Natural Resources in Marx's Explanation of the Falling Rate of Profit, an Abstract

By Howard Petith

Did Marx think that the rate of profit would fall, in part because of a growing shortage of natural resources? One can find a few economists who hold that he did, but the overwhelming majority think that it is obvious that he didn't since natural resources appear nowhere in his main exposition of the falling rate of profit in volume III of Capital. My objective is to argue that, in a qualified sense, Mars did believe that resource shortages would cause the rate of profit to fall.

Briefly the argument is as follows. In the volume III argument Marx did not explain why the rise in the rate of surplus value would not be sufficiently large to stop the rate of profit from rising. Furthermore, from his other writing it is clear he understood that an increase in the organic composition of capital would have this effect. The mystery is then why Marx knowingly left this gap in his argument. Any explanation, which saves Marx's theory, must do two things: it must fill the gap from Marx's other writing, and it must explain why Marx was reluctant to do this himself.

There have been a large number of attempts to fill the gap in this way but none of them have tried to explain Marx's reluctance to use the particular method that is being put forward. I argue first that adding Marx's comments on resource scarcity to the volume III argument can fill the gap and second that Marx had both political and theoretical reasons for not wanting to base his argument on resource scarcity. Thus, in the absence of other explanation that fill the gap correctly only two conclusions are tenable: Either he believed that resource shortages were important but hid this or that he was reluctant to use resources in his argument but could find no alternative. This is the qualified sense of the previous paragraph. Finally as an ending I show that if Marx had had access to modern analytic techniques he would have seen that he could have introduced resources without encountering the problems he feared .

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The Hound of the Baskervilles: Natural Resources in Marx's Explanation of the Falling Rate of Profit

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Abstract; Did Marx think that the rate of profit would fall, in part because of a growing shortage of natural resources? One can find a few economists who hold that he did, but the overwhelming majority think that it is obvious that he didn't since natural resources appear nowhere in his main exposition of the falling rate of profit in volume III of Capital. My objective is to argue that, in a qualified sense, Mars did believe that resource shortages would cause the rate of profit to fall.

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I Introduction.

Did Marx think that the rate of profit would fall in part because of a growing shortage of natural resources? One can find economists like Lebowitz (1982) , Perelman (1985, 1987,chap.2) and Moseley (1991) who think so . But the received opinion is that he did not: For example Walter Eltis (1991) in the New Palgrave does not mention resources in connection with Marx's theory and both Steedman (1977,p. 129) and Roemer (1981 p.87) state specifically that Marx's theory did not depend on scarcity. My objective in this paper is to argue that in a " qualified sense", Marx did believe that resource shortages would cause the rate of profit to fall.

Briefly the argument is as follows. Marx knowingly left a gap in his argument just at the point where resources should have appeared. Moreover he thought that he had good reasons for not wanting to introduce resources. But if Marx had had access to modern analytic tools, he would have easily seen that he needn't have worried. Thus only two conclusions are tenable , either that he believed that resource shortages were important and hid this or that he could not resolve the issue but, in the light of better knowledge, would have happily used the resource shortage argument. This is the qualified sense of the previous paragraph.

II The Importance of Land.

From a neoclassical perspective, the need for a fixed factor in order to make the rate of profit fall with capital accumulation is crystal clear. Suppose that the wage is fixed and that the production function is constant returns in capital and labour alone, then the fixed wage determines sequentially the marginal product of labour, the capital to labour ratio and finally the rate of profit. The rate of profit cannot fall. But if one adds a fixed factor, land, then capital must grow faster than labour to maintain the wage and the rate of profit falls. Thus one needs land to make the rate of profit fall.

However the need for land is less clear if one adopts nineteenth century analytic techniques. Then the production technology was one of fixed input coefficients and technical progress was thought of as increasing the capital coefficient and lowering that of labour. The point can be illustrated if we adopt a one sector circulating capital model. Let A and a be the input coefficients of capital and labour and w the wage. Then the rate of profit r is

(1) r = **Error!**= **Error!**- 1 .

Here if the rise in A is more powerful than the fall in a , then the rate of profit will fall. This , I take it , is Marx's basic argument for the falling rate of profit.

But this is not quite enough to produce a tendency. Marx needs an argument to show that the rise in A will dominate the fall in a. This is the point at which it would be natural to introduce land. The labour coefficient does not fall much because of growing pressure on the land. Thus the need for land, though less clear , is still strongly present in the nineteenth century analysis.

Marx's Argument.

One can now reformulate the above model in Marxian terms and watch Marx flirt with resource scarcity.

Using Steedman's (1977 chap.9) setup, let l_t be the value of the good produced at t . Then $l_t = A\, l_{t-1} + a$ and, if we assume steady state in the sense of $l_t = l_{t-1}$, then l = **Error!**. Constant capital per unit output c is c = Al , variable capital per unit output v is v = wal, and finally surplus value per unit output s is s = l - v - c . Marx analysed the rate of profit in terms of the organic composition of capital [2] c/v and the rate of surplus value s/v . These are given by

(2) s/v = **Error!**- 1

(3) c/v = **Error!**

(4) r = **Error!**= **Error!**

where the r is the same one as in (1).

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[2]Marx used this word in the basic argument The subtle differences between the many concepts are disregarded here. See Shaikh (1987)

The basic argument for the falling rate of profit appears in chapters XIII and XIV of Capital III and consists of a basic reason and five counteracting influences. If technical change which accompanies capital accumulation consists of a rise in A and a fall in a, we see all of these played out in the present model. The basic reason is that c/v rises. This is a clear consequence of the changes in A and a . (See (3) and (4)) .

The first of the counteracting influences is the lengthening of the working day which can be interpreted as a fall in a . This raises s/v (see (2)) and thus the rate of profit. Two comments are in order. First, the reasoning is opaque since c/v will also rise , but (1) shows that Marx is correct . Second, the counteracting influence is safe, in the sense that it will not threaten the tendency of the rate to fall because there are limits to the extention of the working day.

The second counteracting influence is a fall in the wage below the value of labour power. This raises s/v and thus the rate of profit. Once again the reasoning is opaque since c/v also increases, but (1) shows that it is correct. In addition this is a safe counteracting influence as well since the wage cannot fall continuously.

Leaving the third influence for last, the fourth is that a lower wage may encourage the production of labour intensive luxury goods while the fifth is that foreign trade will generally cheapen goods, both of which will tend to raise profits. There is little to say here: If one regards the fourth as a fall in A and a rise in a , then this should raise profits because the reverse movement caused them to fall. On the other hand , the fifth is not easily portrayed in terms of the simple model.

The third influence causes Marx trouble. He is worried that c/v will not fall because, thinking of c as raw materials, the mass of raw materials that a single worker can process grows but their value per unit falls. He concludes, without giving a justification, that this will merely modify the tendency.

There are two points of importance here. First, this is not a basic problem in the sense that it is visible in our simple model. In the formula for c/v , the values cancel and there is no doubt that the movements of A and a will make c/v rise. Marx was forced to worry about this issue because he thought labour productivity in agriculture would lag behind that in industry (1969,p.19) . This in turn was an important ingredient in his theory of absolute rent, (1969 chap. XI, 1959 chap. XLV) . To summarize, the issue is a subsiduary one for the falling rate of profit and Marx was drawn into it for extraneous reasons .

The second point is more striking. Marx (1975, pp.303-4, p. 1105 in Marx's notebook) actually explains why the fall in the value per unit of raw materials will not upset the falling tendency. He returns to the example in which the worker is processing a larger mass of raw materials and devotes a long paragraph to detailing how the fall in the value per unit will be limited by the declining quality of resources. The continuity of thought is so striking that, if Marx had merely appended these few paragraphs to the section on the third influence, there would have been no doubt that he thought resources were an important ingredient.

The overall conclusion to this point is that Marx generally limited himself to safe counteracting influences; but in the one case which was not safe, but was largely subsiduary to the main issue, he clearly thought that resources played an important role although he did not say so.

IV The Hound of the Baskervilles.

But now we come to the strangest part of the story : the dog that did not bark. Marx wants to know the effect of capital accumulation , which raises A and lowers a, on the rate of profit. From equation (4) it is clear that the fall in a has two effects, it raises c/v which lowers the rate of profit and raises s/v which raises the rate of profit. In Marx's terms the only point at which the fall in a causes trouble is when it provokes a rise in the rate of surplus value. Futhermore, this is a dangerous influence because there is no natural limit to the fall in a . This is the natural point at which resource scarcity could be invoked to limit the fall. But what argument does Marx use to limit the rise in the surplus value caused by capital accumulation ? He gives none, he ignores the problem completely! Once one sees it, the size of this gap in the argument literally takes one's breath away.

One's reaction might be that perhaps Marx was unaware that the increase in labour productivity caused by capital accummulation would raise the rate of surplus value. But he writes (1969 p. 86)

" First of all it is wrong to say that the rate of surplus value depends solely on the productivity of labour. ....The rate of surplus value - which if the productivity of labour is given, alters with the length of the working-day and, with a given normal working-day, alters with the productivity of labour - is assumed to be given."

The sense of this is that, if anything, Marx considers the rise in productivity the more obvious and more important causual element.

Thus we are confronted with the following puzzle: Marx knew that there were two reasons why the accumulation of capital might cause the surplus value to rise and upset the falling tendency. The first, the lengthing of the working day, is only loosely related to capital accumulation and of limited scope. The second, the increase in productivity, is intimately connected with the accumulation of capital, perhaps the more important of the two and basically unlimited in scope. Yet Marx provides a detailed discussion of the first and completely ignores the second. Why did he do this ?

Leaving this aside for a moment, it is possible to guess how Marx might have filled this gap from his other writings. Marx is considering the effect of a decrease in workers relative to the mass of constant capital, (1975 p.303, paragraph 4 of page 1105 in Marx's notebook) . He writes that an increase in capital ought to lower the rate of profit proportionally, but it doesn't because it causes surplus labour to increase. How does he know that the increase in surplus labour will not be sufficient to raise the rate of profit ? He doesn't say, but lower down on the same page a strong indication is given. To make the connection one has to take into account Marx's opinion (1959 p. 82) that the worsening of the quality of raw materials, by lengthening the labour time necessary to process them, will lower the rate of surplus value. Returning to page 1105, Marx, in order to explain why the value of constant capital will not fall greatly, goes into great detail as to how advanced production will cause the inescapable deterioration of the quality of raw materials. In short, the increase in capital which increases production will not cause the rate of surplus value to rise sufficiently to raise the rate of profit because the increase in production will also cause a fall in the quality of raw materials.

To summarize, there is a serious gap in Marx's explanation of the tendency of the rate of profit to fall, of which he must have been aware. This gap can be filled from his other writings in a way that involves natural resources. But this is not quite the same as claiming that Marx thought resource scarcity would cause the rate of profit to fall. Rather the impression that one has from this section and the preceeding one is that Marx did not want to use this argument but at times found himself driven to rely on it.

V The Reasons for Marx's Reluctance.

This brings us to the question of why Marx did not want to use resource scarcity as the basis of the falling rate of profit. At least three reasons can be cited.

First, using resource scarcity would have contradicted his basic view of the nature of capitalism. In Ricardo's model, which was based on resource scarcity, labour productivity fell to subsistence level and the rate of surplus value, or rate of exploitation, fell to zero. On the other hand, in his announcement of what his theory would do (1969 p.439) , he writes

" The rate of profit thus falls, not because labour becomes less productive but because it becomes more productive; not because the worker is less exploited, but because he is more exploited .... for capitalist production is inseparable from the falling relative value of labour."

I think he feared that if he accepted the Ricardian supposition of falling productivity of land he would also have to accept the Ricardian conclusions which were diametrically opposed to his own.

Second, if resource scarcity was what brought capitalism to its knees, then society would be in too impoverished a state to make the transition to communism. Elster (1985 chaps 7 & 9) emphasizes that this is one of the basic problems that has haunted Marxism down to the present. In 1851 Marx wrote to Engels : " The more I get into this crap, the more I am convinced that agricultural reform ... will be the alpha and omega of the coming revolution. Otherwise Parson Malthus would be correct." Almost twenty five years later , in the Critique of the Gotha Program, he wrote in a slightly more refined manner of Malthus'" libel on the human race" , " if this theory is correct ... socialism cannot abolish poverty, which has its base in nature, but only make it general, distribute it simultaneously over the whole of society ". (quoted from Perelman 1985 p. 468 and p. 461).

The third reason concerned political strategy. Here I repeat the argument put forward by Perelman (1987, chaps. 1 and 2). Marx was engaged simultaneously in political and intellectual activity . For this reason Marx was willing to distort his intellectual position for political ends. Perelman's first chapter gives a convincing specific example of this. Proceeding along this line, if Marx had openly said that capitalism was going to be brought low by resource scarcity, he would have been forced to explain how socialism would resolve this. Thus, even if he privately believed that capitalism would be destroyed by resource shortages , he would not have admitted this publically in order to avoid being drawn into an unprofitable political argument.

VI What Marx May Have Believed.

We have seen that Marx flirted with the use of resource scarcity to explain the falling rate of profit but at the same time had reasons for eschewing its use. But what did he believe ? Clearly the question cannot be answered definitively. I will now set out three opinions, Perelman's, mine, and the traditional one and comment on each of them. The major conclusion is that the traditional opinion is untenable.

The first opinion is that of Perelman (1985, 1987, chap. 2) set out above. He holds that , rather than stating his true posistion, Marx hid it behind the concept of the organic composition of capital. Perelman supports his opinion with numerous quotes , all of which are suggestive but none of which clinch the argument. A small point is that Perelman should have merely said "left out" rather than "hid behind". But my main comment is that, while Perelman may well be correct, in the absence of a quote from Marx in private correspondence explicitly admitting his belief, one cannot be sure.

My own view is that Marx did not want to rest the tendency of the rate of profit to fall on resource scarcity for the three reasons that I have given, but on the other hand could find no satisfactory alternative argument. I think that he died with the issue unresolved in his own mind. This opinion would certainly fit with the gap in his main exposition and his flirtation with resource scarcity at other moments.

The traditional opinion is that Marx did not believe that resource shortages would be the cause of the falling rate of profit because, if he had had this belief, he certainly would have said so in his central exposition in Capital III, (1959, chaps. XIII and XIV). Here it must be admitted that I am in danger of setting up a strawman. But I know of no careful argument in favor of the position and have the impression that most people consider it as self evident.

But on careful inspection, two problems arise: the first is serious but the second appears to me to be imposslble to resolve. Any position on what Marx believed must provide an argument, based on Marx's writings, to fill the gap which Marx knowingly left. The first problem is to provide such an argument that does no rely on resource scarcity. There are a group of economists, Fine and Harris (1976), Rosdolsky (1977) and Shaikh (1978,1991), who claim to have found just such an explanation. Their argument is based on the fixed component of constant capital, which is outside the ambit of the simple model of sections II and III, and shows that no matter how fast the rate of surplus value rises, the rate of profit eventually falls. Clearly here is a worthy candidate to fill the gap.[3]

[3]Roemer (1982, section 5.3) has used a generalized version of Okishio's theorem to show that the argument will not work with competitive pricing, an argument which Shaikh (1991, p.308) has apparently accepted. However

The second problem is more difficult to resolve. Once one has found an alternative way of filling the gap, one must explain why Marx did not use it. For example, if one chooses the above argument, one has to explain why Marx did not use it to fill the gap and it is difficult to see how this could be explained since the aspect that recommends it to its supporters is exactly that it fits in well with the body of Marx's beliefs. In short, to make the traditional position credible, on must find an argument in Marx's writings other than the one concerning resources which unites two characteristics : it limits the rise of the rate of surplus value and it is one that Marx did not want to use. I do not think that such an argument exists and, for this reason, I think that the traditional opinion is untenable

VII What Marx Would Have Believed.

To finish I want to argue that if Marx had had today's analytic techniques at his disposal, he would have easily seen that he could have both accepted resource scarcity as the reason for the falling rate of profit and not have encountered any of the difficulties which worried him.

First note that Marx distinguished between his model and Ricardo's by the way the rate of profit was determined (1967,pp. 466-7). For Ricardo, the rate of profit is determined in agriculture and then this is imposed on industry. For Marx, the rate of profit is determined, in a general equilibrium manner, in all sectors together. If one translates this into modern parlance and thinks in terms of aggregate models, Ricardo has a two sector model in which the industrial sector uses labour and fixed and circulating capital and the agricultural sector land and labour, while Marx thinks in terms of a one sector three factor model.

As noted above, Marx thought that capitalism would exhibit a falling rate of profit and rising rates of surplus value and labour productivity. This is not the place to construct complicated models. But if one supposes a Cobb-Douglas production function with constant returns to

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this is not relevant in the current context since the argument we seek does not have to be correct, it merely has to reflect Marx's beliefs.

scale, one can show immediately that the three factor, one sector model has approximately these characteristics.

Let the production function be

$$Y = K^{\alpha}L^{\beta}M^{1-\alpha-\beta}$$

where Y, K, L, and M are output, capital, labour and land and α and β are positive constants such that $\alpha + \beta < 1$ and let land and the real wage w be constant. Since the production function is Cobb-Douglas, the share of the three factors are respectively α, β and $1-\alpha-\beta$. Next identify s the surplus value with profits and v variable capital with the wage bill. Then note that the constant wage implies that

$$w = \textbf{Error!} = \beta K^{\alpha} L^{\beta-1} M^{1-\alpha-\beta}$$

is constant. Finally note that from this,

$$w K^{1-\alpha-\beta} = \beta(\textbf{Error!})^{\beta-1}M^{1-\alpha-\beta}$$

so that **Error!**< 0 . From all of this it follows that , as capital accumulates,

a) $s/v = \alpha/\beta$, so that the rate of exploitation remains constant;

b) $Y/L = K^{\alpha} L^{\beta-1} M^{1-\alpha-\beta} = w/\beta$, so labour productivity remains constant as well; and finally

c) the rate of profit r is $r = \textbf{Error!} = \textbf{Error!} = \alpha\, \textbf{Error!} w$ so that the rate of profit falls.

Productivity and the rate of surplus value are only constant here. But, as shown in Petith (1995) , if the elasticity of substitution is greater than one , these grow as well.

If Marx had had access to these results I think they would have allayed his fears and he would have accepted resource scarcity as one of the causes of the falling rate of profit.[4] First, as the above shows, he would not have to have modified his views as to how the capitalist system worked. Second the transition to communism would not have been imperilled because the productivity of labour would not have fallen. And finally, since the model makes it clear that resource shortages cause a problem only for capitalist profit making, there is no generalized resource shortage problem for socialism to resolve.[5]

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[4]The other being crisis.

[5]This depends a bit on the Cobb-Douglas, see Solow (1974).

VIII Conclusion.

So did Marx think that resource scarcity was one of the causes of the tendency of the rate of profit to fall ? I have argued that only two positions are tenable, the first is that he actually did but kept his position hidden for reasons related to the then current political situation. The second is that is that he was not sure and died with this uncertainty unresolved. But in this latter case that, if he had had access to modern analytic techniques, he would have immediately accepted resource shortages as one of the causes of the falling rate of profit. In this qualified sense the answer is yes, Marx did think that resource shortages would be one of the causes of the falling rate of profit.

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