessive*? The section 'Demand-side theories' argues that demand-side theories cannot answer these questions;[1] in the section 'Value production and crisis tendencies,' I suggest that the answer is, in large part, that value has failed to

'self-expand' sufficiently. Yet this raises a further question: what determines the growth rate of value? According to Marx's theory, its most fundamental determinant is employment growth (or, more precisely, growth of living labor extracted in production). I argue that this theory alone provides a foundation for explaining the coexistence of some key macroeconomic phenomena – rapid technological advance, sluggish or negative employment growth, the tendency of prices to fall, rising debt burdens, and economic crises – as a *coherent unified whole*.

A very different theory – the 'physical quantities approach' (Steedman 1977: 72, 216–17) – dominates today's 'Marxian economics.' Duménil and Lévy (2000: 142), like other proponents of physicalism, hold that '[t]he labor theory of value is not . . . [the foundation of] the theory of crisis or of historical tendencies. . . . [It] does not provide the framework to account for disequilibrium and dynamics in capitalism.' Physicalist authors do recognize that technological progress tends to reduce commodities' values and prices. Curiously, however, they deny that these reductions impair profitability, holding instead that profit rates are determined solely by 'physical quantities.' As a founder of this approach Bortkiewicz (1952: 40) wrote, 'it is wrong to connect a change in the rate of profit with a change in prices, since, as can be seen from our formulae, . . . price movements affect the capitalist's product [i.e. sales revenue] to the same degree as they do his outlay'; the profit rate thus remains unchanged.

What is actually wrong, I argue in section 'physicalism vs Marx's theory,' are the physicalist formulae. They misconstrue what profitability is (in the world outside physicalist models) and mismeasure it. The physicalist profit rate would measure profitability correctly only in a world in which technological advances did not tend to reduce prices.

Demand-side theories

Tautologies vs explanations

One widely held view on the Left attributes economic crises to the anarchic and competitive nature of private capitalism, which causes firms systematically to expand faster than demand will permit in the long run. Periodically, this results in excess capacity and overproduction, that is, production in excess of demand.[2]

This account is actually a tautology, not an explanation. As Marx (1978: 486) noted, '[i]t is a pure tautology to say that crises are provoked by a lack of effective demand or effective consumption. . . . The fact that commodities are unsaleable means no more than that no effective buyers have been found for them.' To attribute crisis to an excess of production over demand, in other words, is merely to restate that there is a crisis. It does not explain what has caused it. To do so, one needs to explain *why* the volume of output

has proven to be excessive – why, that is, demand has been too sluggish to enable everything to be sold at existing prices.

Attempts to attribute the Asian economic crisis to an overexpansion of credit also substitute tautology for explanation. That the region experienced a sudden outflow of capital *means* precisely that the prior inflow of capital was, in retrospect, excessive. The phenomenon has been restated but not explained.

A similar observation can be made with respect to Minsky's (1982) 'financial instability hypothesis.' Emphasizing the excessive increase in indebtedness – speculative and 'Ponzi' financing – that takes place in tranquil times, Minsky offers valuable insights into the conditions that permit 'shocks' to the economy to develop into crises. Yet the excessiveness of the debt burden is itself left unexplained. With reference to what has it become excessive? Why is the economy unable to absorb credit at the same pace as it is created? Only by answering such questions does one move from tautology to explanation.

Underconsumptionism

Underconsumption theories have indeed tried to explain what determines the growth of demand. They hold that total demand is ultimately determined by the demand for consumer goods, which is strictly limited by biological needs and/or the restricted development of new needs under capitalism.

Underconsumptionists recognize that investment spending, an additional source of demand, is not determined directly by consumer demand, but by the extent to which firms desire to increase production. Yet, they maintain, consumer demand limits the increase in production, and thus investment demand, because, directly or indirectly, 'the process of production is and must remain, regardless of its historical form, a process of producing goods for human consumption' (Sweezy 1970: 172).

Given the restricted growth of consumer demand, and the quicker growth of *potential* output that results from technological progress, it follows that a chronic tendency exists for aggregate supply to exceed aggregate demand. This is unsustainable in the long term, so it leads to crises of overproduction. Either production and employment must decline, or prices must fall, or some combination of the two.

Underconsumptionists deserve considerable credit for attempting to explain forthrightly why demand does not keep pace with production. Yet their crucial claim that the expansion of capitalist production is limited by consumer demand happens to be false. This was first demonstrated in the schemes of reproduction in Volume 2 of *Capital*. Marx did not dispute the tendency toward underconsumption, but showed that it constitutes no insurmountable obstacle to the expansion of production (Dunayevskaya 1989: 126).

One part of output consists of consumer goods. Another consists of means of production that are used, directly or indirectly, to produce new consumer goods. Consumer demand sets a limit to the expansion of these parts of output. Yet Marx's schemes demonstrated that there exists a final part of output that does not enter into consumption either directly or indirectly. Iron is used to produce steel, which is used to produce mining equipment, which is used to produce iron, and so on. The growth of *this* part of output is not constrained by 'human consumption,' since its demanders are not humans, but capitals.

The schemes also demonstrated that growth under capitalism generally requires that this final part of output grow faster than the others.[3] Thus, rather than being a system that produces for consumption's sake, capitalism increasingly becomes a system of production for production's sake.

Instead of attempting to disprove these demonstrations, underconsumptionists merely dismiss them in favor of what they believe to be reality, namely the dogma that even capitalist production is production for consumption's sake.[4] Explanations must of course correspond to reality; the problem is that the reproduction schemes *demonstrate* that this dogma does not.

Because the part of output that is not constrained by consumer demand grows faster than the other parts, production can indeed grow faster than consumption, even in the long term. Yet if the expansion of production is not limited by consumer demand and, again, investment demand is governed by capitalists' desire to expand production, it follows that consumer demand can set no insuperable limit to investment demand. Appeals to underconsumption are thus unable to explain what determines *total* demand.

This also implies that underconsumptionism cannot adequately account for crises. If investment demand is sufficiently strong, no crisis will occur, despite constraints on consumer demand. If, on the other hand, investment demand is weak and a crisis does occur, the crisis cannot be due to underconsumption, since what has constrained investment is something other than underconsumption.

It is widely recognized, even by demand-side theorists, that falling rates of profit (actual and expected) are what lie behind weak investment. They contend, however, that what lies behind falling profitability is weak demand in the market. Yet we have seen that, in order to explain the weakness in demand, weak investment spending must *first be presupposed*. Thus the demand-side explanation reduces to the circular claim that weak investment causes weak investment!

Breaking free from the circularity requires a reversal of the causal relation. It is the profit rate that regulates investment demand, and thus total demand, not the opposite. Thus the falling tendency of the profit rate does not result from 'realization' problems in the market, since these problems are not its cause, but its consequence. As Dunayevskaya (1991: 43) noted,

'it is the crisis that causes a shortage of "effective demand." The . . . "inability to sell" manifests itself as such *because of the fundamental antecedent decline in the rate of profit, which has nothing whatever to do with the inability to sell*.'

Value production and crisis tendencies

A brief sketch

A brief sketch of the view that I will develop further below runs as follows. When technological advances displace workers with machines, commodities' values (costs of production) fall. Their prices therefore tend to fall, too. This causes the devaluation of existing capital investments, as do technological advances directly, by making older equipment obsolescent. Devaluation leads to crises because the losses of value must eventually be written off and charged against profits, causing current profit rates to plummet. (But the same process restores future profitability since, after the write-offs, profit is larger in relation to the now-devalued capital.)

Declining prices – deflation – and even declines in their growth rate – disinflation – also depress profitability by reducing sales revenues. The decline in profitability can trigger a drop in investment, leading to a crisis of 'overproduction.' Deflation and disinflation also raise the real burden of debt, which tends to cause bankruptcies and financial instability. By heightening the risk of default, rising debt burdens can also bring about credit crunches, another cause of falling investment spending.

The falling tendency of prices can often be neutralized, as it has been throughout most of the past 70 years, by means of excessive credit expansion. I maintain, however, that this does not *negate* the system's crisis tendencies, but merely *displaces* them. The crises now appear more often in the form of debt crises, including State fiscal crises.[5]

It should be clear that I am not putting forward a 'millennial' model in which the profit rate falls 'mechanically' and 'inevitably' throughout all time (Laibman 1999: 224, 2001a: 81, 92). Some physicalist authors have characterized an earlier paper of mine in these terms, but in fact the paper contained *no model whatsoever*. I explicitly noted that I was not trying 'to model the movement in the observed profit rate' and that I was abstracting from the restoration of profitability by means of crises (Kliman 1996: 213). What has been mistaken for a model was simply a *counterexample* that I constructed in order to disprove the physicalist Okishio Theorem (Okishio 1961), which had long been thought to have refuted Marx's law of the tendential fall in the profit rate.

Productivity growth, values and prices

Marx (1977: 137) held that '[t]he same labour, . . . performed for the same length of time, always yields the same amount of value, independently of

any variations in productivity.' But when productivity rises, a given amount of labor yields more physical output, so values – that is, costs of production – per unit of output decline. Because innovating firms face lower costs than their rivals, they can boost their market shares by lowering their prices and still maintain or even increase their own profit rates. The rivals must either match the price reductions in order to remain competitive, or go out of business. In either case, the end result is that the firms which remain now sell at lower prices, *ceteris paribus*.

Even opponents of this supposedly 'metaphysical' value theory recognize that it correctly explains the effect of technological progress on prices. For example, Greenspan (2000) has stated that:

> Faster productivity growth keeps a lid on unit costs and prices. Firms hesitate to raise prices for fear that their competitors will be able, with lower costs from new investments, to wrest market share from them.... Indeed, the increased availability of labor-displacing equipment and software... is arguably at the root of the loss of business pricing power in recent years.

Let Q stand for aggregate output and L for the total (dead + living) labor needed to produce the aggregate output. Productivity can be expressed as $\Pi \equiv Q/L$. The aggregate value of output is $V \equiv vQ = aL$, where v is an index of per-unit values, and a is a constant. Its constancy reflects Marx's theory that a given amount of labor always produces a given amount of value. Yet the monetary expression of this value varies over time (see, e.g. Marx 1981: 266). The aggregate money price of commodities can thus be represented as $P \equiv pQ = mL$, where p is an index of per-unit prices, and m is the (variable) monetary expression of labor-time (see Ramos 2003). The associated percentage growth rates (denoted by dot superscripts)[6] are thus

$$\dot{\Pi} = \dot{Q} - \dot{L}$$
$$\dot{V} = \dot{L}$$
$$\dot{P} = \dot{m} + \dot{L}$$
$$\dot{v} = -\dot{\Pi}$$
$$\dot{p} = -\dot{\Pi} + \dot{m}$$

If $\dot{m} > \dot{\Pi}$, then $\dot{p} > 0$ – productivity growth will be accompanied by higher, not lower, prices. This does not contradict the point that Marx's theory predicts that technological advances *tend* to reduce prices. *Ceteris paribus*, an increase in productivity growth will reduce $\dot{p}$, and to the exact same degree that it reduces $\dot{v}$ – by one percentage point for every percentage-point rise in $\dot{\Pi}$. My preliminary estimate for the US economy between 1949 and 2000 indicates that a one-point rise in $\dot{\Pi}$ did indeed reduce $\dot{p}$ by roughly an amount, 0.987 point (Table 7.1).

Table 7.1 Effect of productivity growth on prices in the United States, 1949–2000

OLS Regression Estimate[a]	$\dot{p} = 2.50 - 0.987\,\ddot{\Pi} + 0.456\,\dot{Y} + 4.39\,\textbf{\textit{D}}$
	$\quad\;\;(4.89)\;\;(-4.33)\quad\;(2.67)\quad\;\;(7.45)$
	$R^2 = 0.68;\,F = 33.7;\,DW = 1.52;\,N = 52.$ *t*-statistics are in parentheses.

[a] $\dot{p}$, $\ddot{\Pi}$, and $\dot{v}$ are the annual growth rates of the CPI-U price index (year-on-year rate), the Bureau of Labor Statistics' multifactor productivity index for the business sector, and real gross domestic product. *D* is a dummy variable, equal to 1 for the years 1969–82, and 0 otherwise, that I introduced in order to account for an increase in $\dot{m}$ during that period. I introduced $\dot{Y}$ to control for cyclical effects. Multifactor productivity growth rate data are currently available for the years 1949–2000 only.

Profit rate dynamics

The general rate of profit is $r \equiv S/C$, where S is aggregate profit (which equals aggregate surplus-value under Marx's theory) and C is aggregate capital advanced. This implies that $\dot{r} = \dot{S} - \dot{C}$.[7] One important determinant of the rate of capital accumulation $\dot{C}$ is the '*destruction of capital* through crises' – both the destruction of 'real' or physical capital, and the destruction of 'nominal' capital, the 'depreciation of *values*' (Marx 1968: 495, 496). But assuming – for the moment – that no such destruction occurs, $\dot{C}$ is simply the ratio of new investment to capital advanced, I/C. I can be expressed as αS, where $\alpha \equiv I/S$ is the share of profit that is re-invested. Thus $\dot{C} = \alpha S/C = \alpha r$, so that

$$\dot{r} = \dot{S} - \alpha r$$

Assume that $\dot{S} \geq 0$ and $\alpha > 0$. Then the profit rate falls ($\dot{r} < 0$) if $r > \dot{S}/\alpha$, and rises if $r < \dot{S}/\alpha$. Thus r converges over time to $\dot{S}/\alpha$, which we can call r_{LR}, the long-run profit rate.

It seems reasonable that movements in α are principally short-term ones, associated with the business cycle, and thus that α is essentially trendless in the long run. Nor is there good reason to predict any specific trend in $\dot{S}$. Strong theoretical and empirical arguments suggest that profit will be a more or less constant share of the aggregate price of output over the long haul, since wage-increases that threaten profitability will be temporary and self-negating.[8] Thus S will grow at a rate close to the same rate as P, and there is little, if any, reason to presume any particular trend in the latter's growth rate.

There is consequently little, if any, reason to suppose that the long-run profit rate will fall over time! How, then, can the profit rate have a falling tendency?

The answer is that the falling tendency is not a matter of a different steady state (a decline in r_{LR}), but of 'transition dynamics,' that is, adjustment

toward the steady state. As we saw above, if the profit rate is initially greater than r_{LR}, it will tend to fall over time. *The tendency of the profit rate to fall is precisely this tendency of the profit rate to adjust downward toward r_{LR}.*

Put differently, the profit rate will decline if r_{LR} is too low to allow the current rate to be sustained. But what makes r_{LR} too low? It is limited by the growth rate of profit, which in turn is held in check by sluggish employment growth and reduced by productivity growth. To see this, assume as before that profit is a roughly constant fraction of the aggregate price of output over the long haul. Profit then grows at essentially the same rate as does aggregate price, $\dot{L} + \dot{m}$. Thus the profit rate is limited in the long run by the growth rate of value, which in turn depends upon the growth rate of employment. And since $\dot{L} + \dot{m} = \dot{p} + \dot{Q}$, and technological advances tend to reduce $\dot{p}$, they likewise tend to lower the profit rate.

Note that any reduction in $\dot{p}$ – any disinflation – will tend to reduce profitability. Outright deflation – $\dot{p} < 0$ – is not necessary. Nor is the supposed distinction between 'bad' deflation, 'caused' by inadequate demand, and 'good' deflation, caused by technological progress, relevant here. 'Good' deflation depresses profitability no less than does 'bad' deflation, because it, too, reduces revenues today in relation to costs incurred in the past.[9]

Yet technological advances not only reduce profitability, they also restore it. By lowering prices and causing early obsolescence of old equipment, they bring about economic crises in which capital-value is destroyed. From that point forward, the profit rate increases because the destruction of capital reduces its denominator. Thus the profit rate is once again greater than r_{LR}, and the process is set to begin all over again.

The tendential fall in the profit rate therefore expresses itself not through a secular decline in profitability, but through recurrent crises. This was Marx's (1981: 367, emphasis added) view as well: 'the falling rate of profit . . . has *constantly to be overcome* by way of crises.' The destruction of value 'overcomes' the falling tendency and sets the stage for renewed expansion. And since profitability can always be restored if enough capital-value is destroyed (which requires only a sufficiently long and severe crisis), no crisis is permanent.[10]

Value and the debt burden

The framework developed above can help clarify that what makes debt burdens excessive is debt expansion that is too great *in relation to* the surplus-value that has been produced. The same imbalance is what makes Ponzi finance a destabilizing factor, rather than something sustainable in the long term.

A common measure of the business sector's debt burden is the ratio of debt to profit. This ratio will rise if profit grows more slowly than debt. The proportional growth rate of debt is the interest rate, i, plus the ratio of net borrowing (new borrowing minus retired debt) to existing debt, b. Thus the debt/profit ratio will rise as long as

$$\dot{S} < i + b$$

If $\dot{S} < i$, the debt burden is clearly unsustainable. The debt/profit ratio will rise indefinitely and without limit, even if $b = 0$. Short of massive default, the only solution for businesses is to pay back more of their existing debt than they borrow. But even when $\dot{S} > i$, businesses still have to reduce their rate of net borrowing. In either case, the drop in b causes a drop in investment spending, which in turn causes $\dot{S}$ to fall, making yet another decline in b necessary, and so on (If the fall in b causes $\dot{S}$ to fall by a larger percentage, it is impossible to halt the growth of the debt burden.)

'Ponzi finance' refers to an increase in indebtedness not for the purpose of acquiring new productive assets, but simply to pay interest on outstanding debt (Minsky 1982: 28). If the ratio of debt to the value of capital assets is rising, Ponzi finance is taking place. But the debt/capital ratio rises insofar as the growth rate of capital, $\dot{C}$, is less than the growth rate of debt,

$$\dot{C} < i + b$$

As noted above, the profit rate will almost certainly be convergent. This implies that capital-value and surplus-value grow at the same rate in the long run, that is, that $\dot{C}$ converges to $\dot{S}$. Thus if surplus-value fails to grow or grows very slowly (at a rate less than $i + b$), Ponzi finance is almost inevitable. The financial structure becomes unstable, increasingly prone to crisis when confronted with a 'shock.' A decline in the interest rate, perhaps engineered by central banks, could conceivably offset this tendency. On the other hand, as debt rises in relation to the asset base, lenders will demand higher risk premiums, and the interest rate will instead tend to rise.

By using the terms surplus-value and profit interchangeably here, I have implicitly assumed that the monetary expression of labor-time, m, remains constant. During the expansionary phase of the business cycle, however, m increases – the nominal price of aggregate output grows faster than its real value. This temporarily raises the nominal profit rate and temporarily ameliorates the tendency toward excessive indebtedness.

A considerably longer-term discrepancy between the nominal price and the real value of aggregate output arises when government debt is used as a policy tool, and when easy money policies encourage private sector borrowing. Aggregate demand increases more quickly than does the production of value, so commodities' money prices rise above their values. This process, too, tends to counteract the tendency of the (nominal) profit rate to fall.[11]

In contrast to the expansion-induced discrepancy between nominal prices and real values, however, this one *exacerbates* the debt problem, precisely because excessive debt buildup – a buildup of debt in excess of the underlying values – is the very mechanism that is propping up prices. On the one hand,

Table 7.2   Public debt burden in OECD countries, 1979–2001

Country	Public Debt/GDP[a]		Percentage Change[b]
	Low (in %)	High (in %)	
United States	36.2 (1981)	75.8 (1993)	109
Japan	45.6 (1979)	132.8 (2001)	191
Germany	30.8 (1979)	63.2 (1998)	105
France	30.1 (1981)	65.0 (1998)	116
United Kingdom	44.3 (1991)	61.4 (1998)	39
Italy	57.7 (1980)	124.0 (1994)	115
Canada	43.7 (1979)	120.4 (1995)	176
Spain	16.5 (1979)	81.3 (1998)	393
Netherlands	44.1 (1979)	78.8 (1993)	79
Belgium	70.6 (1979)	138.1 (1993)	96
Austria	36.0 (1979)	69.2 (1995)	92
Sweden	39.6 (1979)	77.9 (1994)	97
TOTAL, OECD[c]	39.7 (1979)	75.6 (1996)	90

[a] General government gross financial liabilities, as a percentage of nominal gross domestic product.
[b] From lowest to highest year.
[c] Includes other OECD countries not listed above.

Sources: *OECD Economic Outlook* (Paris: Organization for Economico-operation and Development), No. 59, June 1996, Annex Table 34; No. 71, June 2002, Annex Table 33.

then, the tendency of the profit rate to fall is less likely to find *immediate* expression; the profit rate, in other words, is less likely to fall. On the other hand, these Keynesian policies do not negate, but only *displace*, the system's crisis tendencies. Instead of the crises appearing in the goods market, they crop up mostly in the forms of debt crises and of fiscal crises of the state.

Table 7.2 helps to indicate the magnitude as well as the ubiquitous nature of the fiscal difficulties faced by Organization for Economic Co-operation and Development (OECD) countries in the last two decades. The twelve countries, listed in order of GDP, together produce more than 70 percent of the value of world output. Except for the United Kingdom, all of them have experienced massive increases in the burden of public debt. The overall debt/GDP ratio fell somewhat during the boom years of the late 1990s, but the OECD expects it to rise again.

Physicalism vs Marx's theory

The physicalist profit rate

The 'physical quantities approach' is rooted in static general equilibrium models formulated by Dmitriev (1974), Bortkiewicz (1952), and later writers. Such models suppress intertemporal changes in prices and values, and thus

the profit rate becomes a function solely of 'physical quantities' – technology and real (i.e. physical) wages. In diametrical opposition to Marx's (1968: 439; cf. Marx 1981: 347) theory, in which '[t]he rate of profit...falls, not because labour becomes less productive, but because it becomes more productive,' these models imply that productivity increases *raise* the profit rate. For the profit rate to fall, some kind of *falling* productivity is therefore necessary. If the real wage rate is constant, the physicalist profit rate falls only if total factor productivity falls. If instead, the value of the wage is constant, this profit rate becomes a function solely of capital productivity (output per unit of physical capital) and falls only if capital productivity falls (see Brenner 1988: 11). Thus Laibman (1997: 56) posits 'severe diminishing returns to mechanization' in order to derive a falling profit rate. Clearly, the implications of physicalism are, in Brenner's (1998: 11) apt phrase, 'impeccably Malthusian.'

Although proponents of physicalism recognize that technological advances create a tendency for prices to fall, they deny that this impairs profitability. They do so in one of four ways.

Static equilibrium

Prices in their models are stationary; each good's input and output prices are equal. How, then, do technological advances tend to reduce prices? The answer is that there has been history, but there is no longer any. Productivity increases *did* reduce prices, but they have since stabilized. Since they are no longer falling, the profit rate now depends solely upon physical quantities. This answer might seem reasonable, since surely no single technological innovation will reduce prices forever. Yet technological advance is an ongoing process. Continuous technological change tends continually to lower output prices in relation to input prices. So today's revenues decline continually in relation to costs incurred in the past, which does depress profitability.

The 'tracking' argument

In light of this problem, some theorists have conceded that physicalism's stationary-price profit rate does not accurately reflect the actual rate. Nonetheless, they have countered, the value rate of profit must 'track' the physicalist rate. This claim was debated in two symposia in *Research in Political Economy* (Volumes 17 and 18). In the end, Foley (2000b: 281) agreed with Alan Freeman and me that 'it is possible for the *money* and *labor* rates of profit to fall [under conditions in which the physicalist rate must rise], if the money price level or labor productivity...change in certain ways.' David Laibman held fast to the tracking argument, but only by redefining 'tracking.' According to his revised definition, the value rate of profit tracks the physicalist rate even if the former falls *forever* while the latter rises forever (Kliman and Freeman 2000: 292; Laibman 2000b: 274).

Irrelevance of absolute prices

Some proponents of physicalism appeal to corn models and standard commodities in order to argue that values and prices are mere veils. In an economy in which corn was the only output and non-labor input, they maintain, the profit rate would be determined 'directly between quantities of corn without any question of valuation' (Sraffa 1982: xxxi). And the real-world profit rate is *fundamentally* determined in the same way.

Yet even in the corn-model case, profitability does indeed depend upon the self-expansion of value. Imagine a firm that invested $100 a year ago for 4 bu of seed corn, which it used to produce 5 bu of corn, harvested today. Also imagine that, owing to rising productivity, the latter are worth only $100. Sraffians insist that the firm's profit rate is not zero percent, but 25 percent – the rate of increase in corn. To see what's wrong here, imagine that the firm *borrowed* the original $100 for one year. Will its creditor be content with a repayment of $80, on the ground that the $100 loan was equivalent to 4 bu, which are worth a total of $80 today? It will more likely demand the whole $100 – plus interest, which the firm cannot pay.

The Sraffians' error stems from their misunderstanding of the doctrine that only relative prices, not absolute money prices, affect profitability. Since corn is the only 'commodity,' they reason, it has no relative price, and thus profitability depends upon the physical data alone. But the corn *does* have a relative price, one that falls and thereby lowers the profit rate: each bushel is worth 1/4 of the $100 loan asset before the harvest, but only 1/5 thereafter. This phenomenon is known as debt deflation. As the Bank of England's Mervyn King (1993) has emphasized, 'debt deflation is a real[,] not a mone-tary[,] phenomenon, and is concerned with a change in relative prices.'

Hence, the fact that value and price are relative concepts does not mean that '[v]alue is a relation between *contemporary* commodities . . . only' (Bailey 1825, quoted in Marx 1971: 154), which is the real significance of the Sraffians' 'relative price' doctrine – and which, ironically, was the crux of Bailey's attack on Ricardian value theory! Financial relations are temporal relations, relations that link the past and the present, the present and the future, relations in which value *persists* over time.

Replacement-cost valuation

Finally, some physicalist theorists are able to deny that falling prices reduce profitability because they use post-production replacement costs, not costs actually incurred in the past, to compute profits and profit rates. Because this procedure makes price changes irrelevant, it yields a 'profit rate' that depends upon physical quantities alone. Yet this 'profit rate' is not a profit rate in the normal sense. It is not the rate that guides capitalists' decisions (the rate they seek to maximize), nor the rate of 'self-expansion' of value, nor the rate that regulates capital accumulation.

Investors, managers, and state planners care about the rate of return on their actual, original investment. Their concept of profit is temporal. Measures of profitability used in investment decisions, such as the internal rate of return (IRR) and net present value, compare sums of value spent and received at *different moments in time*. Marx measured profitability in essentially the same way. For instance, he wrote that '[t]he 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' (Marx 1971: 131). The foremost purpose of his theory of surplus-value is to explain what determines the difference 'between the value antecedent to production and the value which results from it.' Replacement-cost valuation cannot explain this, since it does not use the value antecedent to production to measure cost. Physicalist 'profit' is simply not surplus-value; it is the difference between the value of output and the inputs' replacement costs at a *single moment in time*.[12]

The actual profit rate is also important because it governs the rate of capital accumulation $\dot{C}$. Indeed, $\dot{C} \equiv I/C$ is simply the profit rate (S/C) times the ratio of new investment to profit (I/S). If all profit is re-invested, then the rate of accumulation must equal the profit rate. Yet because the replacement-cost profit rate is not computed on the actual sum of capital advanced C, it fails to govern the rate of accumulation in this way.

An example

The following simple example (Table 7.3); does not attempt to model the real-world movement of profitability. Its purpose is to substantiate the claims made in the last subsection. The economy produces corn by means of seed corn and labor. The wage rate is zero, so profit equals the new value generated in production, and the value advanced for seed corn is the entire capital advanced. The total value of output is the cost of the seed corn plus the new value generated. Capitalists re-invest all output and, accordingly, the total value produced in one year becomes the capital advanced in the next. Employment is constant over time, and since according to Marx's theory the same amount of labor always creates the same amount of value, new value is also constant. Physical quantities, and the first year's capital advanced and new value figures, are data; all other figures are derived. (Using end-of-year (output) prices to revalue the seed corn, we obtain capital 'advanced' in replacement-cost terms; subtraction of the latter from the value of output yields the revised new value = profit.)

Because productivity increases continually, so does the physical profit rate. But the IRR – the (temporal) value rate of profit – falls continually, since capital advanced is increasing by $125/year, while profit is stagnant. The replacement-cost profit rate, equal to the physical rate, rises continually.

Table 7.3 Value, physical, and replacement–cost profit rates

| Year | Capital advanced | New value = Profit | Value of output | Profit rate (in %) | $\dot{C}$ (in %) | Unit price of output (in $) | Replacement-cost calculations | | | |
							Capital 'advanced' (in $)	New value = Profit (in $)	Profit rate (in %)	$\dot{C}$ (in %)
1	$1250 (1250 bu)	$125 (125 bu)	$1375 (1375 bu)	10.0 (10.0)	10.0	1.00/bu	1250.00	125.00	10.0	8.2
2	$1375 (1375 bu)	$125 (150 bu)	$1500 (1525 bu)	9.1 (10.9)	9.1	0.98/bu	1352.46	147.54	10.9	7.5
3	$1500 (1525 bu)	$125 (180 bu)	$1625 (1705 bu)	8.3 (11.8)	8.3	0.95/bu	1453.45	171.55	11.8	6.9
4	$1625 (1705 bu)	$125 (216 bu)	$1750 (1921 bu)	7.7 (12.7)	–	0.91/bu	1553.23	196.77	12.7	–

But this means that it diverges increasingly from the IRR and from the rate of self-expansion of value, which is precisely what the IRR measures.

As noted above, the rate of capital accumulation *C* must equal the profit rate when, as in this example, all profit is re-invested. The value rate of profit satisfies this definitional requirement, but the replacement-cost rate does not. It exceeds both the actual rate of capital accumulation and the replacement-cost-based rate by an ever-increasing amount. Thus as time proceeds, *the replacement-cost profit rate becomes a decreasingly adequate measure of the actual expansion of value in relation to the original capital advanced, and of the rate of capital accumulation.*

This example disproves the Okishio theorem, which supposedly refuted Marx's law of the tendential fall in the profit rate. The real wage (= 0) is constant, and the technical changes are continually cost reducing, since they reduce the ratio of seed corn to output. According to the theorem, the profit rate cannot fall under such conditions, yet the IRR falls continually.

What creates value?

Is there *any* way, then, that the profit rate might mirror changes in productivity, in the manner of the physicalist rate, but without cooking the books? Is it possible, in other words, to conceive of a physically determined profit rate that nonetheless accurately measures the self-expansion of value and governs investment decisions and the rate of accumulation? Certainly. One needs only to repudiate Marx's theory that living labor creates all new value – but one does need to repudiate it.

One may, for instance, contend that value is determined in the market, not in production. In other words, one may contend that the total value of commodities is just the price paid for them, which is determined by the relation between aggregate supply and aggregate demand. Yet as we have seen above, demand depends on profitability, which in turn depends upon the growth of value. Theories of this sort therefore fall prey to a circularity – the generation of value determines the aggregate demand that determines the generation of value – that makes them truly unable to account for the determination of value.

Another – physicalist – way to repudiate Marx's theory is to claim that new value is determined not by the amount of living labor extracted, but by the amount of net product. Imagine, for instance, that each bushel of net product in Table 7.3 (the physical figure corresponding to new value) generates a constant $1 of new value. If we otherwise retain the same assumptions that were used to generate Table 7.3, we obtain Table 7.4.; The rates of profit and capital accumulation are now identical to the physical rates. In accordance with physicalism, and without using replacement-cost valuation to cook the books, rising productivity causes the profit rate and maximum rate of capital accumulation to rise.

Table 7.4 Corn as value substance

Year	Capital advanced (in $)	New value (in $)	Value of output (in $)	Profit rate (in %)	$\dot{C}$ (in %)	Unit price of output (in $)
1	1250	125	1375	10.0	10.0	1.00/bu
2	1375	150	1525	10.9	10.9	1.00/bu
3	1525	180	1705	11.8	11.8	1.00/bu
4	1705	216	1921	12.7	–	1.00/bu

I noted earlier that proponents of physicalism accept that technological change tends to reduce prices. Yet physicalism *itself* is not compatible with this tendency. As Table 7.4 shows, *once the net product is made the determinant of new value, technological advances cannot cause the price of corn to fall* (unless the books are cooked).[13] Indeed, the reason the rates of profit and accumulation are rising is precisely that, despite continually increasing productivity, the price of corn is not falling.

From Ernst (1982) to the example of the last subsection, twenty years' worth of examples have demonstrated conclusively that Marx's law of the tendential fall in the profit rate does not suffer from the *internal inconsistency* that has been attributed to it. Nonetheless, it might be *false*. That sources of value other than living labor may exist cannot be ruled out *a priori*. Empirical criteria must be used to decide the matter.

I suggest that the well-known tendency for rising productivity to lead to falling prices counts as very strong empirical evidence in favor of Marx's theory. The other theories discussed here cannot predict this tendency. Because demand-side theories cannot account for total demand, they cannot explain movements in aggregate prices. Physicalism fares even more poorly. If changes in the profit rate are to mirror changes in productivity, rising productivity cannot lead to falling prices.

Conclusion

This chapter has critiqued prominent theories of profitability and crisis, especially underconsumptionism and the 'physical quantities approach' that dominates Marxian economics. It has argued instead that economic crises are rooted in capitalism's production of value as an end in itself. The imperatives imposed by the production and accumulation of value lead to recurrent disruptions of physical production. A key policy conclusion flowing from this analysis is that an end to recurrent crises will require a different way of producing and coordinating society, based on a different goal: 'the development of human powers as an end in itself' (Marx 1981: 959).

Notes

1. I disregard (post-)Keynesian crisis theory, which seems to me ultimately to offer no explanation at all, since the key determinants in this theory, changes in investors' expectations and in central bank policies, are themselves left unexplained.
2. The theory advanced by Brenner (1998) can be read in this manner, though I am not sure it was what he intended.
3. A decline in input–output coefficients could counteract this tendency.
4. 'Any attempt to get away from this fundamental fact represents a flight from reality . . . [The existence of] reproduction schemes which apparently demonstrate the opposite does not change matters one whit: production is production for consumption' (Sweezy 1970: 172).
5. I am not suggesting that this account constitutes a complete explanation of economic crisis, only that the linkages sketched out above are important ones that should not be overlooked.
6. If $Z = XY$, then $\dot{Z} = \dot{X} + \dot{Y}$ and if $Z = X/Y$, then $\dot{Z} = \dot{X} - \dot{Y}$. The growth rate of constants is 0.
7. Only under the 'temporal single-system' – or 'sequential' and 'non-dualist' – interpretation (see e.g. Freeman and Carchedi 1996) of Marx's value theory do these relations hold true. Under this interpretation, C is determined temporally – it is the sum of value *actually advanced prior to production* – and there is a single system of price and value determination in which commodities' values and prices both depend in part upon the *price* of inputs. Physicalist interpreters hold to the contrary that C is determined atemporally; it depends upon inputs' *post-production* (or replacement) cost. As will be shown below, this implies that the tendency of r does not depend upon the rate of accumulation of capital-value ($\dot{C}$). Most physicalist interpreters also subscribe to a dual-system interpretation, according to which commodities' values depend upon the *value* of inputs. Under this interpretation, aggregate profit can deviate from aggregate surplus-value.
8. See Marx (1977: 769–72); Brenner (1998: 16–21). Faced with rising wages which threaten profitability, firms substitute machines for workers, or reduce investment spending and thus cut back on production and employment. In both cases, the drop in employment depresses wages.
9. I suspect that one reason why the negative effect of technological advances on profitability is not recognized more widely is that innovating firms tend to increase their own profit rates since they produce more cheaply than before. But to assume that what is true for the individual firm is true for the whole economy is to commit a logical error, the fallacy of composition.
10. 'When Adam Smith explains the fall in the rate of profit [as stemming] from an over-abundance of capital, . . . he is speaking of a *permanent* effect and this is wrong. . . . Permanent crises do not exist' (Marx 1968: 497n).
11. '[T]he rise in the rate of profit [in England between 1797 and 1813] was due [partly] to rising *nominal* prices of commodities, because loans and government expenditure increased the demand for capital even more rapidly than its supply' (Marx 1968: 460).

12. Moseley (2000b) and others have argued that Marx valued inputs and outputs simultaneously and thus that he measured profitability in replacement-cost terms. This interpretation fails standard tests of interpretative adequacy, since it renders his law of the tendential fall in the profit rate and other important theoretical conclusions internally inconsistent or false. According to a generally accepted hermeneutic tenet, interpretations must understand texts as coherent wholes, and according to leading historians of economic thought, they must be compatible with the author's main analytical conclusions (see Kliman 2002a).

13. This perverse phenomenon was recognized concurrently by Freeman (1997a), and Kliman (1997).