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**STRUCTURAL INTERDEPENDENCE IN MONETARY ECONOMICS:  
THEORETICAL ASSESSMENT AND POLICY IMPLICATIONS.**

**1. Introduction.**

Acknowledgment of the existence of structural interconnections in a sufficiently developed country is not a novelty in the literature of economics. It has been present since its very beginning, in Quesnay's *Tableau Économique* and Petty's and Cantillon's descriptions of production and consumption as a circular flow. Significant evidence of structural interdependence is provided by Walras's general equilibrium model, by Marx's reproduction schemes and by his circuit of capital, by Keynes's dismissal of the 'classical' assumption of a dichotomic economic system, by Leontief's inter-industry input-output analysis, and by other analytical approaches (von Neumann and Morgenstern strategic game theory, Copeland's flow-of-funds tables, Koopmans's activity analysis of production and allocation).

Relevant contributions to the literature on structural interdependence in economics have been made by Tobin, Davidson, Meade and Stone, Godley and Cripps, Lavoie, Lance Taylor and others, with reference to specific institutional frameworks. In the last decades this branch of research has attracted increasing attention. Sectoral flows of funds connecting balance sheets have been analyzed. Some controversial issues, however, regarding the integration of money and finance in the theory of value and the structural relations between stock and flow variables, are still partially unsettled.

The present essay is concerned with these problems. It has an introductory character and pursues a personal need of conceptual clarification. This is done in an original critical Marxian

perspective – an updated ‘late Marxian’ one, where the roles of both living and past labour embodied in the material means of production are emphasised.

A concise critical examination of some analytical approaches to the subject is initially proposed to clear up the ground of some current misrepresentations. In this deconstructive part of the essay the alleged existence of two separate levels of analysis will be questioned and post-Keynesian approaches will be distinguished from pseudo-Keynesian reductionist and counterintuitive treatments of the subject. In the second part of the essay some suggestions for a reformulation of the analysis of structural interdependence will be advanced. A disaggregated theoretical model of classical reminiscence, in which money provides a formal mediation between values and prices, will be proposed. It will be argued that the existence of structural interdependence in economics was correctly recognized by classical economists, with the notable exception of Ricardo, and that so did Marx.

Technical issues concerning some quantitative and qualitative features of the value relation and the measurement of the value of heterogeneous capital will then be discussed. A few conclusions will finally be drawn. It will be argued that the theory of capital, which is part of the wider theory of value, should be substantially reformulated in the integrated framework of a more comprehensive theory of value, capital and money, centred on the acknowledgment of the productive roles of both labour and capital.

## **2. The present state of the theory of value and capital.**

A theory of value should answer three fundamental questions: the search for the substance, the source and the measure of value. For Adam Smith labour was the central analytical concept. The substance of value was human labour, the source of value was the productive power of labour and the real measure of value was the ‘toil and trouble’ implied by the productive effort of labour. Smith held three labour theories of value: a substantive one, the ‘labour-embodied’ theory, for pre-capitalist societies; a different one, the ‘labour-commanded’ theory, where labour was a *numéraire*,

not a determinant of value, for capitalist societies; and an ‘adding-up’ theory of price, where wages, profits and rents entered as independently determined components, so that prices could deviate from labour values.

This ambiguous vision was a potential source of confusion, that did not pass unnoticed to Ricardo. He criticized Smith’s treatment of the subject, but retained his labour-embodied theory as a first approximation to reality, arguing that value was ultimately determined by the quantity of labour needed to produce a commodity and by the rate of profit reckoned for the time capital remained dormant. Value was thus affected by the social distribution of income, and this posed a problem of circular reasoning, because commodities prices could not be determined independently of the distribution of income, which in turn could not be determined independently of prices. What was needed was an invariable measure of value, but Ricardo’s search for it was unsuccessful. Equally unfortunate was, later on, Sraffa’s attempt to solve the problem by means of an imaginary ‘standard commodity’ whose value was invariable to changes in the distribution of income, though not to changes in the technique of production.

Two contrasting interpretations have been given of Ricardo’s theoretical system: the ‘neo-Ricardian’ interpretation<sup>1</sup>, implying a sequential determination of commodities quantities, prices and the distribution of income; and the ‘new view’ of the Ricardian system, where quantities, prices and the distribution of income were interdependently and simultaneously determined by the familiar market mechanism of supply and demand.

In the alleged ‘neo-Ricardian’ interpretation provided by Pierangelo Garegnani, Sraffa’s disciple and literary executor, the classical surplus approach was partitioned in two distinct logical

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<sup>1</sup> Originally advanced by Dmitriev, Bortkiewicz and other exponents of the Russian-German school of mathematical economics active at the beginning of the twentieth century, the ‘neo-Ricardian’ interpretation was ‘re-discovered’ half a century later by Sraffa. Serious doubts can however be casted on the Ricardian character of Sraffa’s theoretical system, in which the choice of labour as measuring rod of value was rejected and which had a static character, whereas Ricardo’s system was dynamic. Besides, in Ricardo’s system production prices equilibrate supply and demand, differently from Sraffa’s long-period normal prices.

stages, as production was divided from distribution and distribution from valuation.<sup>2</sup> According to Garegnani, who set himself the ambitious objective to reconcile several authors in a great theoretical synthesis, for which he thought Sraffa had posed the basic premises, there is a strong connection between the theoretical systems of Sraffa, Ricardo, Marx, Keynes and Kalecki. In this theoretical framework, the Sraffian system was assigned the task to determine commodities long-run relative prices and the Keynesian system that of determining output quantities and the level of employment. The achievement of this task was however problematic, since the Keynesian framework referred to the short-period and the Sraffian one to a long-period tendential position implying a uniform rate of profit. There would thus be two competing paradigms for the short and the long-period, difficult to be consistently combined in a theoretical synthesis. Moreover, Ricardo's labour theory of value was considered by Sraffa indefensible for its logical inconsistencies and unnecessary as a theory of price. And Sraffa's analytical separation of value, production and distribution was clearly contrasting with Keynes's idea that the classical dichotomy between real and monetary variables was a misconception.<sup>3</sup>

### **3. On a popular post-Keynesian theoretical approach and two pseudo-Keynesian variants.**

Odd vogues entailing rediscoveries of past theories are frequent in economics. The classical surplus approach to the theory of value and the Austrian capital theory are typical cases in point.

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<sup>2</sup> Garegnani's intention was to defend Sraffa from the charge of advocating a special case of general equilibrium theory, exclusively centred on the supply side ("only half of an equilibrium system", in Joan Robinson words, 1961)<sup>2</sup>, where output quantities, the technical conditions and the structure of production were not affected by the way in which income was spent. The idea that the leading classical economists and Marx denied the integrated nature of the economic system was introduced by Garegnani (1984) to support the thesis of the existence of close Ricardian and Marxian connections with Sraffa's theoretical system. This idea had been originally advanced by Ricardo in his early *Essay on Profits* (1815), in the analytical framework of a corn model, where the rate of profit could be determined as a physical ratio, but had been later abandoned by Ricardo in the third edition of his *Principles* (1821), and is not present in Marx. See Cavalieri, 2009.

<sup>3</sup> It was an invalid division, as was later shown by Patinkin. In the presence of nominal rigidities, as wage and price stickiness, the dichotomy does not hold.

‘Stock-flow consistent approach’ (SFCA) and ‘modern monetary theory’ (MMT) provide further examples of the tendency of some economic ideas to reappear somewhat weakened in a context of relative intellectual inertia.

SFCA is a known structural approach based on sectoral financial balances. Described by its proponents as an innovative, rigorous and powerful post-Keynesian heterodox methodology implying a complex accounting framework based on financial balance sheets<sup>4</sup>, it correctly acknowledges the existence of interconnections among economic variables. This feature, however, is not a novelty. The basic propositions of SFCA are indeed familiar truisms implying that everything comes from somewhere and goes somewhere else, that flow variables cumulate over time into stock variables, that every transaction must have a corresponding counterpart, since someone’s inflow is someone else’s outflow, that sectoral inflows and outflows sum up to zero and that a sector debts are another sector assets. These are not novelties.

The basic structure of SFCA models consists of a set of simultaneous difference or differential equations which define the portfolio and spending decisions, agents behaviours and the dynamic adjustment mechanisms. After its formulation, the parameters of the model are estimated and calibrated and the system is closed and solved. A possible convergence to steady state equilibrium is identified. The model can then be subjected to simulated shocks and parameters modifications.

Accounting consistency, logical coherence and formal rigour are desirable qualities. But, in my opinion, they are not *in se* sufficient to endorse a theoretical approach. SFCA is entirely centred on the demand-side of the economy. It does not consider the existence of supply-side capacity

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<sup>4</sup> See Godley and Lavoie, 2007, preface p. xxxiv, pp. 16-18 and 21-22. Also Fontana, 2000, and Hodgson, 2001. The SFCA group is strictly connected with the Levy Economics Institute of Bard College, N.Y., an influential international research centre and policy think-tank (financially supported by the speculative activity of Warren Mosler, one of the founders of MMT). SFCA modelling has been criticized by Thomas Palley (2013), a radical structural Keynesian, for being far from true Keynesism and post-Keynesism. It has been charged of representing a naïve reinvention of the wheel.

constraints. Moreover, being largely based on the United Nations standard system of national accounts, SFCA shares merits and drawbacks of such system, where the social surplus is considered the heterogeneous sum of profits net of depreciation and wages inclusive of workers subsistence goods, with the result that profits are underrated and wages overvalued.

‘Modern Monetary Theory’ (MMT), or neo-Chartalism, also known as ‘Mosler economics’, is a school of thought ideologically less characterized than SFCA. It describes how a sovereign country with fiat money and floating exchange rates works and brings fiat money and government financial activity at the centre of circuit approach. Its basic assumption is that the quantity of money in circulation is not subject to budget constraint, unless the economy has achieved full employment. It is argued that monetary policy is scarcely effective and that the government must first spend and then raise taxes.

According to MMT, deficit spending by the Treasury can be run indefinitely, for unlimited amounts, quite independently of the size of the budget debt. The government is conceived as a self-funding institution, a job guarantee and an employer of last resort, that can provide full employment without inflation, high wages and pensions and medical care for everybody. Its main proposition is that in a sovereign country public debt adds to private wealth.<sup>5</sup> Fiscal austerity should be avoided. Bank loans could be created out of nothing and their repayment would pose no problem to the closure of the circuit. This is illogical. Finance must always come from somewhere. Inside money cannot come out from nothing. As monetary circuitism, MMT is a pseudo-Keynesian approach to monetary theory and policy. It assumes that money is the *primum movens* in the production of commodities, that loans create deposits and reserves and that banks are not credit intermediaries and need no money to make loans. The economy could never be constrained by narrow finance. I can accept the idea that loans make deposits, though not the obtrusive corollary that no initial finance is needed.

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<sup>5</sup> This idea is a dangerous illusion. Pure financial limits to deficit spending by a government may not exist, and should not be legally imposed, but real capacity constraints always limit the expansion of deficit spending.

Let me now consider the monetary circuit theories of production and circulation, where the supply of money is strictly endogenous. It is assumed that in a sequential scheme bank loans create deposits and firms use such loans to start their production activity. The expenditure by households of the wage bill, however, returns to firms an amount of money which is at most sufficient to provide them with the liquidity needed to repay the principal of the debt, though not also to pay interests on it and close the circuit. This is the obtrusive ‘profit paradox’ of monetary circuit theories, a logical impediment systematically neglected by monetary circuitists.<sup>6</sup>

The sequence of events fancifully hypothesised by some circuitists (Zezza, 2004, 2012, and Dos Santos and Zezza, 2007) is of surprising ingenuousness. It is assumed: 1) that the amount of loans initially made by banks to firms covers interests payments as well as wages; 2) that the money borrowed by firms, minus the part destined to cover future interest payments, is entirely used to pay production costs; 3) that when production is completed and products are sold in the market, firms will get as sale receipts the whole amount of money they have spent to pay wages and other costs (they will make no profits); 4) that with these receipts firms will then return the money previously obtained by banks and that they will pay the interests accrued with the money previously set aside; 5) that banks will use these interest receipts to cover current costs and to purchase goods and equities issued by firms (this is irrelevant for the closure of the circuit, but concerns its reopening). Now, assumptions 2) and 4) do not need an explanation. They are quite obvious. The relevant assumptions are 1) and 3). Assumption 1) is counterintuitive and theoretically unjustifiable; it is pure science fiction. Assumption 3) is the really crucial one and is utterly arbitrary.

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<sup>6</sup> To overcome the ‘profit paradox’, a pupil of Graziani has proposed that the initial loans should cover not only the wage bill but also interests (Zezza, 2012, p. 159). Other pupils of Graziani have ignored in their accounts of the debate on the circuit approach the present writer’s numerous critical contributions to the subject, made from a non-neoclassic structuralist perspective (Cavaliere, 1994, 2004, 2009, 2013). See Realfonzo, 2003, 2006, Fontana and Realfonzo, 2005, Forges Davanzati and Realfonzo, 2005. Only recently the relevance of the profit paradox has been acknowledged by some circuitists (see Forges Davanzati and Patalano, 2014).

Attempts to solve the profit paradox in circuit theories have been made also in other directions. It was suggested to refer not to a single-period monetary circuit, but to a set of overlapping monetary circuits, implying lagged reimbursements of bank loans in the long period, in an analytical framework of a multi-period analysis (Parguez, Rochon) in which only a share of outstanding loans would be retired in each period. As an alternative, it has also been suggested, by Rochon, to introduce a different *ad hoc* assumption: that the availability of additional sources of liquidity would be provided exogenously, by the State, through continuous fiscal deficits, or by the rest of the world.

It was also proposed to allow workers to get bank loans, and thus become net borrowers, rather than net lenders; or to assume that some firms go bankrupt, and do not reimburse their debts, while other firms make profits; or to include firms profits into the wage bill; or to look at firms' unsold commodities as an investment in inventories (contrary to what is done in national accounting). In my opinion, none of these *ad hoc* suggested proposals is really practicable. The circuit approach is a simplistic theoretical construction devoid of solid analytical bases.

#### **4. Income and money circuits and their roles in structural models.**

An important feature which needs to be cleared is the relationship between the circuit of income and that of money. Circuitists have a wrong conception of this relation. The circuit of money is The circuit of money is an integrant part of the circuit of income. The circuit of money is an integrant part of the circuit of income. It is an ideologically neutral theoretical concept that can be applied to any economic system. It reminds me a two-lanes road loop, with different directions of traffic. Along one of these lanes runs the flow of goods and services, from sellers to buyers; in the other one the corresponding flow of money paid by buyers to sellers runs in the opposite direction.

This was the prevailing state of theory when some Keynesian authors called the attention n the real balance effect, arguing that it could not be hypothesised in an economy with pure inside

money and that it would have lost large part of its theoretical relevance in a mixed inside and outside money system, where the neutrality of money was not granted. There was therefore the need to abandon the traditional classical and neoclassical dichotomic conception of the economic system.

Although so retrenched, the real balance effect was seemingly capable to eliminate the alleged dichotomy between the explanation of the absolute price level and that of the relative prices of commodities. The critique addressed by Patinkin to Keynes for having ignored the real balance effect thus could not be neglected. Later on this induced some authors to maintain that Keynes was considering a purely inside money system, where the real balance effect could not arise. In Keynes's theoretical system, on the contrary, there were both inside and outside money, which produced wealth effects similar to the real balance effect. In an inconvertible money system unpegged from something having a real value, there is clearly no reason to conceive a durable formation of liquid balances.

Money circuitists are inclined to underrate the real balance effect. The model of an economy that they have in mind is that of a pure credit system, which does not allow the existence of liquid balances. It is a model that implies Say's law, rejected by Marx and Keynes.

The use of economic theory and statistical methods for structural modelling will now be shortly considered, without entering into a specified description of the models. In stochastic econometric models the observable endogenous variables are structurally connected, by equality or inequality relations, to explanatory variables. Such models can be used to test the predictive power of competing economic theories.

In post-Keynesian theories two basic types of models of income determination have been proposed. One of them is the 'neoclassical synthesis' IS/LM model, originally advanced and later abandoned by Hicks. It provides a sort of compromise between pre-Keynesian and Keynesian theories. The other one is AD/AS model, of classical, rather than neo-Keynesian type.

As concerns Keynes's own opinions, he was critical of neoclassical theory, that he improperly termed 'classical'. He refused Say's Law of markets and the dichotomy of real and monetary

variables and underlined the role of the liquidity preference function and of the speculative demand for money, inversely related to the rate of interest, that he considered exclusively determined by monetary variables.

The Hicksian IS/LM model is a static one which focuses on the demand side of the economy. It makes use of two independent and differently-sloped curves traced in the interest-rate-output space ( $i, Y$ ): the downward sloped IS curve, whose shifts express changes in fiscal policy, and the LM curve, whose shifts reflect changes in monetary policy. These two curves, representing short-run equilibrium in the goods and money markets under 'fix-price' and unemployment Keynesian conditions, intersect each other, determining the equilibrium point of the static system. The addition to the model of a Phillips-curve ensures price adjustments and opens the way, through the natural rate of unemployment properties of such curve, to a long-run self-stabilization of the system. The purpose of this model is to represent Keynes's *General Theory* as a particular case of the traditional neoclassical paradigm – the case of fixed prices, liquidity trap, monetary illusion and aggregate supply which adapts to changes in aggregate demand.

The other standard macroeconomic model is the 'aggregate demand-aggregate supply' (AD/AS) one, a post-Keynesian model of classical reminiscence, where a decreasing short-run aggregate demand curve for goods and services, relating the price level and the demand for output, and an upward-sloping and nearly vertical long-run supply curve, relating the price level and output produced, are traced in the price-output space. The two curves intersect each other, determining the equilibrium price and output levels under 'flex-price' conditions. With a Phillips-curve, they allow to interpret the Keynesian macroeconomic theory in disequilibrium terms.

These two models are ultimately pretty similar.<sup>7</sup> Properly integrated, they provide a new-Keynesian model suited to describe an economy with a limited degree of price flexibility, in which the economic system is non-dichotomic and money is non-neutral.

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<sup>7</sup> In recent times the Keynesian equality of aggregate income and effective demand has been questioned by Steve Keen's reassertion of an old claim by which effective demand would be equal to income plus the change in debt,

## 5. Marx's remarks on the subject.

The publication of Marx's notes written in preparation of volumes II and III of *Capital* have renewed the attempts to 're-read' Marx in a non-deterministic and non-economistic perspective. This is in compliance with the idea that the 'mature' Marx gradually revised his approach to the theory of value, treating the subject by successive logical approximations. In *Capital*, vol. I, he had started by considering production of commodities in general and had provisionally assumed equality of prices and values. But then he realized that in modern capitalist societies commodities did not exchange at their values. They exchanged at market prices which could diverge systematically from values. This may explain why he did not finish *Capital* and in his late years he planned to write a revised version of volume I.<sup>8</sup>

As a value-theorist the young Marx was not a Ricardian.<sup>9</sup> He became more Ricardian later on. But he reasoned at a higher level of abstraction, he did not consider modern capitalism the natural and definitive form of organization of society and was fairly critical of Ricardo's failure to distinguish labour from labour-power and of his inability to explain the source of surplus value and profit.

There is some textual evidence of this evolution of Marx's thought towards a more general theory of value, based on the productive contributions of both labour and capital. In a famous passage of *Grundrisse* (1857-58), the incomplete 'Fragment on Machines', Marx recognized that the worker productive skill had passed over to the machine.<sup>10</sup> But he did not abandon entirely the

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multiplied by the velocity of circulation of money. Keen's argument that a growing debt creates additional demand and that this is logically consistent with SFCA, have been opposed by Krugman and Bernanke.

<sup>8</sup> Marx, however, did not formulate a full-fledged labour-and-capital theory of value, that is a total factor productivity theory, as he probably thought that by recognizing a direct productive role of capital, whose availability involves a cost (for postponement of consumption, or for rental payment), a legitimacy of profits could be deduced.

<sup>9</sup> On this point, see Rosdolsky (1968) and Mandel (1971).

<sup>10</sup> In the following passage Marx questioned the pure labor theory of value: "... once adopted into the production process of capital, the means of labour passes through different metamorphoses, whose culmination is the machine, or

labour theory of value; he retained it at a macroeconomic level, arguing that total prices equalled total values and total surplus equalled total profit.<sup>11</sup>

Textual evidence suggests that in his mature age Marx revised his previous formulation of the labour theory of value, abandoning the idea that only productive living labour can transfer value directly to the product, whereas capital can only do this at the limited rate of its depreciation, and began to regard surplus-value as a direct expression of both living labour and past labour and to consider capital the dominating productive factor.<sup>12</sup>

Later on, in the *Theories of Surplus-Value* (1861-63), Marx recalled Ricardo's opinion that in addition to living labour the composition and the duration of capital were relevant to determine commodities prices, and in the 1864 draft of the missing chapter six of the first volume of *Capital*, entitled *Results of the Immediate Process of Production*, he affirmed that commodities were "the direct product of capital". In *Value, Price and Profit* (1865), he said that "in calculating the exchangeable value of a commodity we must add to the quantity of labour *previously* worked up in the raw material of the commodity, and the labour bestowed on the implements, tools, machinery, and buildings, with which such labour is assisted". The reference to the 'labour bestowed' indicates the quantity of social labour embodied in capital goods used up in production is regarded as transferred to the product. And in the first volume of *Capital*, chapter 23, Marx confirmed that in modern industry the worker had become a mere appendage of machinery. A complete inversion of the relation between living labour and dead labour embodied in fixed capital had taken place, marking the passage from the formal subsumption to a real subsumption of labour under capital. It

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*rather, an automatic system of machinery... 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"* (Marx, *Grundrisse*, notebook VI, par. 585-86).

<sup>11</sup> This is, however, a double identity which cannot in general hold at one and the same time, once Bortkiewicz's correct system of transformation of values into prices is applied..

<sup>12</sup> Significant evidence in this direction can be found in two of his works of the late 1850s: the *Urtext* (1858) fragment, where capital was described as value in process, and *A Contribution to the Critique of Political Economy* (1859), usually called '*the Critique*', where Marx introduced the concept of abstract labour and denied that labour could be considered the only source of wealth.

was a radical ontological change of perspective. Capital had become the subject and labour the object.<sup>13</sup>

Then, in the second volume of *Capital*, the process of reproduction and circulation of capital was analyzed by Marx through the distinct circuits of money-capital, commodity-capital and productive-capital. In the overall continuity of this metamorphosis, capital emerged as unity of production (its source) and exchange. And in *Capital*, volume III, Marx's examined the process of capitalist production, focusing on the movements of capital as a whole and on the effects of competition among capitalists. But he did not perform this task correctly. He did not transform correctly inputs prices into output prices and regarded the rate of profit as determine independently of prices. The direction of causality, for Marx, was univocally determined: it went from values, originated in the sphere of production, to market prices. Deviations of single prices from values were admitted, but they cancelled out at an aggregate level.<sup>14</sup>

## **6. Measuring and mapping problems. A formal model.**

Marx knew that measuring the value of a capital stock is a difficult task. To add together heterogeneous capital goods, they must be expressed in the same units, which is practically impossible for the enormous variety of types of capital goods. Moreover, the value of capital is a mixed stock-and-flow concept, which results from the combination of two differently time-dimensioned magnitudes: the value of a benchmark stock of specific homogeneous capital goods, taken at a given initial point of time, and the investment flow over time, both reckoned in constant money. But it impossible to convert capital stocks into flow equivalents on the basis of the degree of capacity utilization, which is not known. An alternative method had thus to be found.

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<sup>13</sup> "It is not the worker who buys the means of production and subsistence, but the means of production that buy the worker to incorporate him into the means of production" (*Capital*, I, p. 1004).

<sup>14</sup> The transfer of value from Marx's constant capital to final output, in the presence of technical changes, which would unpredictably affect the depreciation of capital goods, was also left undetermined.

In principle, this could be done in a number of ways: (i) by cumulating gross formation of fixed capital over time in constant prices and deducting depreciation and retirements, that is as the updated historical sum of costs of past investment flows, reckoned at constant prices, plus cumulated interests, minus depreciation and retirements, using an age-pricing profile depicting assets loss in productive efficiency (a ‘backward-looking’ method, that of perpetual inventory estimates, the basic method in national accounting); (ii) at the present replacement cost of the existing capital goods, at market prices, taking account of their state of efficiency (an ‘entry value’ method commonly used in insurance practice); (iii) at the selling price, or ‘exit value’, of capital goods, when a market for second-hand capital goods exists; (iv) by the expected capacity of capital goods to produce a future discounted flow of services (a ‘forward-looking’ perspective); (v) by the average length of the production process (a ‘roundabout’ Austrian method); (vi) by relying on suitable index number techniques.

The choice between these methods depends on the specific purposes an analyst is pursuing, that is on an income-wealth, a productivity or a cost perspective. Marx chose the backward-looking method of historical cost. I shall depart from Marx and consider the last method, which implies the use of price and quantity indexes to compute changes in values of capital goods or services as appropriate weighted averages.

Money provides a formal mediation between values and prices. This is shown using matrix algebra. The unit cost of labour-power in terms of money is the ratio of total labour cost to the value of real output, expressed in terms of money. The unit cost of capital is its market rental price. It should include the opportunity cost of financial capital and a premium for a risk factor.<sup>15</sup>

Let me call real capital at time  $t$  the money value of capital goods divided by the real wage, and measure it by the depreciated value of capital at the previous time  $t - 1$ , augmented by the new

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<sup>15</sup> The choice of the index number to be used in the aggregation of heterogeneous capital assets and of the relevant weights are specific technical problems which will not be considered here. Reference can be made to the OECD 2001 manual on *Measuring Productivity*.

investment,  $K_t = (1 - \delta) K_{t-1} + I_t$ , where  $I_t$  is investment and  $\delta$  the depreciation rate. I shall make use of a simple model of production with homogeneous labour, fixed and circulating capital and a technology of the activity analysis type with a finite number of activities. A matrix system of equations  $\mathbf{y} = (\mathbf{I} - \mathbf{A})\mathbf{x}$ , where  $\mathbf{y}$  is the net product vector denoting the activity levels,  $\mathbf{x}$  is its quantity or volume size index and  $\mathbf{I}$  is the identity matrix, will be used to describe the technological structure of the model and the commodity composition of the net product  $\mathbf{y}$  required to satisfy at a certain moment a given final demand.

Let  $\mathbf{A}$  be a Leontief input-output matrix of technical coefficients of single product industries and  $\mathbf{A}\mathbf{x}$  be the circulating capital. Each row of  $\mathbf{A}$  shows how the total product of an industry is allocated among other industries and each column how inputs are used by each industry. If the system is viable, the inverse of  $(\mathbf{I} - \mathbf{A})$  can be written as a convergent geometric series with an infinite number of terms,  $(\mathbf{I} + \mathbf{A}_1 + \mathbf{A}_2 + \mathbf{A}_3 + \dots + \mathbf{A}_n)$ , where  $\mathbf{A}_n$  tends to zero as  $n$  moves to infinity, an expression which describes the vertically integrated temporal structure of production.  $(\mathbf{I} - \mathbf{A})^{-1}$  can then be used to calculate the production of commodities required to satisfy any possible composition of households' final demand. That is to open the model. This can be done by deleting the last equation of the system and by adding to each of the remaining equations a constant on the right side.

The vector of production prices of commodities, reckoned in money terms, can then be written in the presence of production with a surplus as a sum of profits and wages,  $\mathbf{p} = \mathbf{p}\mathbf{A}(1 + r) + \mathbf{a}_n w$ , where  $r$  is the equilibrium rate of profit, equal to the rate of interest on money capital,  $\mathbf{a}_n$  is the row vector of the labour inputs and  $w$  is the real wage rate. Profit is distributed in proportion to the capital advanced in each industry, with a uniform rate of profit, competitively determined<sup>16</sup>.

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<sup>16</sup> Since the proportion cannot be determined without knowing the prices of commodities, which are not known if the rate of profit, that is not independently determined, is not known, the distribution of the social surplus of the system at a given point of time must take place simultaneously with the determination of the prices of commodities and the value of capital.

The system of  $n$  price equations, with  $n + 2$  unknowns ( $n$  prices,  $r$  and  $w$ ) can be closed by taking a commodity price as *numéraire* and adding a further equation providing an exogenous value for  $r$  or  $w$ . The general solution is given by the price vector  $\mathbf{p}$  in the matrix equation  $\mathbf{p} = \mathbf{a}_n w [\mathbf{I} - (1 + r) \mathbf{A}]^{-1}$ , which shows that commodities prices depend on the quantities of labour embodied in the commodities produced, on the technical conditions of production that determine the amount of the surplus and on the social distribution of income between wages and profits. The total value of the commodities produced, expressed in terms of purchasing power (labour commanded) at the prices  $\mathbf{p}$  that originate when the real wage is taken as *numéraire*, is the sum of wages and profits. In the limit case in which  $w = 1$  and  $r = 0$ , the labour theory of value holds in pure form and values and prices coincide.

The matrix within the square brackets can be expanded in an infinite Taylor series of convergent powers, in terms of the dated quantities of direct and indirect labour embodied in the various stages of production, vertically integrated. This allows to reduce commodities prices to dated labour quantities, properly weighted. To ensure convergence of the Taylor series,  $(1+r)^t$  must be less than the inverse of the eigenvalue and associated eigenvector with greatest modulus of the diagonalizable matrix  $\mathbf{A}$ . This condition is satisfied for any value of  $r$  lower than the greatest theoretical one, which corresponds to a subsistence wage. The solution can then be re-written in the form of a matrix equation of ‘reduction to dated quantities of labour’, homogeneous in production prices:

$$\mathbf{p} = \mathbf{a}_n w + (1 + r) \mathbf{a}_n \mathbf{A} w + (1 + r)^2 \mathbf{a}_n \mathbf{A}^2 w + (1 + r)^3 \mathbf{a}_n \mathbf{A}^3 w + \dots$$

If this equation is satisfied by a particular price vector, any positive multiple of the vector satisfies it. The meaning of the equation is clear. Labour values are relevant to explain commodities prices, but they are not the only relevant element (unless in the unrealistic limit case of  $r = 0$  and  $w = 1$ ).

The price implications of this matrix system can be evidenced if one makes the assumption of constant returns to scale. In this case, prices must equal average production costs. To get the vector  $\mathbf{p}$  of commodities prices, one should add to the quantities of labour employed in the various stages

of production the profits accrued in the course of time from the moment labour is employed to the moment output is sold. Denoting by  $\lambda$  the vector of labour-values, i.e. of the embodied labour coefficients, we have  $\mathbf{p} = \lambda [\mathbf{I} - r\mathbf{A} (\mathbf{I} - \mathbf{A})^{-1}]^{-1}$ . This expression allows to transform the vector of commodity labour-values  $\lambda$  into the corresponding price vector  $\mathbf{p}$ . The matrix which determines the price solution is the transpose of the matrix  $\mathbf{A}$  of the quantity solution.  $(\mathbf{I} - \mathbf{A})^{-1}$  is the Leontief inverse matrix of total requirements. The transformation of labour-values into prices of production is formally solved. The proportionality factor is  $\lambda$ , the vector of vertically integrated labour-values, money plays a fundamental role and the same does total labour-time, the sum of living and dead labour.

This model allows to consider flows of circulating capital as well as exogenously given stocks of fixed capital of different nature, vintage, age and state of efficiency, treated as joint products (abstracting from some complexities involved in the problem). All elements in the analytical scheme are ultimately reduced to flows. This closed model, which focuses on the production side of the economy, but can be opened by proper introduction of a demand side determining the level of activity, with the assumption of a given technology or of a given value added. This can be done in various ways.<sup>17</sup>

If we denote final demand by  $\mathbf{d} = (\mathbf{I} - \mathbf{C})\mathbf{p}$ , where  $\mathbf{C}$  is the consumption matrix and  $\mathbf{p}$  a column-vector, the equilibrium condition between supply and demand requires equality of  $(\mathbf{I} - \mathbf{A})\mathbf{x}$  and  $(\mathbf{I} - \mathbf{C})\mathbf{p}$ . Then if  $(\mathbf{I} - \mathbf{C})$  is invertible and the inverse is nonnegative,  $\mathbf{p} = (\mathbf{I} - \mathbf{C})^{-1}\mathbf{d}$ . This means that the economy's output  $\mathbf{x}$  can be profitably sold in the market at the price vector  $\mathbf{p}$ .

## 7. Back to Marx. Towards a reformulation of the theory of capital.

To determine the amount of labour-time represented by a unit of money, Marx relied on a particular proportionality factor, the “monetary expression of value” (MEV), that is the money

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<sup>17</sup> For instance, using a method of allocation suggested by Avijit Ghosh in his supply-driven input-output model. See Ghosh, 1958).

equivalent of a unit of abstract labour-time at a given point of time.<sup>18</sup> In vector notation, we can express it by:

$$\text{MEV} = (px - m)/L = (px - m)/\lambda x,$$

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 money value of the social product,  $m$  is the money value of the material and operating cost of production, augmented by the financial cost of capital,  $L$  is abstract labour-time and  $\lambda$  is the vector of labour coefficients. By dividing MEV by the average unit cost of production of commodities – which is the sum of the money cost of a unit of real capital, the money cost of a unit of direct labour, the money cost of the all other input services and the money cost of a unit of financial capital – one gets  $(1 + r)^t$ , a coefficient which includes  $r$ , the internal social rate of return.

MEV is a value form which reflects the true essence of value, a measure of the labour value of money. It is the money cost of production of a unit of real capital, augmented by the financial cost of such unit; that is the ratio between the price and value of the net product of the economy, a ratio which has the dimension of units of money per units of time.<sup>19</sup>

The mapping problem is then solved. To get the labour-value of a money unit, it is sufficient to multiply the money unit by MEV. Correspondingly, by dividing a commodity price by MEV, one gets an approximate measure of the total resources factor productivity, reckoned in terms of the

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<sup>18</sup> ‘Monetary expression of value’ is the locution used by Marx in *Value, Price and Profit* (1865), where he pointed out that “price, taken by itself, is nothing but the *monetary expression of value*” and that “looking somewhat into the *monetary expression of value* ... you will find that it is a process by which you give to the *values* of all commodities an *independent and homogeneous form*”.

<sup>19</sup> In the literature there are two versions of this index: the ‘simultaneist’ (or atemporal) version known as the NI-MELT, which is the ratio of the value of net product of the economy to the living labour employed in the production of the gross product, and the ‘temporalist’ (or successivist) version, the TSSI-MELT, that is the amount of money value of the net product which exchanges at current prices with a unit of living labour-time (i.e. the ratio of a unit of money to the amount of living labour-time that the unit commands), an amount which is suitable to change during the production process.

commodity. And by dividing total commodities prices by MEV, one can get a proxy of total factor productivity.

MEV should not be confused with a different metric, the ‘monetary expression of labour time’ (MELT), that is the money value of the abstract living labour time commanded by commodities. This is a distinct ratio, commonly used in the ‘New Interpretation’ (NI) of Marx’s theoretical system and in its two main variants, the *Simultaneous Single System Interpretation* (SSSI), an equilibrium view of the working of an economic system, and the *Temporal Single System Interpretation* (TSSI), a disequilibrium view, both of which are based on Marx’s dogmatic ‘net value equality’ assumption, theoretically unjustified, between the labour value of the net product of the economy and the total amount of living labour used in the production of gross output.

MELT provides an inferior proxy of the money value of labour-time.<sup>20</sup> It is the product of the quantity of money in circulation times the velocity of circulation, divided by the value of money. It is thus the product of two ratios, the ratio of value added to an index of the quantity of use values produced and that of such index to the labour time expended. It expresses the reciprocal of the value commanded by a unit of money,  $(px - m')/\lambda'x$ , where  $m'$  is the money cost of production net of the financial cost of capital,  $\lambda'$  is the vector of living labour coefficients. It can be decomposed into the product of MEV and VELT, the value expression of labour-time, a parameter which measures the reduction of an hour of concrete labour-time to the corresponding unit of abstract labour-time.

Differently from MEV, MELT does not include the implicit financial cost of capital.<sup>21</sup> It privileges direct over indirect labour, that is living labour time over the past labour embodied in

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<sup>20</sup> MELT can be decomposed into MEV and the value expression of living labour-time (VELT), which measures the amount of abstract labour that corresponds at the aggregate level to a unit of concrete living labour-time and depends on the quantity of labour and the labour productivity. See Rieu, 2006.

<sup>21</sup> Unlike MEV, which is the sum of the real unit cost of production and the unit financial cost of capital, which is a notional cost. See Cavalieri, 2013.

capital goods. Its denominator is concrete working time, not socially necessary abstract labour. MELT is therefore, from an analytical point of view, a less satisfactory metric than MEV.<sup>22</sup>

## **8. Some theoretical conclusions and policy implications.**

A reformulation of the theory of value and capital cannot proceed along Marxian-Keynesian or Sraffian-Keynesian lines. One has to choose between these alternative theoretical approaches. The simple fact of sharing the classical surplus approach to value and distribution and the dislike of mainstream neoclassical economics is not sufficient to reconcile these approaches in a broad post-Keynesian synthesis, as advocated by Garegnani and others. This fundamentalist position has been opposed by other money endogenists, the ‘structuralists’, who focus their attention on the economic system in its totality and on the interrelations among its constitutive elements, and believe in the fallacy of composition.

Kaleckian-Keynesism and Sraffian-Keynesism are unfortunate oxymora, that do not make any sense. The Keynesian-Kaleckian (and Robinsonian) theoretical perspective is a typical short-period approach focused on the role of effective demand, on that of financial markets and institutions and on the non-neutrality of money. It rejects Say’s law and puts great emphasis on uncertainty and on expectations about the future. The Sraffian perspective is a static one, exclusively centred on long-period positions. It does not consider money (unless in its analytical role of *numéraire*) and uncertainty. Marx’s theoretical perspective centres on historical time and is far more general.

As was initially declared, the main goals of this paper were to maintain that structural interdependence among productive sectors should be acknowledged in economic modelling, to contrast some pseudo-Keynesian reductionist and oversimplifying macroeconomic approaches and to contribute to develop an updated Marxian theoretical approach to the theory of value and capital, in a non-deterministic and non-economistic perspective. These tasks have been accomplished and

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<sup>22</sup> Both MEV and MELT can be modified to account for the distinction between productive and unproductive labour. Only productive labour is the source of surplus-value.

the present writer's theoretical position has been cleared. Some policy implications of this position can now be drawn.

Monetarists and Keynesians have long debated the relative importance of monetary and fiscal policies. The debate was carried on for decades, although with scarce success. A large number of empirical studies were made, but they did not ultimately appear conclusive. Changes in aggregate money supply were regarded suited to influence aggregate demand, directly by monetarists and indirectly, through changes in interest rates and open-market operations authorities, by Keynesians. For both of them, monetary policy had to be tighter in periods of full employment and inflationary pressure and easier in the presence of under-utilization of economic resources. In principle, both monetary and fiscal policies, if correctly applied, can be effective, but the effectiveness of fiscal policy is largely conditioned by the method of financing public expenditure and by the structural composition of such expenditure. This makes the use of fiscal policy more complex than that of monetary policy.

The dominant opinion, based on the questionable Hicksian IS/LM theoretical framework, is that in recession times a traditional policy-mix combination of a restrictive fiscal and an expansionary monetary policy would be indicated. It would stimulate the formation of capital, in the presence of monetary growth targeting, if there is not a deficit in the balance of payments. A loose fiscal and a tight monetary policy-mix would instead be appropriate in an open economy with flexible exchange rates, in the absence of monetary growth targeting and in the presence of a deficit in the balance of payments. In the long-run, however, when the lagged effects of policy actions should be taken into account, the effectiveness of both fiscal and monetary policies would not be relevant.

The present writer's opinion is that the use of government deficit spending and of tax instruments for stabilization purposes should be carefully calibrated. The search for the best policy-mix to contrast productivity shocks is complex. Rules have to be established for single tax rates. Fine-tuning Keynesian fiscal policies, implying much more than simple budget deficits or

surpluses, that were popular in the 1970s, should be reevaluated. Income policies should also be revived.<sup>23</sup>

The MMTers idea that banks do not need liquid assets to make loans and their thesis that a sovereign country with its independent fiat money should experience continuous government deficit spending of unlimited amounts to stimulate the growth of output and employment, are illogical and should be rejected.

Monetary and fiscal policies are both institutionally conditioned by the degree of independence of the central bank from the Treasury and by the exchange-rate regime and can both have significant roles for stabilizing purposes and welfare improving. But monetary policy should not be used to solve fiscal difficulties, and fiscal policy should not be used to solve monetary difficulties.

As concerns the policy relevance of the stock or flow dimension of capital, I have criticized Marx's asymmetrical treatment of constant and variable capital and argued that capital is a revolving stock and the neoclassical loanable funds flow approach to capital theory, shared by modern monetary circuitists, is not correct. It ignores the store of value function of money and Keynes's liquidity preference.

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<sup>23</sup> It can be noticed that if money wages are paid, real wages are qualitatively undetermined and each worker can satisfy his basic needs by various baskets of wage goods. In such a situation, given quantities of wage goods cannot substitute the labour coefficients in a model's price equations. An essential condition required to transform the Marxian problem of production of commodities into the corresponding Sraffian problem is thus lacking. This is a further sign of the mutual incompatibility of these theoretical constructions and confirms that there is a need to choose between them.

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**Abstract:** *Structural Interdependence in Monetary Economics: Theoretical Assessment and Policy Implications.*

*This is a theoretical analysis of structural interdependence in monetary economics and of its connections with the theories of value and capital. Some recent attempts to integrate money and finance in the theory of income and expenditure – those of the ‘Stock-Flow Consistent Approach’ to macroeconomics, of ‘Modern Monetary Theory’ and of Circuit Theories – are examined. The surplus approach to the theory of value and capital is then formally considered in a model devoid of Sraffian misleading dichotomic connotations, where money plays a fundamental role and flows and stocks are coherently reconciled. In such framework, a method for measuring the unit cost of real capital is indicated and some reasons for reconsidering the traditional approaches to monetary theory and policy in a ‘late Marxian’ updated analytical perspective are highlighted.*

**JEL Codes:** B22, E12, E44, E52, M41.

**Keywords:** monetary theory; monetary policy; fiscal policy; structural interdependence; Sraffian dichotomy; post-Keynesian economics; MEV.