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Kalecki and the Grossmann Model of Economic Breakdown*

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ABSTRACT: Henryk Grossmann radically changed the course of Marxist economics with his 1929 adaptation of Marx's law of the falling rate of profit. By a simple extension of Otto Bauer's simulation of Marx's reproduction schema, Grossmann demonstrates that accumulation leads to a shrinking pool of surplus value and eventual economic breakdown. It can, however, be argued that once the role of money is taken seriously in Marx's reproduction schema it is no longer possible for accumulation to swallow up all the available surplus value. By identifying the role of the Kalecki principle in Marx's schema, that capitalists earn what they spend, a modified simulation of the Bauer/Grossmann model is developed in which there is no precise mechanical breakdown. This approach leads to a focus, in interpreting Marx's law of the falling rate of profit, on problems of realization associated with an increasing mass of surplus value.

ONE OF THE MOST REMARKABLE DEVELOPMENTS in Marxist economics has been the establishment of an orthodox theory of crisis based on the work of the Polish Marxist, Henryk Grossmann (1929). His representation of Marx's law of the tendency of the falling rate of profit was first seen as an extremely unorthodox position, compared to the then-popular underconsumption and disproportionality perspectives. As Jacoby (1975, 35) has pointed out, "Prior to Grossmann [the falling rate of profit] received very little attention." In more recent years, however, the falling rate

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of profit has taken center stage as a theory of crisis. The cornerstone of Grossmann's contribution is his extension of Otto Bauer's simulation of Marx's reproduction schema. Compared to Bauer's simulation over four years, Grossmann demonstrates for a 35-year period that the accumulation of capital leads to a scarcity of surplus value and eventual economic breakdown.

Howard and King (1989) have surveyed the numerous criticisms that have been made of the Grossmann position, with particular emphasis on the complex relationship between technological change and the rate of profit. A stringent defense has also been provided by Kuhn (1995), drawing upon the recent Marxist literature on the rate of profit. One dimension of Grossmann's simulation that has received limited attention, however, is the role played by the personal consumption of capitalists. Grossmann (1992, 81) refers to the allocation of surplus value to capitalist consumption as "an essential characteristic condition of the accumulation of capital." In the breakdown scenario, investment in constant capital, consisting of items such as new machinery and raw materials, outstrips investment in variable capital, the outlay on wages. Since, relative to constant capital, less living labor is available to produce surplus value, this creates a pressure point in the economic system. The demand on the mass of available surplus value "devours the portion reserved for capitalist consumption," such that the "capitalist class has nothing left for its own personal consumption because all existing means of subsistence have to be devoted to accumulation" (Grossmann, 1992, 80, 76). Since only the working class is able to subsist, there is no incentive for capitalists to continue with accumulation.

The purpose of this paper is to take issue with the treatment of capitalist consumption, and the associated role of investment, in the breakdown model. As an additional contribution to the evaluation of Grossmann's position, I argue that once the role of money is taken seriously in Marx's reproduction schema it is no longer possible for accumulation to swallow up all the available surplus value. In a reading of Marx's reproduction schema proposed by Sardoni (1989), monetary expenditures on capitalist consumption are cast into circulation at the start of each production period. Expenditures on capitalist consumption are governed by the advance of money, before production of these items of consumption takes place. This interpretation is captured by the principle, developed by another Polish Marxist,

Michal Kalecki, that capitalists earn what they spend. "Now, it is clear that capitalists may decide to consume and to invest more in a given period than in the preceding one, but they cannot decide to earn more. It is, therefore, their investment and consumption decisions which determine profits, and not vice versa" (Kalecki, 1991c, 240–241). Under this Kalecki principle, capitalist consumption is not seen as a residual that is allocated from the pool of surplus value, but rather as a monetary outlay, which together with investment determines the volume of surplus value.

It will be shown, by modifying the breakdown simulation to include the Kalecki principle, that the class neutrality assumption of a constant rate of exploitation is accordingly relaxed. Both Bauer and Grossmann regarded this assumption as provisional. And as has been noted by Laibman (1992, 122): "A rising rate of exploitation is as much a source of contradiction and an immanent critical tendency in capitalism as is a falling rate of profit." Moreover, it can be argued that the consequences of a rising rate of exploitation are important to Marx's exposition of the falling rate of profit thesis in *Capital*, Volume III (*Capital* III).

In the first part of the paper, Grossmann's model is introduced by considering his numerical adaptation of Marx's reproduction schema. In the second part, the role of money in Grossmann's model is examined by introducing the Kalecki principle. In the third part, a new simulation of the Grossmann table is developed in which the reproduction schemes do not break down due to a scarcity of surplus value. From this perspective it is suggested, in the final part, that realization problems should be considered in developing the falling rate of profit tendency as a theory of crisis.

The Law of Capitalist Breakdown

The starting point for Grossmann's model of accumulation is provided by Otto Bauer's 1913 adaptation of Marx's reproduction schema (Bauer, 1986). Grossmann's objective was to directly engage and contend with Bauer's argument that capital accumulation could be sustained through successive periods of expanded reproduction, without breakdown. The approach taken by Grossmann (1992, 67) is to "demonstrate the real facts through Bauer's reproduction scheme." Furthermore, "Bauer succeeded in constructing a reproduction scheme which,

apart from some mistakes, matches all the formal requirements that one could impose on a schematic model of this sort" (*ibid.*). Since Grossmann plays such a key role in establishing the credibility of the Bauer model, reaching radically different conclusions to Bauer, we shall also refer to it interchangeably as the Grossmann model.

Grossmann (1992, 65) adapts the Bauer model with the explicit aim of forming a theory of crisis from the "essence of capitalist production." Following Marx's employment of the reproduction schemes, prices are assumed to be identical to values, so that deviations of demand from supply are not considered in Grossmann's abstract theory of crisis. Similarly, problems associated with credit, in practice always present in economic crises, are not considered relevant at this abstract level of analysis.

An accessible introduction to Grossmann can be provided by examining the simulation of growth which he carried out using numbers taken from Bauer. Key to the Bauer model is an assumption that constant capital increases at a higher rate than variable capital; the former increases at 10% per annum and the latter at 5% (Grossmann, 1992, 67). The result is a continual increase in the organic composition of capital, the ratio of constant to variable capital. The rate of surplus value, the ratio of total surplus value to variable capital, is assumed to remain constant at all times. With variable capital increasing at 5% each year, the same increase in the pool of total surplus value takes place, out of which additional increments of constant and variable capital are funded. Capitalist consumption is treated as a residual, funded by the amount of surplus value that remains after the appropriate amount required for capital accumulation has been set aside.

Table 1 shows Grossmann's simulation, the numbers being very slightly different from the original after correcting for rounding errors and minor errors of calculation.[1] In addition, although Grossmann models the departments of production explicitly, for ease of exposition only economy-wide totals are considered.

At the outset the economy employs 200,000 units of constant capital and 100,000 units of variable capital. With a rate of surplus value of 100%, a consequent 100,000 units of surplus value are pro-

1 For example, the entry for constant capital in year 4 is 266,200 instead of Grossmann's mis-calculation of 266,000 (see Howard and King, 1989, 334). The numbers shown here are calculated with the advantage of spreadsheet technology.

TABLE 1
Grossmann's Reproduction Schema

Year	Constant Capital (C)	Variable Capital (V)	Capitalist Consumption	Change In C	Change In V	Total Value	Proportion of Profits Saved (%)	Rate of Profit (%)
1	200000	100000	75000	20000	5000	400000	25.00	33.3
2	220000	105000	77750	22000	5250	430000	25.95	32.3
3	242000	110250	80538	24200	5513	462500	26.95	31.3
4	266200	115763	83354	26620	5788	497725	28.00	30.3
5	292820	121551	86191	29282	6078	535921	29.09	29.3
6	322102	127628	89037	32210	6381	577358	30.24	28.4
7	354312	134010	91878	35431	6700	622331	31.44	27.4
8	389743	140710	94700	38974	7036	671164	32.70	26.5
9	428718	147746	97486	42872	7387	724209	34.02	25.6
10	471590	155133	100217	47159	7757	781855	35.40	24.8
11	518748	162889	102870	51875	8144	844527	36.85	23.9
15	759500	197993	112144	75950	9900	1155486	43.36	20.7
19	1111983	240662	117430	111198	12033	1593307	51.21	17.8
20	1223182	252695	117742	122318	12635	1728572	53.41	17.1
21	1345500	265330	117513	134550	13266	1876160	55.71	16.5
25	1969947	322510	109390	196995	16125	2614967	66.08	14.1
27	2383635	355567	99425	238364	17778	3094770	72.04	13.0
30	3172619	411614	73771	317262	20581	3995846	82.08	11.5
31	3489880	432194	61596	348988	21610	4354269	85.75	11.0
33	4222755	476494	30394	422276	23825	5175744	93.62	10.1
34	4645031	500319	10800	464503	25016	5645669	97.84	9.7
35	5109534	525335	∅	510953	26267	6160204	102.26	9.3

NOTE: Grossmann uses the symbol ∅ to refer to a negative quantity, which is economically meaningless.

duced, resulting in a rate of profit (100,000/(100,000+200,000)) of 33.3%. This pool of surplus value is used for funding a 10% expansion in constant capital of 20,000 and a 5% expansion of variable capital by 5,000. The fourth column of Table 1 shows that, after funding this capital expansion, 75,000 units are left as a residual for purposes of capitalist consumption. In this initial year of economic activity, the capitalists retain 75% of their profits for personal consumption (savings of 25%).

Year 2 shows a new input of 220,000 units of constant capital incorporating the additional 20,000 units produced in the previous period; and a new 105,000 units of variable capital incorporating the

additional 5,000 units of variable capital. With the rate of surplus value remaining the same, a new pool of 105,000 units of surplus value is produced, and disposed of with further increases in constant capital (by 22,000) and variable capital (by 5,250). The residual volume of capitalist consumption, after funding the capital expansion, is 77,750. Note that, although there is an increase in capitalist consumption, the proportion of profits consumed by capitalists falls to 74.05%, compared to 75.00% in Year 1.

This reduction in the proportion of profits consumed has important consequences for the economy as the simulation is repeated over subsequent periods. Although Bauer was able to demonstrate that expanded reproduction is sustainable over a four-year period, Grossmann showed that if the simulation is continued for 35 years then this results in economic breakdown. Table 1 shows a steady fall in the proportion of profits consumed until, in period 34, only 2.16% are consumed. The stringent demands of capital accumulation are fulfilled, with constant and variable capital increasing by 10% and 5% respectively throughout the 35 periods. The problem, however, is that with variable capital failing to keep pace with constant capital the pool of surplus value extracted from variable capital also fails to keep pace.

> The portion of surplus value destined for accumulation as additional constant capital . . . increases so rapidly that it devours a progressively larger share of surplus value. It devours the portion reserved for capitalist consumption . . . swallows up a large part of the portion reserved for additional variable capital . . . and is still not sufficient to continue the expansion of constant capital at the postulated rate of 10 per cent a year. (Grossmann, 1992, 80.)

By year 35, a breakdown is reached in which there is insufficient surplus value to fund the capital expansion and personal consumption of capitalists.

Grossmann's lasting contribution to Marxist economics was to explain his breakdown theory in terms of Marx's law of the tendency of the falling rate of profit. Table 1 shows how a continuous increase in the organic composition of capital results in a fall in the rate of profit, and with the rate of surplus value constant the economy is constrained by an insufficient pool of total surplus value. The ten-

dency for constant capital to substitute for labor means that labor is more productive, but also that less labor is available, relative to capital as a whole, for the production of surplus value. In contrast to Bauer, Grossmann argues that under Marx's falling rate of profit thesis the expanded reproduction of capital is not sustainable if a long enough period of expansion is considered.

To understand this outcome, a particularly useful analysis of the Bauer model has been provided by Samuelson and Wolfson (1986). They point out that all bar one of the model's components are exogenous, independent values that are not allowed to vary. The rate of surplus value is set at 100%, the rates of growth of constant and variable capital are set at 10 and 5%, and the initial stocks of constant and variable capital are 200 and 100 thousand units, respectively. The only component of the model that is variable is the capitalists' propensity to save out of surplus value. As we have seen, the eighth column of Table 1 shows that this propensity steadily increases from an initial value of 25% in the first year, to 35.4% in year 10, and so on until in year 35 all of profits are exhausted in the funding of capital expansion. Since all of the other components are exogenously fixed, the one parameter that can change is the capitalists' propensity to save. With constant capital expanding at a higher rate than variable capital, and with a fixed rate of surplus value, something must give, and hence the savings propensity is the component that must increase with capital accumulation. The consequence of the way in which this model is set up is that eventually the savings propensity reaches 100%, so that no profits are left to fund capitalist consumption and even the expansion of capital cannot be facilitated. In the next part of the paper we question the validity of this treatment of the propensity to save as an endogenous residual.

The Kalecki Principle

The Bauer–Grossmann interpretation of Marx's reproduction schema can be contrasted with an alternative perspective in which the role of money provides the focus of analysis (see Trigg, 2002). In Chapter 17 of *Capital* II, Marx shows that capitalists advance a quantity of money capital M in order to purchase constant and variable capital. This outlay generates a quantity M' at the end of the produc-

tion process. Marx poses the question, "where does the money come from?" (Marx, 1978, 407). From his theory of value it can be established that the difference M' — M is rooted in the production of surplus value, but this does not explain how the extra volume of money is generated.

Marx identifies the role of money by starting first with the case of simple reproduction, where the total volume of surplus value is allocated to unproductive capitalist consumption. An example is presented in which a particular capitalist produces £1,000 of surplus value. This "£1,000 is converted into money with the money that he threw into circulation not as capitalist, but as consumer, *i.e.*, did not advance, but actually spent" (Marx 1978, 410). For Marx this expenditure on capitalist consumption is met out of the capitalist's own money resources: it "means nothing more than that he has to cover his individual consumption for the first year out of his own pocket . . . " (*ibid.*, 409). Generalizing to the capitalist class as a whole:

> It was assumed in this case that the sum of money that the capitalist casts into circulation to cover his individual consumption until the first reflux of his capital is exactly equal to the surplus-value that he produces and hence has to convert into money. This is obviously an arbitrary assumption in relation to the individual capitalist. But it must be correct for the capitalist class as a whole, on the assumption of simple reproduction. It simply expresses the same thing as this assumption implies, namely that the entire surplus-value is unproductively consumed . . . (*ibid.*, 410.)

It follows that the additional money M' — M is provided under simple reproduction by capitalists casting into circulation the amount of money required to purchase their requirements for personal consumption.

This key role for capitalist consumption is retained under expanded reproduction, which "does not offer any new problems with respect to money circulation" (*ibid.*, 418). Under expanded reproduction, capitalists advance money for the purchase of new constant and variable capital alongside the money cast into circulation for capitalist consumption. In addressing the question, "where does the money come from?," Marx therefore develops an answer in which the whole of M' is advanced. As lucidly summarized by Nell (1998, 207): "On this view, *theoretically*, it is correct to speak of M becoming

M', but in *practice* there is no initial sum of money, M, followed later by a larger sum, M'; there is *only* M'."

On this interpretation of Marx's writings in *Capital* II, it is a logical step to suppose that the Kalecki principle, that capitalists earn what they spend, is in operation. As argued by Sardoni (1989, 214), in Marx's reproduction schema capitalist profits "depend on their consumption and investment expenditures, just as in Kalecki's analysis." For capitalists to earn the difference M' — M, they have to advance this amount of money in the first place — they earn what they spend. For Kalecki (1991d, 461) "capitalists can decide how much they will invest and consume next year, but they cannot decide how much they shall sell and profit." In the Grossmann approach, however, capitalist consumption is a residual left over once capitalists have decided their production of surplus value, out of which new constant and variable capital are allocated. The capitalist consumption portion of surplus value is not determined by the amount of money advanced at the start of the production period, but by the portion left once production has been completed.

Using Marx's reproduction schema, Kalecki derives an aggregate relationship between profits and capitalist expenditures.[2] Assuming zero savings on the part of workers, an aggregate identity is established between profits, capitalist consumption and investment:

$$\text{profits} = \text{capitalist consumption} + \text{investment} \qquad (1)$$

This equation shows clearly how the Kalecki principle works, with profits determined by capitalist expenditures. Since capitalists can only choose what they spend, and not what they earn, they "as a class determine by their expenditure their profits and in consequence the aggregate production" (Kalecki, 1991a, 25).

To explore how the Kalecki principle can be applied to Grossmann's numerical simulation, we can first show how equation (1) relates to Table 1. In year 1, total profits of 100,000 consist of 75,000 units of capitalist consumption together with 20,000 constant capital

2 Following Trigg (2002), profits and investment are defined in net terms. This approach is consistent with Marx's category of surplus value, in contrast to the gross definition of profits adopted by Kalecki.

and 5,000 variable capital: 25,000 units of investment in total.[3] Hence the identity

$$100{,}000 = 75{,}000 + 25{,}000 \tag{2}$$

can be established between profits and capitalist outlays on consumption and investment.

In order to activate the expenditure side of the profit equation, we can make use of Kalecki's working assumptions about the structure of capitalists' consumption. Kalecki argues (1990a, 69) that capitalists' consumption is "relatively inelastic," that is, a large part does not depend on profits. Only a small proportion of capitalists' consumption will change in response to a change in profits.[4] In an empirical exercise, which Kalecki (1990b, 132) argues "is confirmed by statistical evidence," he posits that about three fourths of capitalists' consumption is made up of the constant part. Since capitalists' consumption is so inelastic with respect to profits, only one fourth is directly related to profits. These proportions can be used, for purposes of illustration, to explicitly model the structure of capitalists' consumption in Table 1. There we see that in period 1 capitalists consume 75,000 units. Using Kalecki's assumptions the constant part constitutes 56,250, three fourths of the total. It follows that if the parameter λ, relating capitalist consumption to profits, takes a value of 0.1875 then capitalist consumption has the structure:

$$75{,}000 = 56,\ 250 + (0.1875 \times 100{,}000) \tag{3}$$

3 A full algebraic demonstration of the following Kalecki modification of the Grossmann model is provided in Trigg, 2004.

4 For Kalecki the constant part of capitalist consumption, C_k, is defined as B_0, with the remaining part depending upon total profits (in proportion λ), such that:

$$C_k = B_0 + \lambda P$$

where P represents total profits. Since $P = C_k + I$,

$$P = B_0 + \lambda P + I$$

and hence

$$P = \frac{B_0 + I}{1 - \lambda}$$

This final equation represents a multiplier relationship between total profits (P) and the total exogenous expenditure by capitalists ($B_0 + I$), the multiplier being defined as $1/(1 - \lambda)$. This multiplier relationship is used to determine profits in the simulation that follows in Table 2.

In year 1 of the Grossmann simulation this provides a different way of viewing the same volume of capitalists' consumption. Instead of capitalists' consumption depending completely upon the amount of profits that remains after capitalists have decided how much to invest, this consumption is modeled in its own right. From either perspective, in year 1 the capitalists extract and realize surplus value representing 100,000 units. There is no suggestion here that using Kalecki's approach should undermine the critical role of surplus value in the origin of profits (see Trigg, 2002).

Where this alternative perspective provides different results from Grossmann is when the simulation is continued beyond the first year. Again following Kalecki, we assume that the constant part of capitalists' consumption will increase over time. "A secular rise in wealth and income of capitalists tends to raise, with rather a long time-lag, their 'standard of living,' *i.e.*, the amount they are apt to consume irrespective of the level of their current income" (Kalecki, 1991b, 184). However, "the long-run rise in capital and profits may be associated with the concentration of both" (Kalecki, 1991b, 184), and this could cause a reduction in the constant part of capitalists' consumption. In view of these factors it is plausible to assume a slowly increasing constant part of capitalists' consumption. For our adaptation of Grossmann's simulation, a rate of growth of 2.5% can be assumed for the constant part of capitalist consumption, half the 5% rate of growth for variable capital.[5]

Simulation Without Breakdown

Applying the Kalecki principle and these empirical assumptions to the Grossmann table, a new simulation of expanded reproduction is presented in Table 2. This Kalecki-modified schema retains the key characteristics of the Grossmann model. Constant capital still grows at 10% each year, compared to 5% for variable capital, and this requires a steady increase in the proportion of profits saved, from 25% in year 1 to 65.4% in year 35. Also in keeping with the Grossmann model, the rate of profit steadily falls over time, from 33.3% in year

5 Marx argues that "it is at least clear that the consumption of the entire capitalist class and the unproductive persons dependent on it keeps even pace with that of the working class. . . ." (Marx, 1978, 407). The simulation that follows will show that by making Kalecki's empirical assumptions capitalist consumption does roughly keep pace with variable capital.

TABLE 2
Kalecki-Modified Reproduction Schema

Year	Constant Capital (C)	Variable Capital (*V*)	Profits	Rate of Surplus Value	Capitalist Consumption	Proportion of Profits Saved(%)	Rate of Profit (%)
1	200000	100000	100000	1	75000	25	33.3
2	220000	105000	104500	0.995	77250	26.08	32.2
3	242000	110250	109305	0.991	79592	27.18	31.0
4	266200	115763	114441	0.989	82033	28.32	30.0
5	292820	121551	119937	0.987	84578	29.48	28.9
6	322102	127628	125826	0.986	87234	30.67	28.0
7	354312	134010	132141	0.986	90009	31.88	27.1
8	389743	140710	138921	0.987	92911	33.12	26.2
9	428718	147746	146208	0.990	95949	34.37	25.4
10	471590	155133	154048	0.993	99133	35.65	24.6
11	518748	162889	162491	0.998	102472	36.94	23.8
15	759500	197993	203482	1.028	117633	42.19	21.3
19	1111983	240662	259646	1.079	136414	47.46	19.2
20	1223182	252695	276772	1.095	141819	48.76	18.8
21	1345500	265330	295371	1.113	147554	50.04	18.3
25	1969947	322510	387521	1.202	174401	55.00	16.9
27	2383635	355567	446810	1.257	190668	57.33	16.3
30	3172619	411614	557481	1.354	219638	60.60	15.6
31	3489880	432194	601337	1.391	230739	61.63	15.3
33	4222755	476494	701614	1.472	255514	63.58	14.9
34	4645031	500319	758867	1.517	269348	64.51	14.7
35	5109534	525335	821486	1.564	284265	65.40	14.6

1 to 14.6% in year 35. The difference, however, is that capitalist consumption is not treated as a residual, dependent upon the amount of profits that happen to remain after the prior commitments of capital accumulation. In Table 2, capitalist consumption is an active component in the model, providing an important driver in the generation of profits, as capitalists cast money into circulation.

Table 2 also shows that after an initial period of stagnation in the first 11 years, the rate of surplus value increases during the 35-year period of expanded reproduction. The role given to capitalist expenditures on investment and consumption in the determination of profits serves to increase the rate of surplus value from 1.000 to 1.564 during the course of the simulation. Under Grossmann, surplus value is extracted on a one-to-one basis from each unit of vari-

able capital, at a rate of 100%. Once, however, surplus value is determined by the expenditure decisions of capitalists then this one-to-one extraction of surplus value is relaxed.[6] This modification of the model is consistent with the spirit of the original Bauer formulation, which Grossmann adheres to so closely. In developing the reproduction schema, Bauer states: "To simplify the investigation we assume *for the time being* that the rate of surplus value remains unchanged, at 100 per cent" (Bauer, 1986, 93, emphasis added). Although, as Bauer's translator (J. E. King) points out, the promise to later relax this assumption is not fulfilled, the assumption of a constant rate of surplus value is not regarded as having any particular theoretical significance. Indeed, for Grossmann (1992, 128), "the basic mistake is Bauer's assumption that the rate of surplus value is constant despite the assumed rising organic composition of capital."

This rising rate of surplus value is also consistent with Marx's theory of surplus value. It has been shown that under the Kalecki principle profits are determined by capitalist consumption. Under simple reproduction, profits are identical to capitalist consumption, with investment in new capital included under expanded reproduction. However, while capitalists may first cast into circulation the money required for such luxury consumption, the reflux of that money back to the capitalist class is only made possible by the production of surplus value. Although the consumption of luxury goods is unproductive, in comparison to how this surplus value could have been more usefully employed, the labor power that produces these goods is productive, since it produces surplus value (see Howard and King, 1985, 129). Hence an expansion of demand for luxury goods generates an expansion in the mass of surplus value congealed in the total volume of these goods produced, thereby increasing the rate of surplus value.[7]

6 The rate of surplus value is now endogenous, in contrast to its previous status as an exogenous parameter in the Grossmann model. The previously endogenous proportion of profits saved is now an exogenous parameter.

7 This relationship between luxury goods and surplus value can be distinguished from Marx's analysis in *Theories of Surplus Value*, Part III, of productivity in the luxury goods department. As is well known, luxury goods do not enter as means of subsistence for workers, and therefore a change in productivity will not impact upon the value of labor power (the denominator of the rate of surplus value). "The cheapening of luxury articles does not enable the worker to live more cheaply. He requires the same amount of labor-time to reproduce his labor power as he did previously" (Marx, 1972, 350). However, under the Kalecki principle, if more luxury goods are consumed by capitalists, the labor congealed in these surplus goods can be posited to represent an increase in the mass of surplus value (the numerator of the rate of surplus value).

Yaffe (1972, 24), a follower of Grossmann, has argued: "It is quite amazing that critics of Marx such as Joan Robinson can say that Marx's theory rests on the assumption of a constant rate of exploitation." For Yaffe the key question is whether the rate of surplus value can rise sufficiently to enable the combination of a sustained fall in the rate of profit and an increasing mass of surplus value. Yaffe (1972, 26) argues that for this combination to be sustained the rate of surplus value must increase at an accelerated rate.

Of course, the requirement of an accelerating rate of surplus value is difficult to sustain. Yaffe (1972, 27) refers to the "increasing difficulty in raising the rate of exploitation sufficiently to satisfy the self-expansion requirements of capital as capitalism progresses." However, it is not possible in the Kalecki-modified framework to identify a particular year of breakdown after n years of simulation, as in the Grossmann story. In contrast to Grossmann's Table 1, in Table 2 capitalist consumption increases steadily throughout the 35-year period, without breakdown.

Moreover, the simulation can be extended to a period of 100 years, and beyond, without there being a drying up of surplus value. This 100 year simulation of Table 2 is illustrated by the trajectory of the rate of profit in Figure 1, with Figure 2 showing the accelerating rate of surplus value.

The Falling Rate of Profit

In addition to questioning the relationship of the Grossmann breakdown thesis to Marx's reproduction schema, consideration can also be given to its relevance to Marx's exposition of the falling rate of profit tendency in *Capital* III. Grossmann's claim to have faithfully represented Marx's theory rests on passages in Section III of Chapter 15, "Excess Capital and Excess Population."[8] The breakdown scenario, in which the mass of surplus value dries up in year 35 of the Bauer schema, is interpreted by Grossmann (1992, 76) as a case of "overaccumulated capital." Quoting from Marx, "there would be a steep and sudden fall in the general rate of profit" (Marx, 1959, 246). Moreover, "the fall in the rate of profit would then be accompanied

8 In considering these passages, the 1959 Lawrence & Wishart edition of *Capital* is cited in order to be consistent with the interpretation of Grossmann (1992). The more recent Penguin editions are used elsewhere.

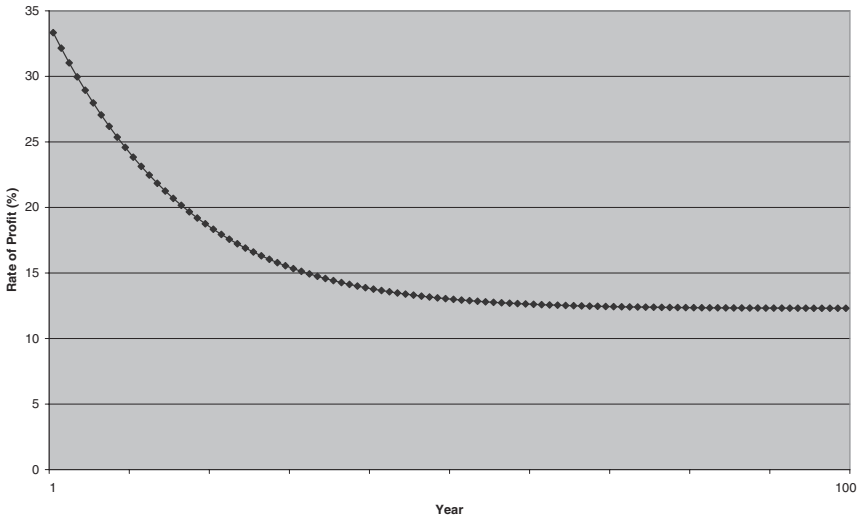

Figure 1: The Rate of Profit in the Kalecki Simulation

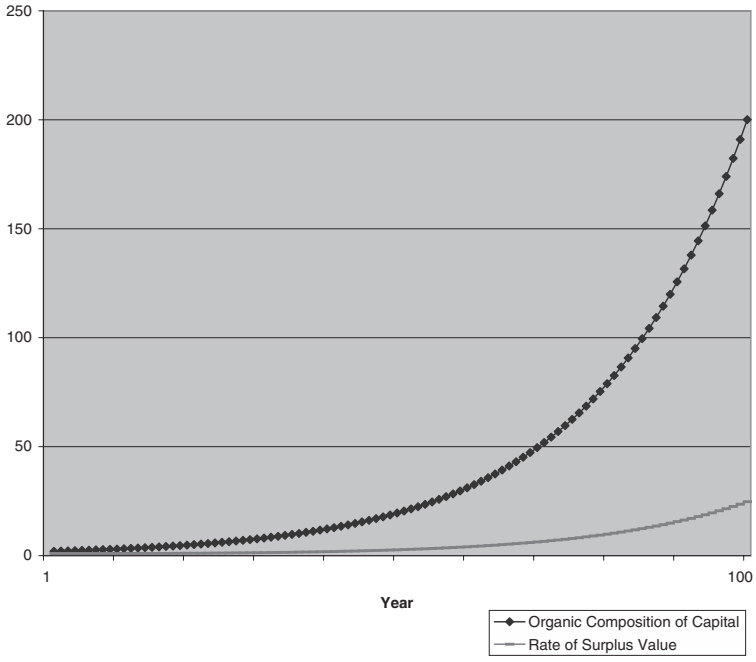

Figure 2: Components of the Rate of Profit in the Kalecki Simulation

by an absolute decrease in the mass of profit. . . . And the reduced mass of profit would have to be calculated on an increased total capital" (Marx, 1959, 247).

The problem with this interpretation, however, is that in these passages Marx was considering a particular case in which there is a rise in wages and a fall in the rate of surplus value. It is for this reason that there can be overaccumulation for which increases in capital generate no extra profits. To quote Marx in full: "*There would be a steep and sudden fall in the general rate of profit*, but this time due to a change in the composition of capital not caused by the development of productive forces, but rather by a rise in the money-value of the variable capital . . . and the corresponding reduction in the proportion of surplus labor to necessary labor" (Marx, 1959, 247, emphasis added). Here we see some of the words quoted by Grossmann in italics, but put in the context of the rest of the sentence. The overaccumulation scenario that he finds in Marx is associated with the particular case of an increase in wages, a causal factor that plays no role in Grossmann's interpretation. Indeed, since the falling rate of profit is expounded by Marx in the context of a decreasing rate of surplus value, it is difficult to place this overaccumulation scenario at the center of his theory.

A different reading of *Capital* III can be suggested, in which questions of realization are the main focus of analysis (see Rosenthal, 1999). Thus far, in applying the Kalecki principle to Marx's circulation of money, we have assumed that monetary outlays take place, funding the purchase of all capital and consumption requirements. However, as capital expands, the volume of profits accumulates to such an extent that stringent demands are placed upon the economic system in terms of the amount of money that has to be cast into circulation for realization of these profits. Marx places realization problems at the center of his analysis of the falling rate of profit:

> With the development of this process as expressed in the fall in the profit rate, the mass of surplus-value thus produced swells to monstrous proportions. Now comes the second act in the process. The total mass of commodities, the total product, must be sold, both the portion that replaces constant and variable capital and that which represents surplus-value. If this does not happen, or happens only partly, or only at prices that are less than the price of production, then although the worker is exploited, his exploitation is not realized as such for the capitalist and may even not involve any realization

of the surplus-value extracted, or only a partial realization; indeed, it may even mean a partial or complete loss of his capital. (Marx, 1981, 352.)

Marx is clear, in this key part of his discussion of the falling rate of profit, that the realization of surplus value is not guaranteed. "The conditions for immediate exploitation and for the realization of that exploitation are not identical. Not only are they separate in time and space, they are also separate in theory" (Marx, 1981, 352). Indeed, this provides a key underpinning for Marx's argument as to why the falling rate of profit, and its associated burgeoning mass of profits, provides such severe problems for capitalism. "The means — the unrestricted development of the forces of social production — comes into persistent conflict with the restricted end, the valorization of the existing capital" (Marx, 1981, 359). By focusing on the realization of the mass of profits, an alternative to Grossmann's overaccumulation scenario can be suggested that is consistent with Marx's core thesis of a falling rate of profit with a rising rate of surplus value.

As the basis for a theory of crisis, this demand-side perspective does not provide a precise mechanical breakdown of the type developed by Grossmann. Moreover, the development of a complete alternative is beyond the confines of the present study. However, since under the Kalecki modification of the Grossmann model, the rate of surplus value accelerates because of the monetary outlays on spending by the capitalist class, the sustainability of this process must depend upon the finance of these monetary outlays. One of the key determinants of these outlays is the role of banks in providing credit to fund such spending activity. In contrast to Grossmann's relegation of credit to a less abstract level of analysis, the Kalecki-modified model points towards the relevance of the financial system to Marx's falling rate of profit thesis.

Conclusion

This paper suggests a modification to Grossmann's 35-year simulation of Marx's reproduction schema by introducing the Kalecki principle, the proposition that capitalists earn what they spend. It can be concluded that proponents of the Grossmann model have a double blind spot in relation to the circulation of money in Marx's analysis. First, they fail to explore the active role of capitalist consumption as

money cast into circulation, and on this basis wrongly argue that the supply of surplus value will dry up. And second, they ignore problems of realization that follow from the increases in the mass of surplus value associated with the tendency of the falling rate of profit. The Kalecki principle is offered as a way of developing Marx's falling rate of profit thesis from a perspective in which the role of money is taken seriously.

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