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**ON THE THEORY OF CAPITAL
IN POST-INDUSTRIAL SOCIETIES**

1. The present state of capital theory.

The theory of capital is a wide, complex and intellectually compelling subject, characterized by a high level of abstraction and by a plurality of logical dimensions, physical (or technical), financial and temporal. Its task is to explain the nature of capital and interest, the connections between the theories of value and capital and the role of capital in production, valuation and in the social distribution of income.

This entangled topic, which introduces to the dynamics of production in a capitalistic framework, can be afforded at two analytical levels of determination: that of a fundamental value-theoretic search on the inner nature of the economic process, an exercise in economic logic and pure economics, typical of theoretical economists, and that of an empirical asset valuation, practiced by bookkeepers and accountants. Up to now, these two levels of determination have been generally kept distinct and analysed separately. It is time to reconcile them.

The present state of the theory of capital is rather disappointing. The basic problem of measuring heterogeneous capital goods in proper value terms, by pricing them, has not yet been satisfactorily solved. The functional links of the theory

of capital with the theory of value and with the theory of distribution are not sufficiently cleared. There is still some work to be done in this field. Capital theory should ultimately be seen as a chapter of general equilibrium analysis.

In this essay we shall first provide a short historiographic introduction to the subject. It will be an exercise in critical thinking about thinking, aimed at introducing a further analysis. Attention will be focused on capitalist production for profit.

The analysis of the theory of capital will then be pursued in a 'late-Marxian' perspective, derived from the position held by Marx after his 'epistemological break' of the middle 1840s, described by Althusser as a radical change of theoretical perspective which signed Marx's passage from Hegelian idealism a general theory of practice, that of historical materialism. We shall supply textual evidence to support this interpretation.

Working in this direction, we shall criticize and refuse two fundamental Marxian postulates: *i*) the assumption that living labour is the only source of value, with its corollary of the alleged value equality between the net output of the economy and the living labour employed in production; and *ii*) the roles attributed in the process of capital valorisation to constant and variable capital. Contrary to Marx, we shall argue that only part of the value of the real capital involved in production transfers unaltered in the value of output.

This double refusal will lead to a radical change of the traditional Marxist perspective in capital theory. A change pursued along ‘late Marxian’ lines, in conformity with Marx’s own indications and in the historical framework of a post-industrial society. The untenableness of the pure labour theory of value in its quantitative dimension will emerge very clearly and a broader cost-of-production version of the theory of value will be proposed in which value will not be considered an inherent technological quality of a commodity, or a relation between things, the expression of an illusory fetishist conception.

Following Marx, value will be considered a social relation, a relation between human beings, not an exchange relation between things. And the same will be done as concerns capital.

We shall suggest a new method to calculate the monetary expression of abstract labour-time, to make possible a correct integration of the theory of capital with the theory of money. It involves the use of a budgeting parameter suited to include on the cost side both the real cost of production, gross of depreciation allowances expressing the asset’s loss of productive efficiency due to its ageing, and the financial cost of capital.

2. Some lessons from the past.

Let us begin by recalling a few historical reference points. Starting from the pre-classical theories of value of Cantillon and Petty, the labour-and-land and ‘loaf of bread’ theories, based on the cost of production of commodities in an agricultural framework in which the social surplus had the prevailing form of land rent.

With Adam Smith the theoretical perspective changed. The concept of value, previously limited to material objects, was extended to intangible services, and the ‘toil and trouble’ of labour was recognized as the only source and measure of value. Smith held two theories of value. One of them was a labour-embodied theory. It was meant to apply to the “early and rude state of society which preceded the accumulation of capital and the appropriation of land”, an analytical context where labour-embodied and labour-commanded necessarily coincided. For a capitalist economy in which production was undertaken for profit, Smith had a different theory of value, a labour-commanded theory in which prices were not necessarily proportional to labour costs.¹

¹ Smith held also an ‘adding up’ theory of natural prices – the central prices to which commodities market prices are assumed to gravitate in the long period – where wages, profits and rents entered as independently determined components in a ‘trinitarian’ price formula, at their normal rates. The theory included profit and rent into price and treated them as deductions from the product of labour. It was therefore a cost-of-production theory of value and was not consistent with a pure labour theory.

A theory of value should answer two distinct questions: the search for a reliable measure of value (a technical problem) and that for the social substance of value (an ontological problem). Classical economists, in general, considered these two aspects strictly connected and gave them a single answer, the labour theory of value.

The Ricardian school regarded capital as accumulated labour, or as a wages-fund, and reduced capital to its labour equivalent. Another school of thought, led by Torrens, held a cost-of-production theory in which equal emphasis was put on labour and capital costs. Interest costs were regarded as the reward due to savers for the sacrifice involved by postponing consumption; and the rent on land was considered a component of the cost of production.

Ricardo generalized Smith's labour-embodied theory of value. He pointed out that the value of a commodity depends on the relative quantity of labour needed for its production, not on the compensation paid for this labour. The price of reproducible commodities was determined by their unit cost-of-production, plus a profit margin. Rent was not regarded as a component of price.

The productivity of capital was denied by the 'Ricardian socialists' and by J.S. Mill, who as Smith and Ricardo thought that value was an intrinsic property of commodities. Mill

abandoned the idea of capital as a wages-fund and substituted it with the old one of accomplished and hoarded labour, held by von Thünen and Rae. He attributed productive power only to labour and natural resources. For Mill, the labour and the cost of production conceptions of value could be reconciled, because he thought that all costs of production were ultimately resolvable into labour.

Then came Marx. He focused his attention on value and on the fundamental relation between value and capital. As Ricardo, he recognized that nothing can have value without being an object of utility and that the value of rare and non-reproducible things is determined by the demand for them, rather than by their labour content.

Marx's theory of capital, a unified theory of value and money, was first exposed in 1859, in the *Critique of Political Economy*. It contained a number of significant novelties: *i*) the introduction of the notion of abstract labour, i.e. of socially necessary labour-time, different from Ricardo's empiricist concept of embodied labour; *ii*) the distinction between labour, the agent of production, and labour-power, a commodity, expressing the labourer capacity to work; *iii*) the equivalence of labour-time, the intrinsic or immanent measure of value, and money, its external measure (a remark that opened the way to a

monetary theory of value)²; iv) the questionable distinction between constant and variable capital; v) the assumption that living labour is the only source of new value; vi) the identification of the origin of surplus-value in unpaid labour; vii) a rejection of the *homo oeconomicus* reductionist perspective; viii) the idea of capital as a relational concept, a social relation of production and distribution, that cannot find a direct physical or technical expression.³

Two basic stages can be distinguished in the evolution of Marx's theories of value and capital: a former one, that of the 'young' or 'junior' Marx, and a later one, of the 'senior' and more mature Marx. The first one found its definitive form in *Capital*, vol. I, first chapter, where Marx exposed in simple terms the leading lines of his theoretical conception, starting from the level of immediate appearances, to render his

² Money was for Marx the necessary form of appearance of value and capital. He maintained that in the process of production labour "*becomes value in process, money in process and, as such, capital*" (*Capital*, vol. I, chapter four). We agree with his idea to consider capital a process, but we prefer to look at capital as value in progress, value in motion.

³ Capital is indeed a relational concept, not an absolute one. Nothing is capital *in se*, for its own immanent properties. Under proper conditions, almost everything can be potentially regarded as capital, from a functional point of view. Any attempt to define capital once and for all, in general terms, as a specific class, or set of classes of commodities is open to semantic objections.

discourse comprehensible also to unprepared readers. But he did it with the clear intention to develop the argument more extensively, without some restrictive assumptions, later on.

In his last works, the *Critique of the Gotha Programme* and the *Notes on Wagner*, Marx to recognize that living labour is not the only source of net value. At that time he had no longer in mind a labour theory of value (though a limited one, valid only at an aggregate level), but a cost-of-production theory in which both labour and capital had an active role. He knew that with different technical composition of capital in production processes, the prices of commodities produced for profit in a capitalist society could not be proportional to the quantities of embodied labour. Commodities did not exchange in proportion to their values, but to their prices of production, characterized by equal rates of profit.

Now we know something more. Namely, that two opposite analytical methods are available to reduce prices to real costs of production in theories of value of classical kind, in which emphasis is put on the supply side, in a backward-looking perspective. One of them – suggested by Dmitriev and applied by Bortkiewicz and other neo-Ricardians – is that of the reduction of prices to dated quantities of labour-time, properly weighted and vertically integrated. The other approach – devised by Torrens – is the reverse one: it is a capital theory of value in which the labour coefficients in price equations are

substituted by physical quantities of commodities (wage-goods). It is a commodity theory of value.⁴

A possible way to reconcile these methods is to conceive a theory of capital based on the money-form of value. More particularly, on an inconvertible money having no intrinsic value and suited to express the relevance of both labour and capital.

3. Towards a value measure of the ‘quantity of capital’.

A revival of Smith’s idea of a long run natural equilibrium order in economics took place in the second half of the 19th century, with the declining influence of the Ricardian school. In price theory attention shifted from the supply to the demand side of the market; from the cost of production to utility and scarcity. In the theory of capital and interest, abstinence, the sacrifice implied by postponement of consumption, described by Senior, was rediscovered.

A leading neoclassical American economist, John Bates Clark, was the highest authority on capital theory. He conceived capital as a permanent moving fund of uncommitted purchasing power and abstract productive capacity, expressible in money terms, though not necessarily consisting in money.

⁴ Both methods imply a mental regression in time, a process of backwardation that has to be truncated at a certain point, to avoid incurring in an impossible regression *ad infinitum*.

His colleague Frank Knight looked at capital as a single magnitude measured in terms of money. He held a productivity theory of capital entirely independent of subjective time-preference. Another eminent neoclassical scholar, Irving Fisher, regarded as capital any stock of wealth suited to produce an income flow. That is the capitalized value of an income stream.

An attempt to reconcile the supply and demand sides of the theory of value and capital was made in England by Alfred Marshall. His theoretical construction was designed to integrate the theory of income distribution with the theory of value and to close the gap between the economist and the businessman conceptions of capital. Marshall's intention was to lay down the foundations of a comprehensive theory of production, value and distribution, where long-period normal prices would be explained on a cost-of-production basis, whereas current prices would reflect the changing market relation between supply and demand. He used several notions of capital – a stock of productive wealth, a homogeneous fund of wage advances, a specific factor of production distinct from labour and land – but did not connect them in a consistent theoretical conception.

An innovative approach to the theory of capital was proposed by Leon Walras. He regarded as capital any resource which could be used as an input in production, including labour ('personal capital') and land ('natural capital'). He had in mind

a disaggregated approach to capital theory, a general equilibrium model implying a vector of heterogeneous capital goods, whose prices were determined by capitalizing the net income of capital services. In this approach everything depended on everything else, as in any general equilibrium model. The source of capital, therefore, could not be identified. Moreover, no uniform risk-adjusted rate of return on capital emerged, in the presence of new heterogeneous capital goods.

These approaches to the theory of capital were not shared by other marginalist authors. Jevons provided a distinct version of marginalism. He focused the attention on the time structure of capital and on the role of circulating capital.

Then Menger, the founder of the 'old' Austrian capital school, reversed the direction of value imputation of classical political economists, centred on labour. He held a subjective and a-temporal theory of value and pointed out the importance of intermediate capital goods. In his structural approach to the theory of capital, goods were classified in distinct orders, according to their distance to final consumption. A pupil of Menger, Wieser, focused the attention on a capital stock of non-permanent productive resources, periodically consumed and reproduced. In his productivity theory of interest time preference did not play a significant role.

Böhm-Bawerk, another leading member of the old Austrian capital school, rejected Clark's idea of true capital – a

homogeneous fund of abstract values –as a pure abstraction (‘a mythology of capital’). He looked at capital as saved-up labour and saved-up land and proposed to measure it by a single magnitude, an average period of production. As concerns interest, he rejected productivity theories and argued that interest has to be paid on capital since production takes time and needs to be financed in the meanwhile.

Knut Wicksell – a general equilibrium economist close to the Jevonian and Austrian diachronic perspective and conscious of the problems posed by the measurement of capital in value terms – went farther on. He regarded capital as a factor of production distinct from labour and land, and noticed that it had to be calculated in non-technical value units, an anomaly that could have serious disturbing consequences, later named ‘Wicksell effects’.⁵ Together with his pupils Åkerman and Lindahl, he also succeeded in extending the Austrian theory from circulating to fixed capital.

A second generation of Austrian capital theorists, that of Mises and Hayek, refused to conceive capital as a perpetual fund of abstract values capable of maintaining its magnitude

⁵ It is the effect by which any change in the rate of interest or in the supply of capital goods causes a change in the value of a stock of capital, by altering the units in which the stock is measured, so that in competitive equilibrium the rate of interest is no longer equal to the marginal product of capital.

while altering its form, or as an amount of waiting. Mises held a time-preference theory of interest. Hayek was the author of a pure theory of capital. He argued that production takes place in vertical linear sequences and thus cannot be correctly represented by means of simultaneous equations models. He also explained why the complex time-lapses structure of production could not be suitably summarised by a single parameter. As Knight, he considered Böhm-Bawerk's average period of production a misleading concept.

Another Austrian economist, Schumpeter, denied to produced means of production the nature of a distinct productive factor and argued that all capital goods could ultimately be 'resolved' into labour and land.

Later on, a new generation of 'Austrian' capital theorists came to the forefront and brought further contributions on specific points of the theories of capital and interest, but did not succeed to construct a theory of capital in disequilibrium fully integrated with the theory of money and suited to explain business cycles.

Two other important schools of thought on capital and interest were active in the 1930s: that of the 'Ordo' Freiburg liberal circle of Eucken and Röpke in Germany and that of Robbins at the London School of Economics. In both of them, Hayek had a significant role.

4. The reorienting of capital theory in the 1930s.

At the end of the 1930s the debate on the theory of capital was reoriented in the direction of simultaneous equations models fit for a timeless structural analysis of the system. They were either of the neo-Walrasian type, implying the assumption of perfect individual rationality, or of a Paretian type, allowing for non logical actions.

All these models are subject to methodological objections, for the logical implications of the assumption of a static framework and of given initial endowments of capital assets. When new capital goods, qualitatively different from the old ones, are produced, the equilibrium condition that requires equal rates of returns on all capital assets is not satisfied.

In England two economists, Dennis Robertson and John Hicks worked, independently of each other, in this direction. Robertson used a period analysis implying a time-lag between the reception and the spending of income, which he applied to the study of industrial fluctuations, that he thought could be explained by a shortage of saving and an excess of bank credit to investors. He held a 'loanable funds' theory of interest. Hicks analysed the market process in a forward-looking pseudo-dynamic perspective in which every variable was dated. He then focused on the study of steady growth equilibrium, but admitted to be 'very skeptical' about its relevance, and

ultimately proposed a reformulation of the theory of capital on alleged neo-Austrian lines.

The Austrian capital theory deserves appreciation for its contributions to express the connection between time and value, to discard the neoclassical concept of ‘quantity of capital’, to point out the relevance of time in production processes and to rediscover the creative role of entrepreneurship, obscured by the standardized optimizing procedures of neoclassical theories. But apart from the simplest point-input point-output case, concerning the growing of timber trees or the maturing of wine, it incurred in serious difficulties in the treatment of more complex cases of production, in which the connection of individual input and output units poses harder problems.

The Austrian school, moreover, did not afford an analysis of the relations between the synchronic (horizontal) and the diachronic (vertical) capital structure of the system. And it was not equally successful in studying a disequilibrium context. This was one of the reasons that explain why the Austrian capital theory did not get Keynes’s approval.⁶

⁶ During the capital theory controversy between Hayek and Keynes new questions were raised: whether substitution or complementarity relations prevailed between factors of production; whether there was any difference between choosing among various commodities available at different times and among different commodities available at one and the same time;

Keynes was scarcely interested in the theory of value and even more in the theory of capital. But he did not dismiss capital theory entirely. His aim was to propose a general theory of asset holding, based on an expectations-augmented extension of Marshall's theory. He had in mind a monetary theory of value and a forward-looking theory of capital, focused on the expected returns of new investments (the marginal efficiency of capital), instead than a backward-looking theory, focused on past investments.

In the *General Theory* there is a whole chapter on the nature of capital. Keynes made clear that he sympathized with the pre-classical doctrine in which labour was the basic productive factor.⁷ Special attention was later paid by Keynes to the temporary demand for short-term finance in form of overdraft

whether investment should be considered as inversely related to the rate of interest or as directly related to the level of final demand. Shared conclusions, however, were not drawn. The positions of the discussants were too distant. They reflected two opposing visions. Hayek believed in the fundamental self-correcting power of the market economy. Keynes did not share this view and advocated a more active government intervention to stabilize the economy.

⁷ He observed that if the supply of capital goods was kept sufficiently abundant, the yields of capital would decrease up to the point at which the marginal efficiency of capital would be zero. Then the demand for capital assets would cease, causing the "euthanasia of the rentier" and the end of "the cumulative oppressive power of the capitalist to exploit the scarcity-value of capital" (*G.T.*, p. 376).

bank facilities covering the period which elapses between the planning and the execution of an investment.⁸ He named it the ‘finance motive for holding money’, a component of the total demand for money. Once the investment was completed, the short-term financial arrangement was substituted by a long-term one, provided by institutional underwriters.⁹

This conception allowed to build a bridge between the Keynesian different components of the demand for money, that affects the time structure of production systematically, through the level of the rate of interest, and to argue that in long-run equilibrium the rate of interest would be simultaneously determined by a threefold-margin of choice, between present and future consumption, real and financial investment, money

⁸ Keynes thought that under stationary conditions, investors would usually be in the position to meet their payment obligations for the purchase of capital goods, without need of additional financial resources. But in a growing economy there would be a need by firms of ‘extra-finance’, that should be met by issuing new securities and by borrowing again from the bank system.

⁹ In a stationary economy, investors would be in the position to meet their payment obligations. Capital goods producers would be able to repay their bank debts with the sums received from buyers and the repaid bank loans would provide a revolving fund for short-term finance. But in a growing economy there would be a need of extra-finance for net investment. The crucial elements for financing new investments were the liquidity position of the banking system and the willingness of financial intermediaries to lend at the ruling interest rates.

and bonds.

5. On Cambridge debates and their controversial implications.

From Keynes's Cambridge circle a fundamental criticism was addressed in the early 1950s to the macroeconomic versions of the neoclassical conception of capital. It came from Joan Robinson, who in a provocative article described the aggregate production function as an instrument of economic miseducation, open to serious objections. She posed two basic questions – what is the meaning of ‘the quantity of capital’ and what determines the rate of profit – and argued that there is no physical quantity of capital, no marginal product of capital and that the social distribution of income is not determined by the marginal productivities of factors.¹⁰ Her assertion that capital is not measurable in aggregate terms independently of the rate of profit and the social distribution of income shook the backwater of capital theory, but did not succeed in discarding the mainstream neoclassical version of the theory of capital, linked to the names of Clark, Knight, Fisher, Böhm-Bawerk and

¹⁰ Leading ‘neo-neoclassical’ authors had made use of unrealistic ‘parables’ implying a single homogeneous capital good, to show that the distribution of income between profits and wages was determined by the technical parameters of an aggregate production function and that the capital intensity was a monotonic function of the rate of profit.

Wicksell. Times were not yet sufficiently mature to abandon some traditional tools of equilibrium analysis.

A few years later, after the appearance of Sraffa's book on production of commodities by means of commodities, the debate on capital theory was resumed. It was definitively shown that the capital intensity of production is not a monotonic function of the rate of profit, that different capital goods cannot be aggregated into a single magnitude, because their aggregation is a special technical problem, and that 'Wicksell effects' can arise involving changes in the methods of production and in the value of the capital stock, associated with changes in the rate of interest incompatible with those assumed by the neoclassical theory.¹¹ The logical possibility of insurgence of paradoxical phenomena, such as 'reswitching of techniques' and 'capital-value reversing', was definitively ascertained.

Two broad conceptions of value opposed each other in the 'Cambridge controversy': the neo-Ricardian theory of the Anglo-Italian school and the neoclassical theoretical construction. In each of them two distinct components could further be distinguished. On the neo-Ricardian side, a Sraffian

¹¹ Joan Robinson did not take an active part to that phase of the debate. She was interested in the working of capitalism in historical, not in logical time (long-period positions) and regarded Sraffa's approach to the theory of capital as too narrow in scope ('half a general equilibrium system').

component, that held a commodity theory of value, and a Marxist component, that continued to believe in the validity of the labour theory of value, were present. On the neo-classical side, a mainstream component which supported the use of aggregate production functions could be distinguished from a neo-Walrasian minority wing.

The neo-Ricardians were able to show that a fall in the interest-profit rate¹² was not necessarily associated with an increase in capital intensity. Therefore no monotonic inverse relationship between the amount of capital and its remuneration emerges. But they did not provide an alternative logically consistent theory, suited to explain the nature of the return to capital.

The ultimate implications and the overall empirical relevance of the Cambridge debate have been subject to controversial interpretations. Aggregate neoclassical parables, modeling the world as if there was only a single homogeneous and malleable capital good, suited to be expressed as an aggregate magnitude, had to be abandoned; but the fate of neo-

¹² In the literature it is usual to refer to the rate of interest on money as a monetary ratio determined by liquidity considerations and to the rate of profit on capital as a 'real' rate of return expressing the profitability of investment. In equilibrium, abstracting from different degrees of risk, the two rates are necessarily equal. They should not be regarded as the rental price of a specific factor of production.

Walrasian disaggregate temporary or inter-temporal capital models was not definitely cleared. Were they also subject to insurmountable criticisms, or not? Paradoxical capital behaviours, anyhow, continued to be treated as empirical anomalies: logical ‘curiosa’, or ‘local puzzles’.

The Cambridge debate was at last archived as an inconclusive ideological controversy that caused much ado for nothing. A lot had been deconstructed, and little reconstructed. The basic questions in capital theory – how capital is created and valorised – remained unanswered. Aggregate production functions did not cease to be used by neoclassical authors.

6. New readings of Marx’s theoretical system.

This disconcerting situation still persists, in spite of some later attempts to remove it. The two most significant of them came in the late 1970s and in the early 1980s. The first one was a movement of reaction to the Marxian ‘orthodox’ vision of the theory of value, by which value had been intended in purely technological rather than in classist terms. That is as a production-centered value form, rather than as a value form connected with the social distribution and circulation of output. A ‘class-struggle’ neo-Marxist approach to the theory of value, aiming at reintroducing politics into that theory, was opposed at that time to the ‘circulationist’ approach. It was linked to Italian

workerist movement's idea of a social property of 'the commons'.¹³

The second novelty came in the early 1980s, when a 'New Interpretation' (henceforth NI) of the Marxian theory, focusing on the money-form of value, was proposed by neo-Marxist scholars. They were influenced by Isaak Rubin's reading of Marx's writings on value and capital and by the Regulation approach to the problem. Money was assigned the task of providing at the aggregate level of net product a formal mediation between labour values and production prices, regarded as part of a single analytical system. Therefore no problem of transformation of values into prices could arise.

The integration of the theory of value with the theory of money was achieved in two stages: first by determining the value of money as the ratio of the total amount of living labour employed in production to the money value of the net product of the system, less unproductive consumption, and then by expressing the value of labour-power in money terms, as the share of money wages in the net product.

This approach presupposes the pure labour theory of value. It emphasizes the importance of money in production and the

¹³ See, for instance, De Angelis, 2007.

productive role of living labour and obscures that of material means of production.¹⁴

The central point to ascertain is whether the value of labour-power is given by the money wage, i.e. by a non-allocated purchasing power directly observable, or by the real wage, which it is not easily observable. If the correct answer is the money wage, as argued by NI., then some important consequences follow: (i) the value of labour-power corresponds to the share of money wages in net output; (ii) the Marxian condition of equality between the sum of values and that of prices is satisfied for the net product of the system; (iii) the labour-commanded and the labour-embodied measures of value coincide; (iv) the Marxian law of value cannot be applied to labour-power, a commodity whose exchange-value is not known in advance.

A paradoxical result would then emerge, if labour exploitation is defined as the situation in which workers produce more value than the amount embodied in the wage goods that they obtain in return. Workers doing the same job, side by side, for an equal time and getting the same money wage, would be illogically subject to different rates of

¹⁴ It is not evident, however, why money should be taken as a quantitative expression of value in a world where commodities do not necessarily exchange at their values. The assumption of equal exchange under unequal production relations can be questioned.

exploitation whenever they purchase different bundles of wage goods.

If on the contrary the value of labour-power is taken to be the real wage, then money cannot be directly assumed as an expression of abstract labour. An intermediation process between values and prices is required. To determine the value of labour-power, one must first know the value of a given basket of wage goods and that of money wages. In NI there is no such intermediation process. Everything is posit by definition. The value of labour-power is the amount of living labour commanded by the money wage.

The value of money is defined in NI as the ‘monetary expression of living labour-time’ (MELT) and it is measured by the ratio of the net product at current market prices to the living labour employed in production. This ratio can be computed only *ex post*, that is when the price of money in terms of commodities is known.

Two variants of NI should also be considered. One is the *Simultaneous Single System Interpretation* (SSSI) of neo-Ricardian scholars, in which all capital, both circulating and fixed, is measured in money terms¹⁵ and all prices and the rate of profit are simultaneously determined, by the solution of a system of linear equations in a stationary equilibrium

¹⁵ See Moseley (1990).

framework.¹⁶ Prices and values are necessarily equal and the rate of profit is uniform in all sectors and is the same in price and value terms.

Commodities which appear as inputs and as outputs in the production process have the same prices, as in Bortkiewicz's and Sweezy's analyses of the problem. This is, however, a questionable assumption, because it can be objected that inputs must be purchased at prices which are not transformed, before outputs are produced and sold at transformed prices.

It can also be objected that an analysis of stationary equilibrium states, involving a uniform and unchangeable rate of profit, lacks of historical realism in the presence of technical progress and obsolescence of old capital goods.

The other variant of NI – the *Temporal Single System Interpretation* (TSSI), or *Marxian Disequilibrium Approach* – was proposed by 'new orthodox' non-Sraffian Marxists who accept the labour theory of value. In this approach emphasis is put on the possibility of continuous structural changes. All variables are reckoned in money terms, in temporal sequence. Inputs values are supposed to be already transformed into prices, and prices can change during the production process, if productive techniques change. Hence there is no reason to attribute to commodities the same prices when they are

¹⁶ This explains the name *Equilibrium Marxism* given to this approach by some critics.

considered as inputs and as outputs. Values and prices are interdependent elements of a single system, defined in historical time. But they are not simultaneously determined.

In principle, this approach looks more general and logically superior to SSSI. It is a progressive research program which marks the passage from a stationary equilibrium analysis to a disequilibrium framework. Time is explicitly introduced into the analysis and it is no longer necessary to suppose that exchanges take place between equivalents. In each period input values equal output values of the previous period, and are not necessary equal to the output values of the same period. But this approach, as the other single-system interpretations, is based on the wrong Marxian premise that the only source of surplus-value is living labour.

In a sense, TSSI resumes and develops the Austrian capital theory conception of a sequential production in which inputs come first, outputs follow over time and capital is the expression of the time structure of production. But in the light of experience, the assumption that techniques are open to continuous changes during a production process appears unrealistic and untenable. In the real world changes in the techniques of production and in the relative prices of inputs and outputs are not continuous.

Let us notice, furthermore, that to maintain that TSSI is a theoretical construction logically consistent in the framework

of its questionable analytical premises, does not imply an acknowledgement that this approach is a correct interpretation of Marx's thought.

The basic idea underlying all single-system interpretations of Marx's theoretical construction is that values and prices form a single system of interdependent variables, easily convertible in each other; not two separate logical systems, as was assumed in Bortkiewicz's 'dual system' interpretation of Marx's production schemes, supported by Sweezy and other Marxist theorists.

The single-system assumption is an unproved postulate, that cannot be demonstrated. It should be accepted or refused. In our opinion, it cannot be accepted, because implies the new value equality, based on the unrealistic pure labour theory of value.

The senior and mature Marx – *Marx par excellence* – knew that the labour theory of value could not hold in the modern industry of his times, in which workers were reduced to mere appendices of machines. He had gradually realized that the capitalist economy had undergone a radical and irreversible historical change, owing to which the labour theory of value was no longer valid. Abstract labour remained, for Marx, the ultimate source and the social measure of value; but living labour could no longer be considered the single source of surplus-value.

7. Evidence on the evolution of Marx's thought on capital.

Since it can be objected that this radical change of Marx's theoretical perspective is only a conjecture of the present writer, we shall now provide some textual evidence of it.

Marx had initially accepted the labour theory of value in its pure form. He thought that in a capitalist economy the value of commodities was determined by the amount of socially necessary labour time required to produce them. That is by a sum of living and dead labour. Then, gradually and almost silently, he changed his mind.

In the third volume of *Capital*, Marx abandoned the labour theory of value, as an explanation of how commodities prices are determined. But he did not develop an alternative full-fledged theory of value and capital.

In a famous passage of *Grundrisse*, or *Outline of the Critique of Political Economy*, the 1857-58 early draft of *Capital*, Marx had already made clear that not only labour-power but also machines capital-power had an active role in production. "As long as the means of labour remains a means of labour in the proper sense of the term, such as it is directly, historically, adopted by capital and included in its realization process, it undergoes a merely formal modification... But, once adopted into the production process of capital, the means of labour passes through different metamorphoses, whose

culmination is the machine, or rather, an automatic system of machinery..., set in motion by an automaton, a moving power that moves itself... In no way does the machine appear as the individual worker's means of labour. ... Rather, it is the machine which possesses skill and strength in place of the worker... The worker's activity, reduced to a mere abstraction of activity, is determined and regulated on all sides by the movement of the machinery, and not the opposite".¹⁷

In another work of 1858, the original text (*Urtext*) of *A Contribution to the Critique of Political Economy*, Marx explained that capital is not a thing, a productive factor, but a process by which an owner of money exchanges it for the labour capacity of others, that is offered for sale, as a commodity, to be consumed through use.

In Marx's draft of chapter 6 of *Capital*, written in 1864 with the title of *Results of the Direct Production Process*, not included in the published version – where Marx says that the wage form of labour is a pre-condition of capitalist production – one finds the following sentence: “*Capital employs the worker, not the worker capital, and it is only things that employ the worker and therefore, in the shape of the capitalist, possess helphood, and a consciousness and will of their own, which are capital*”.

¹⁷ Marx, *Grundrisse*, 1857-58, chapter on capital, ‘Fragment on machines’, notebook VI, par. 584-86.

Later on, in the first volume of *Capital* (1867) Marx wrote: “*On a closer examination of the working-machine proper, we find in it, as a general rule, though often, no doubt, under very altered forms, the apparatus and tools used by the handicraftsman or manufacturing workman: with this difference, that instead of being human implements, they are the implements of a mechanism... The machine proper is therefore a mechanism that, after being set in motion, performs with its tools the same operations that were formerly done by the workman with similar tools*” (*Capital*, I, 368). And “*In manufacturing the organization of social labour is purely subjective; it is a combination of detail labourers; in its machinery system modern industry has a productive organism that is purely objective, in which the labourer becomes a mere appendage to an already existing material condition of production*” (*Capital*, I, 382). Further on Marx adds: “*In the factory we have a dead mechanism which is independent of the workers, who are incorporated into it as its living appendages*” (*ibidem*, 548).

Under such conditions, any attempt to distinguish the productive contributions of labour and capital appears destined to failure. The opposition between labour and capital weakens. And the labour theory of value must be abandoned. Marx noted: “*As soon as labour in the direct form has ceased to be*

the great well-spring of wealth, labour-time ceases, and must cease, to be its measure”.¹⁸

Similarly, at the end of *Capital*, vol. I, chapter eleven, Marx wrote: “*It is now no longer the labourer that employs the means of production, but the means of production that employ the labourer*”. And he pointed out that this was a “*complete inversion of the relation between dead and living labour, between value and the force that creates value*”.

Capital had definitively taken hold of production and realized what Marx calls ‘the real subsumption of labour under capital’.

Almost a decade later, in his *Critique of the Gotha Programme*, already referred to, Marx confirmed that “*labour is not the source of all wealth*” and that capital (‘material conditions’) and natural resources are two other sources.¹⁹

In our opinion, this textual evidence, although fragmentary, shows that the elder Marx had changed his views on the role of capital goods in production and had recognized that machines

¹⁸ *Ibidem*, notebook VII, par. 593.

¹⁹ “*Labour is not the source of all wealth. Nature is just as much the source of use-values (and it is surely of such that material wealth consists!) as labour, which itself is only the manifestation of a force of nature, human labour power*” (Marx, *Critique of the Gotha Programme*, 1875, chapter 1). The source of all wealth, for Marx, was labour together with its ‘material conditions’ and natural resources (the classical triad); but the only source of value was labour. He therefore distinguished material wealth from value.

are directly productive of value and surplus-value. That is that they possess a net productive power. Just as labour does; though, differently from labour, machines do not posit their ends.²⁰

Abstract knowledge, objectified in machinery, had become for Marx a productive force in its own right, a 'capital-power'. The pure labour theory of value, that he initially held, had to be substituted by a broader cost of production theory. It is important to take notice of this change of theoretical perspective.

9. For a revision of the theory of capital.

We can now proceed further on and try to lay the bases of a theory of capital in a post-industrial society. To begin with, let us recall that we really need a theory of capital, if we are interested in intertemporal resource allocation, general equilibrium analysis and economic dynamics. Capital theory should provide the foundations of macroeconomic dynamics and growth theory. Our intention is to promote a revision of its

²⁰ Marx regarded machinery as the objectified power of social knowledge, the product of 'General Intellect', an entangled mix of intellectual ability, creativity, technology and history. A typical real abstraction, dealing with the modified character of the subsumption of labour to capital.

present unsatisfactory state, moving along reinterpreted Marxian lines.

We shall start by our refusal of Marx's distinction, in *Capital* (vol. I, chapter eight), of two components of total capital: 'constant capital', whose value is simply transferred to output, and 'variable capital', used to pay wages and thus turned into labour-power in action. And we shall note that Marx's constant capital includes both fixed capital and circulating capital. That is both means of production in strict sense, as plants, machinery and tools, and working capital, as raw and auxiliary materials and goods in process (denoted by Marx 'matières instrumentales').

There is a difference in kind between these two components. Fixed capital consists in stocks of durable goods, fit for repeated uses, but perishable and subject to depreciation. These are goods that transfer their value to output only partially and gradually. Circulating capital, on the contrary, is a capital-flow and it is used up and consumed immediately, by a single act.

We shall now distinguish the fixed capital component of Marx's constant capital C , expressed in money terms, a stock of durable and depreciable capital (K_d), from the circulating part, also expressed in money terms, a flow of 'vanishing capital' (K_v). Besides, we shall call 'wage capital' (K_w), another capital flow, the amount of money spent to hire workers (Marx's 'variable capital' V expressed in money terms).

Therefore total capital K will no longer be $C+V$, as in Marx, but $K_d + K_v + K_w$. And the total social product will no longer be $C+V+S$, as in Marx (S is total surplus-value); but $K_d + K_v + K_w + N$, where N is a 'net economic value' component, measured in money terms (the money value of surplus product).

In the presence of this composition of capital – and in view of the fact that capital accumulation has a flow nature (in Marx's words in the *Results*, that of *a fluens that posits a fluxion*) and that the demand for investment, which determines the rate of accumulation of capital, is a flow version of the demand function for a stock of capital – an integrated stock-and-flow analytical treatment of capital in disequilibrium is required to describe the evolution of the capital stock over time. The demand for capital and the demand for investment are strictly related.

The demand for investment determines the rate of capital accumulation. It is a function of three distinct elements: the level of effective demand, the expected rate of profit, or marginal efficiency of capital, and the current conditions of the money market, synthesized by the level of the interest rate.

A basic proposition in the theory of investment is that in the short-period, when the capital stock is constant by definition, the investment demand is a function of the difference between the marginal efficiency of capital and the ruling rate of interest. In long-period equilibrium, the marginal efficiency of

investment should equal both the rate of interest and the marginal efficiency of capital.²¹

What is needed is an integrated stock-and-flow approach covering both real and financial capital assets. It should show that with stable prices the basic equation relating capital stocks and capital flows requires that the stock value of a durable asset should equal the discounted value of the expected future flow of services yield by the asset. And it should provide the necessary link between the market for real capital assets and the market for financial liabilities.

Under non-inflationary conditions, a durable capital asset should be charged for its use a price equal to a depreciation allowance term, reckoned to account for physical wear and tear and obsolescence, augmented by an interest term, expressing the user or rental cost of financial capital, that is the nominal

²¹ Lerner's marginal efficiency of investment (MEI) is a flow-variable, a demand function for investment, the demand for additional units of capital goods; whereas the Keynes's marginal efficiency of capital (MEK) is a stock-variable, the demand for the existing stock of capital goods. In a Marshallian framework, where money is not held as an asset and *ex ante* savings necessarily equals investments, the equality of MEI and the marginal cost of capital (MCC) is sufficient to determine the equilibrium rate of investment. In a Keynesian framework, where savings can be invested in capital goods or held in money balances, the saving-investment equality is not necessarily satisfied. It is an equilibrium condition. It holds when the demand-price and the supply-price of capital goods are equal.

price that the owner and user of a capital good pays to himself for using the asset.

Different methods are available for the measurement of real stocks of capital assets, but none of them is fully satisfactory. The most popular one is the statistical method of perpetual inventory, based on the idea that stocks are cumulated flows of investment, corrected over time for efficiency loss and exit or discarding patterns. For the use of this method one needs to know, period by period, the whole time series of gross investment, depreciation by wear and tear and obsolescence, and capital retirement.

Alternative possibilities to measure real capital stocks can be provided by book value estimates, direct company surveys and property and insurance records methods. All of them, however, pose conceptual and theoretical problems and present empirical difficulties as concerns the pricing of capital goods by a price index.

Unfortunately, in the case of capital goods no satisfactory solution to the index number problem is known. It is not at all clear in what units capital should be measured. In terms of their present productive capacity (reckoned in the short or in the long-run)? Or in the backward-looking terms of the cumulated amount of consumption foregone? Or in the forward-looking terms of the present expected value of real wealth? It has been suggested that the answer should depend on the specific

purpose of the measurement of capital and that from this point of view the long term productive capacity is the best choice to make for investment purposes.

The definition of the aggregation conditions that should be specifically observed in the measurement of capital stocks and of flows of capital services poses to capital theorists a further difficult and still unsolved problem.²²

9. Marx's monetary expression of value.

Marx called “monetary expression of value” (MEV) the money equivalent of abstract labour-time. That is a proportionality factor expressing the relation between the common social substance of value and the money-form of value, measured by the average unit cost, for the economy as a whole.²³

²² On this point, see a survey of the literature in Felipe and Fisher, 2003.

²³ ‘Monetary expression of value’ is the English locution used by Marx in *Value, Price and Profit*, a 1865 pamphlet with the draft of an address to the General Council of the First International, in which he pointed out that “price, taken by itself, is nothing but the *monetary expression of value*” and that “looking somewhat closer into the monetary expression of value, or what comes to the same, the conversion of value into price, you will find that it is a process by which you give to the values of all commodities an independent and homogeneous form, or by which you express them as quantities of equal social labour. So far as it is the monetary expression of value, price has been called *natural price* by Adam Smith, *prix nécessaire*

If we denote by C_R the money cost of a unit of real capital, by C_L that of a unit of living labour, by C_K that of a unit of other input services, by C_F that of a unit of financial capital and by r the average rate of return on a unit of invested capital (a measure of the efficiency of investments), MEV can be written as the sum of the real cost for unit of production and the corresponding financial cost of a unit of capital. That is as

$$C_R + C_L + C_K + r(C_R + C_L + C_K) = (C_R + C_L + C_K)(1 + r),$$

or, in vector notations, as:

$$(px - \varepsilon) / L = (px - \varepsilon) / \ell x,$$

where p is a price index expressing the vector of commodities unit prices, $wL [I - (1 + r) A]^{-1}$, x is a quantity or volume index of the social product, px is the value of the social product, ε is the notional capital charge, L is abstract labour-time, ℓ is the vector of labour coefficients.

This expression can be used to obtain a formal solution to Marx's 'transformation problem'. Obviously, MEV is not an invariable standard of value, independent of prices and the distribution of income; but no such absolute measure of value is known. Analysts should therefore necessarily use a proxy.

by the French physiocrats". In many passages of *Capital* (e.g., in the first chapter of volume III) Marx made use of this metric to pass from labour values to money values, or prices of production. MEV is a Marxian concept, 'rediscovered' by neo-Marxist scholars.

In principle, two distinct parameters are available for this purpose: MEV and MELT. The money value of commodities reckoned at their market prices, mentioned by Marx, and the money value of abstract living labour time commanded by commodities at the current wage level, proposed by Foley and supported by other neo-Marxist authors. Which of them should be chosen?

Correctly conceived, MEV is a more general expression of the money value of social labour time, as it accounts for the financial opportunity-cost of invested capital and does not imply the pure labour theory of value. Whereas MELT, the ratio of net value added to the living labour employed in production, does not account for the notional cost of capital. It focuses only on living labour and presupposes the pure labour theory of value.

In MELT the money price of gross output is the sum of the money equivalent of the living labour expended in the period (Marx's variable capital) and of the money equivalent of the dead labour embodied in the stock of produced means of production (Marx's constant capital).

MELT has no explanatory power. It can be determined only *ex post*, that is when the purchasing power of money in terms of the commodities that form the bundle of wage goods is known.

If we divide MEV by the average unit cost of production of commodities, the result is $(1 + r)^t$, where r is the expected rate of social surplus per unit cost of output, or internal rate of return (IRR). This is the discount rate that applied to calculate the net present value of the cash flows of an investment reduces it to zero. It is therefore the break-even interest rate that equates the present money value of an investment cost outflows to the money value of its discounted expected future revenue flows. Hence, it is a measure of the efficiency of invested resources that accounts for all explicit and implicit costs and returns of an investment.²⁴

IRR implies instantaneous reinvestment of all the project's future cash flows at its rate. And it does not consider the cost of capital. It should not be used to compare investment projects of different expected duration.

When the notional financial cost of capital is taken into account, one gets a distinct and better efficiency valuation metric, known in engineering economics as 'modified internal

²⁴ The use of this rate is not free of capital theoretic problems. The value of r cannot be directly obtained by solving an exponential equation (trial and error methods of solution can however be used); a single real number value of r may not exist; and in the presence of an alternation of positive and negative net cash flows, with more than one sign change, multiple complex number values of r can be found. Moreover, r cannot be used to compare mutually exclusive projects. And both endogenous (*ex post*, or observed) and exogenous (*ex ante*, or expected) real rates of return can be computed.

rate of return', with which the yields of an investment result lower than with IRR.²⁵

10. Some theoretical implications of the present approach.

The economic implications for the theory of capital and investment of the choice between the technical and the financial conception of capital and between different accounting methods should be clear.

The financial conception suggests the idea that there is an inverse monotonic relation linking the demand for capital to the rate of interest. The technical conception does not allow to infer the existence of a similar inverse monotonic relation between the 'quantity of capital' and the rate of profit.

Accounting procedures and the methods used to measure the depreciation of fixed assets and to evaluate inventories are relevant for their connection with the financial leverage hypothesis, the proposition that states that the higher is a firm's debt/equity ratio the more likely is the managerial choice of

²⁵ The rate of return on invested capital (ROI) used in accounting practice is different. It is the ratio of the net income of an investment to the book value of capital assets, that is to their original historic purchasing cost less cumulated depreciation. As such, it does not consider the time-value or potential earning capacity of money (the possibility to earn an interest).

accounting methods that shift the earnings reported in official income statements from the future to the present.²⁶

Investment and financing decisions are not independent of each other. But their interaction is not sufficiently recognized in the economic literature. The Modigliani-Miller neoclassical theorem unfortunately is still popular.²⁷

What should be considered in investment policy is the response of investments to changes in the average cost of capital, a weighted index number in which all types of costs of capital should be taken into account. Including what has to be paid to get the financial capital needed by an investment. That is including the interest costs implied by borrowing money in the financial market and the dividend costs implied by issuing equities.

An important implication of the abandonment of the pure labour theory of value for capital theory is that profit should be at least partially rehabilitated. It should no longer be regarded as resulting necessarily and entirely from labour exploitation.

²⁶ Straight-line depreciation and FIFO inventory methods should then be preferred for tax purposes to accelerated depreciation and LIFO methods.

²⁷ The theorem sets the irrelevance of corporate capital structure under unrealistic conditions implying a perfect financial market, no taxes, no transaction or adjustment costs, no difference between the lending and the borrowing rates and no information asymmetries.

Since labour and capital are always jointly used as inputs in production and both of them provide productive services, a part of profit, its 'normal' component, should be considered the price of capital services. That is the reward obtained by the owners of capital for the specific contribution made by capital to production.²⁸ 'Pure' or 'extra' profit, on the contrary, could be seen as resulting from labour exploitation.

Other implications of the present approach to capital theory regard the interactions between entrepreneurs investment and their financing decisions. As we mentioned, the availability of a money fund is a necessary pre-requisite of productive activity. All investment decisions by firms imply a financial cost to be paid for the provision of invested capital.

Professional accountants prefer to look at this financial cost as a minimal required return element, rather than as a cost. To calculate profits, they deduce from revenues only the explicit expenses incurred by firms in their production activity. They thus fail to recognize that the value of a foregone opportunity represents a cost for the investor. This has important practical implications. It entails an inefficient allocation of social resources.

²⁸ Needless to say, on ethical and ideological grounds the legitimacy of private ownership of capital goods can be questioned.

Economists, on the contrary, call profit the difference between total revenue and total cost and distinguish normal profits from quasi-rents. This is correct.

Labour and capital are not perfect substitutes in production. In view of their reciprocal implication, both a pure labour theory of value and a pure capital theory appear inadequate.

We have drafted the outline of a cost-of-production theory of value capable to account for the productive contribution of both labour and capital services. It is a theory consistent with the senior Marx's view of the subject, matured after the epistemological break in the intellectual perspective of his theoretical search described by Althusser.

Textual evidence in Marx's writings of this change of perspective has been offered. In our opinion, there are sufficient indications that in an advanced phase of his life Marx dismissed the pure labour theory of value, which he had previously endorsed, and substituted it with a more general cost-of-production theory of value, suited to recognize the direct contributions made by both labour and capital to social output.

Marx explained very clearly why he thought that this important change of theoretical perspective was required at his times. Such change is all the more necessary today, in our technologically advanced and largely automated post-industrial capitalist society, dominated by the artificial intelligence of

‘cognitive capitalism’, in which an immaterial productive factor, knowledge, performs a fundamental role in the organization of production.

The transformation of the fundamental relation between living labour to dead labour was exactly perceived by Marx. The idea of the driving role of cognitive capital is close to Marx’s conception of the ‘general intellect’, the intellectual power that makes the determination of social relations, including capital, largely independent of material ones. Its recognition marks a significant turning point in the history of the of the division of labour over time.

Marx had a vivid perception of the great expansion potentiality of the productive forces of capitalism and of its attitude to exalt the human capacity to transform the world and to get a progressive emancipation from the dictates of the laws of nature.

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Abstract: *On the theory of capital in post-industrial societies.*

This is an analysis of the present unsatisfactory state of the theory of capital and a proposal to reformulate this theory in line with some neglected late-Marxian views on the subject and in the light of the passage of capitalism from the industrial to a post-industrial era characterized by the dominance of speculative finance. The author's aim is to provide a better integration of the theory of capital with those of money and finance. Attention is focused on a Marxian price index, the monetary expression of labour value, MEV, which accounts for both explicit and implicit cost components and, differently from MELT, does not consider only the money value of living labour time.

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Keywords: value; capital theory; post-industrialism; critical
Marxism; MEV.