

Marx All Vindicated—Falling Rate of Profit

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I was right, am right, will be right, but certainly not for ever.

Karl Marx, "*Old Left Review*", October, 1993.

1 . Introduction

While people talk about the end of Marxism, seeing the disruption of the socialist countries, we have to stress the economic system which Marx analyzed more than one century ago was the "typical" capitalist system, whatever it means, and not the socialist countries which has ever existed after Marx's death. Here I am going to summarize, in a series of notes, neither what Marx said, nor what Marxist economists interpreted 'in a correct manner' about what he said. On the contrary, sometimes we have to neglect what Marx had in mind when he defined a certain set of concepts. We are seeking for ways in which Marx's efforts to define, to analyze, and to condemn a capitalist system can be rehabilitated in a modern 'capitalist' economy in order to know the working of capitalist system better. Even in such a 'modest' attempt, there are a considerable number of limits. Today's capitalist economy as one nation is far more complicated than ever; all systems are interrelated with one another, and this network helped by, and threatened by incredibly rapid diffusion of

large amount of variegated information. Changes taking place every minute, new findings this year about the last five decades will be out of date quickly, and unfortunately cannot be applicable to the coming future. We also know the existence of economic externalities most of which escape from functional fields of markets.

In spite of many constraints, this note is the starter of a series in which some of Marx's studies are *re-examined*, and *modified models* are proposed to show that those studies are really useful in understanding the present-day capitalism.

Our treatment will be occasionally mathematical, but not to the degree at which the reader may be discouraged. We try to construct our models using discrete adjustment, implying the use of difference equations in place of differential ones, which makes the story to be swallowable to most students without worrying about mathematical details.

In this note, the first in the series, we take up the *thesis of falling rate of profit* mainly depending on what I have studied so far. Section 2 explains the recent controversies on the thesis, while in section 3 some interesting topics to be tackled with are given.

2 . Controversies

It is asserted in Marx [14, 15] that as the organic composition of a capitalist economy deepens, the uniform (equilibrium) rate of profit must fall. This is quite easy to prove when labour values are proportional to equilibrium prices; this requirement is satisfied when the organic composition of each industry is the same and common. (See Morishima [16]). Let π be the rate of profit, then it is defined as $\pi \equiv s/$

$(c+v)$, where s is the surplus value, c the constant capital, and v the variable capital. Divide both the numerator and the denominator by v , and we get

$$\pi = e/((c/v)+1),$$

where $e \equiv s/v$ is the rate of exploitation. The organic composition of capital in the economy as a whole is defined to be (c/v) . Thus, when technical changes are introduced and the organic composition (c/v) is increased, the rate of profit π is to fall, provided the rate of exploitation e is kept constant. A natural criticism: in reality the organic compositions are different from industry to industry, thus π is after all the *value* rate of profit in which no capitalist is interested.

The decisive as well as ‘destructive’ paper was Okishio [19], which showed that when a cost-reducing new process is adopted in an industry, the uniform rate of profit is raised if the real wage rate is fixed before and after the introduction of the process. This is seemingly destructive, because managers normally adopt new methods which enable them to reduce production costs without the consent of workers, and later they may sit at negotiation table to increase the wage rate as productivity allowances within a certain limit.

To rescue out Marx’s theme, Okishio [20] himself devised out a theory: his own theorem above is valid merely for the short time, and in the long run the organic composition, or the capital labour ratio if the reader insists to use, increases indefinitely to drive down the equilibrium rate of profit to zero, thus sooner or later the profit rate should get smaller and smaller. This is apparently not bad. We can, however, construct an example in which the profit rate continues to increase for the first several hundred years while the maximum rate of profit keeps

on decreasing (not necessarily to zero) for ever because of cost-reducing CULS (capital-using labour-saving) technical progress.

Okishio's theorem in [19] was proved using a simple input-output model without fixed capital or joint production helped by the assumption of indecomposability of the production system. Later studies tried to extend his result into more general models. The first fruits were produced by Okishio and his students allowing for *fixed capital*. (See Okishio [20] and Nakatani [17] for their models and other references.) Further generalizations are made in Fujimoto [7] allowing for the existence of fixed capital of more general type and heterogeneous labour (see also Wood [25]). One more line of efforts is related to the models with joint production. Roemer [21, 23] considered von Neumann models and established an extension of Okishio's theorem assuming that the economy is in growth equilibrium. A great contribution because a von Neumann model of joint production allows for fixed capital of the most general kind. (See Fujimoto [4] for an elementary proof of Roemer's propositions.)

Another twist came from the work of Salvadori [24]. When the economy is out of growth equilibrium, Okishio's theorem may not hold in an economy with joint production. Whether Salvadori's case is exceptional or not cannot be decided in an intuitive way. Bidard [1] presented a proposition, which says that if Sraffian standard commodity exists after the adoption of new processes, then Okishio's theorem is valid in a model of joint production. Then Fujimoto and Ranade [10] proved a theorem that Okishio's theorem holds in a very general model of joint production with nonlinear environments due to external/internal (dis-) economies provided a certain condition concerning inequalities on the

quantity side is satisfied, which condition is weak enough to include the previous results as special cases. An example in Salvadori [24] does not satisfy a sufficient condition given in [10]. Besides, their model allows for entirely new commodities and processes or admits of the case where some of the old commodities/processes are discarded/forgotten. That is, the input-output matrices can be completely different. In Fujimoto and Ranade [10] some conditions on the price side which are equivalent to that on the quantity side are also discussed.

While further generalizations of Okishio's theorem have been made, which are still more destructive of Marx's contention, some works have been done to restore the latter. Roemer [21] in fact provided one more proposition that the labour value of each commodity decreases when cost-reducing CULS new processes are introduced. This implies that if the wage rate is kept fixed, the rate of exploitation is increased assuming the same work conditions. Then, one may argue that when cost-reducing CULS technical changes are adopted, the uniform profit rate falls if the rate of exploitation should be kept constant. The reader can confirm this in one-sector models simply because in those models values can be *confused* with prices; in any case only one value and one price. We can apply Marx's own proof explained in the beginning of this section. The explanation with the help of diagrams is given in Fujimoto [3] together with a simple exposition of Roemer's theorem on labour values. This paper also contains what I think Marx really meant in [14] concerning the falling profit rate thesis, which view is different from that in Lebowitz [12].

3 . Further Studies on the Thesis of Falling Rate of Profit

We now suggest for the sake of students some possible topics they can deal with in their dissertations. First of all, still more general models may be constructed in which Okishio's theorem holds good. Fujimoto and Ranade [10] assumed the concavity of some production functions to employ a mathematical theorem in Fujimoto [6] , which in fact needs only the pseudo-concavity. (With regard to nonlinear programming, Mangasarian [13] is a good, though a little old, reference.) It seems possible to weaken the assumption of concavity, at least to the pseudo one. Or one can drop even the differentiability of relevant functions, which is rather for mathematically inclined students.

One more point with Okishio's theorem is that the conditions are normally sufficient ones; not necessary and sufficient. Thus, we should be able to make still further generalizations. In private correspondence, Krause has already suggested a condition weaker than the one (= Quantity Augmenting Property in the linear case) given by Fujimoto and Ranade [10] .

The second line is to consider the arguments in Fujimoto [3] in general multisector models. Indeed I myself attacked this problem together with Ranade in [9] using a two-sector model *in vain*. What we found there is that it becomes too clumsy to be tractable if we extend the discussion in one-sector models into multisector models in a naive way. We need some more twists to deal with Marx's thesis in an elegant fashion.

Both Marx's thesis and Okishio's theorem are quite plausible though they appear contradictory with each other at the first look. Thus, it is

also plausible to generalize these interesting propositions into various directions.

Supplementary Remarks

- 1 . The reader who likes mathematics is referred to Fujimori [2] for value analysis in von Nemann models, and also to Nikaido [18] for more basic mathematics.
- 2 . Those who are interested in nonlinear models can consult Fujimoto [5] or Lahiri and Pyatt [11] , and literature contained in these papers.
- 3 . In models of joint production, the non-negativity of equilibrium prices should be paid due attention. See Fujimoto and Krause [8] and references cited therein.

References

- [1] Bidard, C.(1988) "The Falling Rate of Profit and Joint Production", *Cambridge Journal of Economics*, 12, 355-360.
- [2] Fujimori, Y.(1982), *Modern Analysis of Value Theory*, Berlin, Springer.
- [3] Fujimoto, T.(1980), "Falling Rate of Profit in the Grundrisse", *Kagawa University Economic Review*, 53, 109-115.
- [4] Fujimoto, T.(1980), "Note on Technical Changes and the Wage-Profit Curve", *Economic Review*, 31, 179-181.
- [5] Fujimoto, T.(1980), "Global Strong LeChatelier-Samuelsan Principle", *Econometrica*, 48, 1667-1674.
- [6] Fujimoto, T.(1980), "Existence of Solutions of Pseudoconcave Inequalities", *Journal of Optimization Theory and Applications*, 31, 107-112.
- [7] Fujimoto, T.(1981), "An Elementary Proof of Okishio's Theorem for Models with Fixed Capital and Heterogeneous Labour", *Metroeconomica*, 33, 21-26.
- [8] Fujimoto, T. and U.Krause (1988), "More Theorems on Joint Production",

- Zeitschrift für Nationalökonomie*, 48, 189-196.
- [9] Fujimoto, T. and R. R. Ranade (1989), "On How Exploitation Becomes Difficult in Two-Sector Models", *Kagawa University Economic Review*, 61, 687-702.
- [10] Fujimoto, T. and R. R. Ranade (1991), "Okishio's Theorem Generalized with Joint Production and Externalities", mimeo, University of Okayama. (rev. 1993).
- [11] Lahiri, S. and G. Pyatt (1980), "On the Solution of Scale-Dependent Input-Output Models", *Econometrica*, 48, 1827-1830.
- [12] Lebowitz, M. A. (1976), "Marx's Falling Rate of Profit: A Dialectical View", *Canadian Journal of Economics*, 9, 232-254.
- [13] Mangasarian, O. L. (1969), *Nonlinear Programming*, New York, McGraw-Hill.
- [14] Marx, K. (1973), *Grundrisse*, (tr. by M. Nicolaus), London, Penguin.
- [15] Marx, K. (1965-1967), *Capital*, (in three volumes), Moscow, Progress.
- [16] Morishima, M. (1973), *Marx's Economics*, Cambridge, Cambridge University Press.
- [17] Nakatani, T. (1978), "Profit, Wage and Technical Change", (in Japanese), *Economic Review*, 29, 72-77.
- [18] Nikaido, H. (1968), *Convex Structures and Economic Theory*, New York, Academic Press.
- [19] Okishio, N. (1961), "Technical Change and the Rate of Profit", *Kobe University Economic Review*, 7, 85-99.
- [20] Okishio, N. (1965), *The Fundamental Theory of a Capitalist Economy*, (in Japanese), Tokyo, Soubunsha.
- [21] Roemer, J. (1977), "Technical Change and the 'Tendency of the Rate of Profit to Fall'", *Journal of Economic Theory*, 16, 403-424.
- [22] Roemer, J. (1979), "Continuing Controversy on the Falling Rate of Profit: Fixed Capital and Other Issues", *Cambridge Journal of Economics*, 3, 379-398.
- [23] Roemer, J. (1980), "Innovation, Rates of Profit and Uniqueness of von Neumann Prices", *Journal of Economic Theory*, 22, 451-468.
- [24] Salvadori, N. (1981), "Falling Rate of Profit with a Constant Real Wage", *Cambridge Journal of Economics*, 5, 59-66.
- [25] Wood, J. E. (1985), "Okishio's Theorem with Fixed Capital", *Metroeconomica*, 37, 187-197.