The relations between politics, economy and sustainability: an analysis model based on historical materialism

As relações entre política, economia e sustentabilidade: um modelo de análise baseado no materialismo histórico

Benedito SILVA NETO[1*]

[1] Federal University of Fronteira Sul (UFFS), Cerro Largo, RS, Brazil.

[*] Contact email: bsilva@uffs.edu.br

ABSTRACT: The essay aims at presenting a model that formally evidences the inseparability between economy, politics and sustainability in societies, based on Historical Materialism. Methodologically, the formulation of the model was carried out based on an analysis of the currently dominant conceptions of the relationship between economy and politics, which are clearly expressed in the category of economic efficiency. In the first section of the essay, we present an introduction to the topic. In the second, an analysis of the historical context of the emergence of the hegemonic category of economic efficiency is carried out. In the third section, the scientific foundations that support it and the main criticisms addressed to it are briefly presented, with emphasis on those related to environmental problems. The fourth section presents the model which grounds the concept that economic efficiency is inseparable from the political decisions taken in society about its material wealth, even those relating to natural systems. In the fifth section, some implications of the inseparability between economy and politics on democracy are discussed. In the sixth section, the final considerations are presented. The discussion carried out in the second and third sections indicates that only with the perspective of overcoming Capitalist social relations can the hegemonic category of economic efficiency be effectively replaced by another more adequate to the analysis of the material reproduction conditions of contemporary societies, even in what concerns their relations with the dynamics of natural systems. Adopting this perspective, the analysis carried out in the fourth section using the formal model shows that, due to the qualitative nature of wealth, economic efficiency cannot be defined independently of the political decisions taken by societies in relation to exploitation, production and distribution of its riches. In the fifth section, it is shown that this inseparability between economy and politics implies the need for a radical democratization of society.

Keywords: wealth; economic efficiency; class struggle; democracy; added value.

RESUMO: O ensaio tem o objetivo de apresentar um modelo que evidencia formalmente a indissociabilidade existente entre economia, política e sustentabilidade nas sociedades, baseando-se no materialismo histórico. Metodologicamente, a formulação do modelo foi realizada a partir de uma análise das concepções atualmente dominantes das relações entre economia e política, as quais se expressam claramente na categoria de eficiência econômica. Na primeira seção do ensaio, é feita uma introdução. Na segunda, é realizada uma análise do contexto histórico do surgimento da categoria hegemônica de eficiência econômica. Na terceira seção, são expostos sinteticamente os fundamentos científicos que lhe dão suporte e as principais críticas a ela endereçada, com destaque àquelas relacionadas aos problemas ambientais. Na quarta seção, é apresentado o modelo que fundamenta a concepção de que a eficiência econômica indissociável é das decisões políticas tomadas na sociedade sobre as suas riquezas materiais, inclusive as relativas aos sistemas naturais. Na quinta seção, são discutidas algumas implicações da indissociabilidade entre economia e política sobre a democracia. Na sexta seção, são feitas as considerações finais. A discussão realizada na segunda e na terceira seção indica que apenas com a perspectiva de uma superação das relações sociais capitalistas a categoria hegemônica de eficiência econômica poderá ser substituída efetivamente por outra mais adequada à análise das condições materiais de reprodução das sociedades contemporâneas, inclusive no que diz respeito às suas relações com a dinâmica dos sistemas naturais. Adotando essa perspectiva, a análise realizada na quarta seção por meio do modelo formal mostra que, devido ao caráter qualitativo das riquezas, a eficiência econômica não pode ser definida independentemente das decisões políticas que as sociedades tomam em relação à exploração, à produção e à distribuição das suas riquezas. Na quinta seção, é mostrado que essa indissociabilidade entre economia e política implica na necessidade de uma radical democratização da sociedade.

Palavras-chave: riqueza; eficiência econômica; luta de classes; democracia; valor agregado.

1. Introduction

We insistently hear that political decisions with profound consequences on the development and sustainability of society must be subordinated to economic criteria. In this sense, supposed economic imperatives are alleged to impose decisions that invariably respond, primarily, to the interests of the ruling classes, which demand "sacrifices" from the popular classes due to a supposed economic unfeasibility of solving their problems. This phenomenon is also observed in the confrontation of environmental problems, with serious consequences on the ecological sustainability of societies.

The need to subordinate political decisions to economic criteria is essentially based on neoclassical orthodoxy, and is also the subject of a broad consensus in heterodox economic theories (Loureiro & Acacio, 2012). This need, however, is contradictory to what is observed in the history of Capitalism, as Gorz (2010) states when pointing out that, in the nineteenth century, the prohibition of child labor and the regulation of the working day, to which paid vacations and weekly rest and the institution of a minimum wage and maternity leave, for example, were added throughout the twentieth century, were invariably considered by capitalists as economically unfeasible. The results of the workers' struggle show the fallacy of this argument.

This essay aims at presenting a formal model for the analysis of the relations between politics and economy and their consequences on the ecological sustainability of contemporary societies, using an approach based on Historical Materialism. Through the structure of the model, we seek to explain how politics and economy are inseparable from each

other, which contrasts with the widely agreed conception, both among laypeople and in the economic literature, of the existence of certain dichotomy, if not open antagonism, between politics and economy. To the extent that elaboration of the model is based on a criticism of that conception, before its presentation, a discussion is held on how the relations between economy and politics are treated in the main currents of economic science. In this sense, methodologically, the essay is organized into six sections.

Considering this introduction as the first section, in the second, an analysis of the historical-social context of the emergence of the conception of the existence of an autonomous economic efficiency is carried out. We consider that the dichotomous view between politics and economy originates in the class struggles that marked the historical formation of Capitalism, along which such a dichotomy was increasingly rationalized in the form of an economic science allegedly based on purely technical aspects. In this sense, we consider that the conception of economy as an autonomous field in relation to other social practices is an expression of an objective process, in which the material reproduction of society is increasingly subordinated to the accumulation of capital (Alcântara, 2014).

The elucidation of the class interests that guided the conception of economic efficiency, however, does not necessarily compromise its scientific legitimacy. To assume this point of view would be to attribute a political-ideological neutrality to science that, in our view, it cannot possess: although, as Lacey (1999) argues, the validation of scientific knowledge cannot be subordinated to political-ideological criteria. Therefore, in the third section, an analysis of the most important scientific foundations that support the neoclassical conception of economic efficiency is carried out, as well as the main criticisms that it has been suffering, especially those focused on its (in)ability to produce adequate measures to the problems that threaten the sustainability of contemporary societies.

In the fourth section, we seek to demonstrate why, fundamentally, politics and economy are inseparable. According to the historical-materialist approach adopted in this essay, our starting point is considering the labor process as the fundamental economic activity of human societies, which cannot be dissociated from choices that always maintain certain degree of freedom in the face of the technical conditions under which they must be taken (Lukács, 2011). In societies with a high degree of labor division, where exchanges take place through currency, the choices that occur in the labor process can only be made through collective decisions of a political nature. However, it is necessary to consider that the overall production process in these societies is highly complex, requiring mechanisms capable of coordinating productive activities so that they promote material reproduction of society according to the collective decisions taken. Through these mechanisms, decisions about the relations between society and nature can translate into efficient economic processes. In order to identify these mechanisms, however, an accurate analysis of the global production process is necessary, which is carried out in this essay through mathematical modeling.

From the considerations made in the previous sections, in the fifth section, the limitations caused by Capitalism to functioning of its political institutions that is consistent with the promotion of the ecological sustainability of societies are discussed.

In the sixth and last section, the final considerations are made.

2. The historical-social context of the emergence of the hegemonic conception of economic efficiency

The modern conception of politics arises in the context of the ideological disputes waged by the bourgeoisie against the monarchical and aristocratic state. In this dispute, three major socio-political movements stood out: the English revolution of 1688, the American revolution of 1776, and the French revolution of 1789. From these bourgeois revolutions, private property and the formation of a labor force capable of being employed by a free contract, entered into between the owners of the means of production and the workers deprived of them, are consolidated. In this context, material reproduction of society becomes increasingly subordinated to the accumulation of capital.

A new ethics emerges in this process, based on the notion that labor is the source of wealth, legitimizing access to it. Moreover, according to bourgeois ideology, property constitutes the fruit of labor accumulated by the owners themselves, and can no longer, as previously happened in Feudalism, be justified by Divine Right. Thus, in the new societies that emerge with bourgeois revolutions, from an ethical perspective, access to wealth would be only justified by property and labor (Clouscard, 2003). Moreover, in opposition to the privileges accorded to the nobility, the bourgeoisie imposes the institution of a Rule of Law, in which all members of society, now regarded as citizens (and no longer as subjects) would be equal before the law, which is elaborated by representatives of the whole of society.

It is interesting, already at this point, to point out a critique of Marx written in 1843 to the ideology that supports the society defended by the bourgeoisie. Marx (2010) shows that a citizen is nothing more than an ideal representation of an individual in Capitalism, abstractly considered as being free and equal, as opposed to real individuals, represented by bourgeois and workers, whose inequality is a necessary condition for maintaining the Capitalist society. Thus, from this critique of Marx, we can identify the social origins of the contradictions of a political system that declares itself to be representative of free and equal individuals, but which must act within the limits imposed by an economic system whose functioning is based on the exploitation of workers by capitalists.

But the more finished theoretical expressions that seek to hide such contradictions have only slowly manifested themselves throughout the history of Capitalism, to the extent that their elaboration, even within the scope of Political Economy, was conditioned by the class struggles that marked the emergence of this system. Undoubtedly, the bourgeois ideology represented an advance in terms of the freedom of individuals, when compared to feudal institutions. And for the consolidation of this idea, Political Economy played a fundamental role, placing itself as a vanguard thought for the orientation of the social struggles of the bourgeoisie, which resulted in the overcoming of Feudalism, thus representing a progress for society. In this context, for classical authors of Political Economy, such as Adam Smith and David Ricardo, thinking economy in a way that was disconnected from the social structure was logically unthinkable. Posing themselves

as defenders of the rational and objective analysis of society, these authors laid the foundations of a new science focused on the study of the social conditions of production and distribution of wealth in capitalist societies. However, it is important to note that, in the context of classical Political Economy, objectivity did not imply neutrality, as the classics of Political Economy, oftentimes explicitly and deliberately, played a fundamental role in the ideological support of a new social order, more free and advanced than the one represented by Feudalism (Netto & Braz, 2006).

After conquering political power, however, the bourgeoisie renounces its progressive ideals and becomes a class whose interest focuses on preserving the Capitalist social order, a process called by Lukács as the "ideological decadence of the bourgeoisie" (Netto, 1978; Netto & Braz, 2006), which manifests itself more clearly in the popular movements that shook Europe in 1848. Since then, the social struggle waged by the bourgeoisie has focused on a fierce opposition to the interests of the workers (Netto, 1978).

Insofar as it represented a thought aimed at a social change based on ideals of freedom and equality, in this new context, Political Economy becomes increasingly incompatible with the interests of the bourgeoisie. The consideration of labor as the foundation of value makes it difficult to dispute that the capitalists' profit is originated by exploitation of the workers, and cannot be justified by ownership of the production means. Progressively, a new scientific conception of economy is elaborated, whose theoretical construction is based on the theory of utility value, shifting its attention from social relations to the functioning of the market, conceived as a mere exchange between things (a conception called by

Marx (2011) as "commodity fetishism"). This economics, called "neoclassical", was consolidated in the last decades of the nineteenth century, increasingly dominating university education until it became hegemonic in contemporary economic thought.

From the end of the nineteenth century, accelerating after World War II, there was the social rise of a "new middle class" (Clouscard, 1996), comprised by professionals associated to the production, transmission and application of scientific knowledge (that is, intellectuals in the broadest sense of this term). Neither owners of the means of production nor direct producers of material wealth, playing a mediating role between capitalists and the proletariat, this new middle class progressively assumes its own social project, that of a Capitalism free of its most negative contradictions. In the impossibility, both social and theoretical, of a clear defense of the system, a significant part of these intellectuals renounce a critical understanding of the structure of Capitalism, focusing on its phenomenological aspects, seeking to find within Capitalism itself the solution to its contradictions. This stance exerted a significant impact on economic science (as well as on other social sciences), resulting in the emergence of currents that tend to avoid any reference to the theory of value and the class struggle in the analysis of economic processes, focusing on their institutional aspects and State action (Laibman, 2004). On the other hand, such currents are particularly critical in relation to the static and reductionist character of neoclassical analysis, especially with regard to the self-regulatory capacity of markets and the general equilibrium theory on which it is based. In this context, new conceptions of economic efficiency are formulated, such as those of adaptive efficiency, proposed by certain institutionalist currents (Gala,

2003), and selective efficiency, proposed within the scope of the evolutionary neo-Schumpeterian current (Possas, 2004). Finally, it is worth mentioning the existence of some conceptions, called "postmodern", which reject the existence of progress in Humanity and, with this, the very notions of development and efficiency, in order to free human beings from a supposed domination by the economy, as proposed by Latouche (2010), for example.

3. Scientific and critical foundations to the hegemonic conception of economic efficiency

The alternative conceptions of efficiency such as those cited at the end of the previous section, however, are far from having an influence comparable to the one exerted by the neoclassical conception, both on economic thought and on public debate. It is for this reason that, in the following paragraphs, we will focus on presenting a synthesis of the neoclassical conception of efficiency, as well as on its main criticisms.

In the early twentieth century, Vilfredo Pareto elaborated a "welfare economics" based on neoclassical economics (Pareto, 1996). In the context of this welfare economics, a definition of economic efficiency is developed based on a state of the economy known as the "Pareto optimum" which would be observed when (Guerrien, 1989):

a) There is efficiency in exchanges, that is, individuals in a society can freely exchange their goods, so that the marginal rate of substitution of goods is the same for all of them;

b) There is efficiency in production, so that a greater quantity of a good cannot be produced without reducing the production of other goods, which can be identified when total production is on the frontier of the production possibilities curve;

c) There is efficiency in the combination of products, so that goods are produced according to the preferences of economic agents, which can be identified when the marginal rate of substitution of goods (defined according to item "a") is equal to its marginal rate of transformation (located on the production possibilities curve, according to item "b").

An important proposal related to the theory of economic efficiency is the so-called Fundamental Theorem of Welfare Economics, which shows that a market with perfect competition in equilibrium is a Pareto optimum. Within neoclassical welfare economics, therefore, it is possible to mathematically identify an optimal state of the economy only from consumer preferences and the technical conditions of production.

However, as already mentioned, there are numerous criticisms of the welfare economics developed from Pareto's studies. It turns out that, in an economy, there may be several states corresponding to Pareto optimums, which form a Pareto boundary (both from the point of view of consumer welfare and production possibilities). Each specific optimum along this boundary depends on the initial allocation of goods, implying that the Pareto optimum is compatible with extremely unequal income distributions (Guerrien, 1989). In this sense, when analyzing the relationship between ethics and economics, Amartya Sen states that:

A given social state is considered to have reached

a Pareto optimum if, and only if, it is impossible to increase a person's utility without reducing someone else's utility. This is a very limited kind of success and, in itself, may not guarantee much. A state can be in Pareto optimum with some people in extreme poverty and others living in luxury, as long as the poor cannot improve their conditions without reducing the luxury of the rich (Sen, 1988, p. 72).

Therefore, the Pareto optimum implies a defense of the "*status quo*" against social reforms that could make a society more just. On the other hand, it is important to point out that even neoclassicals admit the lack of social equality of the Pareto optimization criterion. However, these economists state that promoting greater social equality implies moving the state of the economy away from the efficiency frontier, so that there would be a trade-off between economic efficiency and social equality. In view of this, the solution usually proposed by neoclassicals is to promote an increase in production that benefits all consumers, allowing to circumvent the trade-off between economic efficiency and social equality and, therefore, the distributional conflicts it would provoke (Beck; Di Nino; Stracca, 2021). It is important to note that the proposal to resort to economic growth as a means of circumventing social conflicts provides the neoclassical welfare economics with a strongly productivist character. This productivist character is reinforced by the fact that Pareto's welfare economy identifies well-being with the amount of products consumed. In this sense, many authors seek to include other aspects of well-being, including institutional ones, which may better reflect its multidimensional character (Sen, 1988; Baarsma & Lambooy, 2012).

A critique of neoclassical welfare economics, of special importance for the purposes of this essay, concerns its difficulties integrating into its analyses the negative externalities caused by environmental problems (Harribey, 2013). For neoclassical economists, externalities correspond to the effects of the action of an economic agent that are not subjected to transactions in the market (Guerrien, 1989). Therefore, according to neoclassicals, externalities, either positive or negative, constitute market failures that do not incite the agents that provoke them to consider them in their consumption or production decisions. Thus, the existence of externalities implies that a market in equilibrium does not result in optimal allocation of resources, which prevents the establishment of a Pareto optimum (Guerrien, 1989).

However, the very neoclassical definition of externalities as market failures already indicates how they could be integrated into economic analysis, that is, be "internalized". The main solution proposed by neoclassical economists is to create markets so that the effects of negative (positive) externalities are considered in the producers' costs (in the revenues) or in the consumers' budgetary constraint (in the income) (Baarsma & Lambooy, 2012). In the case of negative externalities concerning environmental problems, the creation of these markets implies some privatization degree of natural resources so that they can be traded.

The problem is that such markets cannot arise only by privatizing the resources provided by nature, insofar as internalization requires state interventions that go far beyond simple privatizations. In fact, the very existence of public goods indicates that certain economic activities and natural resources cause externalities that are very difficult, if not impossible, to internalize through the market (Guerrien, 1989). Given this, even among neoclas-

sicals, it is admitted that some State intervention is necessary to address the problem of externalities. In this case, it is necessary for the State to apply fees or distribute negotiable quotas in order to ensure that, in the case of negative externalities, for example, the private marginal cost to avoid an externality equals the social marginal cost of the effects of such an externality (Harribey, 2013). We emphasize that these costs must necessarily be expressed in monetary values for this equality to be defined.

The discussion carried out in the previous paragraphs shows that, as a fundamental element of welfare economics, the Pareto optimum has been the object of the most varied criticisms, many of them pointing out important theoretical contradictions and practical difficulties related to this analysis category. However, it is interesting to note that even certain deeply critical analyses of the Pareto optimum do not break with the category of economic efficiency associated with it. In this sense, there seems to be broad consensus that the problem lies not in the theory of economic efficiency itself, but in its insufficiency or in the practical difficulties posed to its application. For example, even when proposing a neo-Schumpeterian evolutionary approach to economics, Possas states that:

> the problem is not adoption itself of the criterion of allocative efficiency, but its exclusivity (...) Strictly speaking, the main limitation of the concept of allocative efficiency stems not from its logical foundation, which is solid, or its methodological foundation (individualistic), which may even be acceptable, but from its economic foundation, which is linked to the theory of competitive general equilibrium, of Pareto's fundamental welfare theorems. (...) the static evaluation of the concept of allocative efficiency, even if never exclusively, remains not only valid but also a relevant instrument for public policy in general

and competition (including antitrust) in particular (Possas, 2004, p. 83).

It is therefore possible to assert that the Pareto optimum remains a central reference in studies on economic efficiency, which implies the belief, even if tacit, of the need for certain subordination of politics to the dictates of economy. On the other hand, the growing influence of issues related to environmental problems clearly shows the limits of the analysis of the material reproduction of society exclusively based on monetary values. The position we hold in this essay is that the difficulties of neoclassical economics in general, and particularly the welfare economics proposed in its scope, in generating adequate measures to face the serious threats to the ecological sustainability of contemporary societies derive essentially from its utility-based theory of value, which does not allow a clear distinction between wealth, values and prices (Harribey, 2013). The neoclassical theory, therefore, makes it impossible to clearly represent the economy in physical terms, which can be analyzed independently of monetary values. According to neoclassical economics, natural resources, as well as the effects of their exploitation on functioning of the Biosphere, must necessarily be represented in monetary terms.

In the next section, we propose an analysis of economic processes based on physical units, consistent with their analysis in monetary terms. In addition to that, we consider that the ontological priority of society's material conditions of reproduction (which have always existed) over monetary conditions (a historical product of Humanity, characteristic of modern societies) implies that society's fundamental decisions about its wealth

Desenvolv. Meio Ambiente, v. 62, p. 1462-1484, jul./dez. 2023.

1469

must be made based on non-monetary criteria (Silva Neto, 2020a). In this sense, economic processes cannot be dissociated from criteria, of a political nature, established by society on the exploitation, production and distribution of its wealth. In turn, this inseparability between politics and economy implies a conception of economic efficiency totally different from the one proposed by neoclassical welfare economics, as proposed in the next section.

4. A formal model of economic efficiency based on historical materialism

According to Historical Materialism, access to wealth in capitalist societies is a product of class struggle and not the result of a purely economic process. This conception is clearly stated when Marx refers to demand in the following excerpt from Capital:

> Let us note here, just in passing, that "social needs", that is, what regulates the principle of demand, are essentially conditioned by the relationship of the various classes to each other and by their respective economic position, that is, firstly, by the proportion between total surplus value and wages; secondly, by the proportion between the various parts in which surplus value is decomposed (profit, interest, land rent, taxes, etc.). Therefore, it is here again demonstrated that absolutely nothing can be explained from the relationship between supply and demand before the basis on which this relationship operates is developed (Marx, 2017, p. 216).

Thus, according to Historical Materialism, demand is determined by objective social processes, based fundamentally on class struggle, which implies that, once certain quantity is defined, supply is determined by the conditions under which production takes place, the nature of which is explained by Marx when he says that;

> The use-values of coat, linen, etc., in short, the bodies of commodities, are nexuses of two elements: natural matter and labor. Subtracting the total sum of all the different useful labors contained in the coat, linen, etc., what remains is a material substrate which exists in nature without the interference of human activity. In producing, man can only proceed as nature itself, that is, he can only alter the form of matter. Furthermore, in this very work of shaping, he is constantly supported by the forces of nature. Therefore, labor is not the only source of the use values it produces, the only source of material wealth (Marx, 2011, p. 167).

This excerpt shows Marx's precise conception of the labor process. In it, Marx makes it clear that labor ultimately constitutes the specific way in which human beings relate to nature in order to obtain the products they need. Natural resources therefore occupy a central position in Marx's conception of labor. Insofar as labor is the fundamental process of economy, this conception of Marx makes it possible to elaborate a representation of the economy in physical terms. On the other hand, it is important to point out that, in Historical Materialism, labor is always conceived as an activity carried out from social relations, which play a central role in it. In short, it can be inferred from the conception exposed by Marx that labor is constituted in a relationship of human beings with nature, always mediated by relationships of human beings with each other.

This conception was deepened by Lukács (2011). According to this author, the labor process has two different aspects. The first one begins with the definition by the social being of a teleological

position on what to produce, which occurs through the mobilization of processes that take place in nature. However, this act is only considered labor after validating utility of the product for the social being (that is, for producers themselves or for society). In this sense, while labor has an ontological character, foundational to human beings (Lukács, 2011), it also has a historical character, insofar as social relations change over time, in line with the advance of the productive forces represented by the dominance that human beings exercise over the natural processes on which, ultimately, labor is based.

Therefore, labor occupies a central place in the historical and materialist conception of social reality inaugurated by Marx and Engels. It is therefore understandable that the labor time required for production is considered by Marx as the central element of economy, from which he conceives the law of value, enunciated as follows:

> Regardless of the way in which the prices of the various commodities are fixed or regulated among themselves, it is the law of value that, at first, governs their movement. When the labor time required to produce these commodities decreases, prices fall; when it increases, prices rise, while other circumstances remain constant (Marx, 2011, p. 211).

Based on these conceptions of Marx, a model was developed based on a formulation originally proposed by Silva Neto (2018; 2020a; 2020b)[1], in which restrictions on differential rents related to natural resources directly used for the generation of final consumption products and restrictions on investments in multicyclic means of production (which generate fixed costs in production units) were introduced.

Therefore, a linear programming model was developed, whose primal problem provides the quantity of each product for final consumption and production means to be generated under technical conditions that minimize the socially necessary labor for production. This minimization is subjected to restrictions related to satisfaction of the defendant of final consumption products, the requirements of production means and the exploitation degree of natural resources. From the primal problem, we obtained the dual problem that provides the prices of final consumption products and the production means, as well as the differential rents related to natural resources, which maximize the monetary added value. The model considers the following as exogenous variables: the demand for final consumption products, the surplus of means of production, and the exploitation degree of natural resources. In this model, it was also considered that the final consumption products and the production means that are used for the generation of other production means can directly depend on natural resources.

The primal problem of the model is described as follows:

Minimization of labor time:
Minimize

$$\sum c_i^l y_i^l + \sum c_z^m y_z^m + \sum c_d^h y_d^h + \sum c_n^s y_n^s + \sum c_n^s E_n^s + \sum c_e^o y_e^o + \sum c_e^o E_e^o \qquad (1)$$

Subjected to restrictions

Demand for products for final consumption:

$$\sum y_i^l \geq D_i \qquad (2)$$

Exploitation level of natural resources necessary for the generation of products for final consumption:

$$\sum x_{ui}^l y_i^l \leq R_u \qquad (3)$$

Demand for monocyclic production means for the generation of final products:

$$\sum y_z^m - \sum x_{zi}^l y_i^l \geq E_z \qquad (4)$$

Demand for monocyclic production means for the generation of other production means:

$$\sum y_d^h - \sum x_{dz}^m y_z^m - \sum x_{dn}^s y_n^s \geq E_d \qquad (5)$$

Demand for multicyclic production means used for the generation of monocyclic production means and final consumer products:

$$\sum y_n^s - \sum x_{nz}^s y_z^m - \sum x_{ni}^s y_i^l \geq E_n \qquad (6)$$

Increase in the stock of multicyclic production means used for the generation of monocyclic production means and final consumer products:

$$\sum T_n^s = v_n E_{n.} \qquad (7)$$

Demand for multicyclic production means for the generation of other multicyclic production means:

$$\sum y_e^o - \sum x_{en}^o y_n^s \geq E_e \qquad (8)$$

Increasing the stock of multicyclic production means required for the production of other multicyclic production means:

$$\sum T_e^o = v_e E_e \qquad (9)$$

Exploitation level of the natural resources necessary for the production of the production means used for the generation of other production means:

$$\sum x_{jd}^h y_d^h + \sum x_{je}^o y_e^o + \sum x_{je}^o T_e^o \leq R_j \qquad (10)$$

Where,

c = labor time necessary for the generation of a product indicated by the letter subscribed with the technique indicated by the superscripted letter (for example, c_i^l = labor time c necessary for the generation of product i with technique l);

x = quantity of the product (or natural resource) indicated by the first subscribed letter, necessary for the generation of a unit of the product indicated by the second subscribed letter, with the technique indicated by the superscript letter (for example, x_{jd}^h = quantity x of production means j necessary for the generation of a unit of product d with technique h);

y = quantity of the product indicated by the first subscribed letter, generated with the technique indicated by the superscript letter;

D = demand for final consumer products;

E = surplus generated per production cycle;

T = increase in the stock of multicyclic production means;

R = amount of natural resources;

v = useful life of the multicyclic production means;

z, d = monocyclic production means;

n, e = multicyclic production means;

l, m, h, s, o = production techniques;

u = natural resources used for the generation of final consumption products;

j = natural resources used for the generation of production means.

The dual problem was deduced from the primal one. This deduction is carried out considering that the coefficient matrix of the dual problem corresponds to the transposed matrix of the coefficients of the primal problem. Thus, the coefficients of the vector of the function to be minimized of the primal problem correspond to the coefficients that appear on the right side of the constraints of the dual problem; and the coefficients on the right side of the constraints of the primal problem correspond to the coefficients of the function to be maximized of the dual problem. Thus obtained, the dual problem provides the prices of the final products and the production means and the rents generated by the scarcity of natural resources that maximize the added value considering the technical conditions specified in the primal problem. The dual problem obtained is described as follows:

Maximization of the monetary added value:
Maximize

$$\sum D_i p_i - \sum R_u r_u + \sum E_z p_z + \sum E_d p_d + \sum E_n p_n + \sum T_n p_t + \sum E_e p_e + \sum T_e p_k - \sum R_j r_j \quad (11)$$

Subjected to restrictions

Price formation of final consumer products:
$$p_i - \sum x_{zi}^l p_z - \sum x_{ni}^s p_n - \sum x_{ui}^l r_u \le c_i^l \quad (12)$$

Price formation of monocyclic production means used for the generation of final consumer products:
$$p_z - \sum x_{dz}^m p_d \le c_z^m \quad (13)$$

Price formation of monocyclic production means used for the generation of production means:
$$p_d - \sum x_{nd}^s p_n - \sum x_{jd}^h r_j \le c_z^h \quad (14)$$

Price formation of multicyclic production means used for the generation of multicyclic production means:
$$p_n - \sum x_{en}^s p_e \le c_n^s \quad (15)$$

Price formation of multicyclic production means, formed as described in Expression (15), from the increase in their inventories:
$$p_t - \sum x_{en}^s p_e \le c_n^s \quad (16)$$

Price formation of multicyclic production means used for the generation of multicyclic production means:
$$p_e - \sum x_{je}^o r_j \le c_e^o \quad (17)$$

Price formation of multicyclic production means, formed as described in Expression (17), from the increase in their inventories:
$$p_k - \sum x_{je}^o r_j \le c_e^o \quad (18)$$

Where, in addition to the variables of the primal problem, already described, we have:

p_i = price of product i;

r_u = rent generated by the scarcity of natural resource u, used directly for the generation of final products;

p_z = price of cyclic production means z (used to generate final consumption products);

p_d = price of cyclic production means d (used to generate other means of production);

p_n = price of multicyclic production means n (calculated from its replacement);

p_t = price of multicyclic production means t (calculated from its stock);

p_e = price of the multicyclic production means e (calculated from its replacement);

p_k= price of multicyclic production means k (calculated from its stock);

r_j= rent generated by the scarcity of natural resource j, used for the generation of production means.

Evidently, the prices of the multicyclic production means that are replenished each cycle and the price of these stocked production means are the same, i.e., $p_n = p_t$ and $p_s = p_k$.

According to the duality theorem, with the optimal solutions, we have:

Minimize

$$\sum c_i^l y_i^l + \sum c_z^m y_z^m + \sum c_d^h y_d^h + \sum c_n^s y_n^s + \sum c_n^s E_n^s + \sum c_e^o y_e^o + \sum c_e^o E_e^o =$$

Maximize \hfill (19)

$$\sum D_i p_i - \sum R_u r_u + \sum E_z p_z + \sum E_d p_d + \sum E_n p_n + \sum T_n p_t + \sum E_e p_e + \sum T_e p_k - \sum R_j r_j$$

in other words, the minimum of socially necessary labor (value in labor time) to satisfy the demand for final products and the production means corresponds to the maximum total monetary value subtracted from the differential rents, which results in the maximum added value, considering the production conditions, the demands for surpluses of production means and the exploitation degree of natural resources.

In this model, the wealth corresponding to final consumption products (D), natural resources (R), investments represented by surpluses of production means (E) and the formation of stocks of multicyclic production means (T) are exogenous variables. This means that the quantity and type of final consumer products, investments and exploitation of natural resources are not provided by the model solution. Thus, decisions involving such variables are extraeconomic, and economic processes are triggered from them. On the other hand, it is evident that the technical constraints that define the choice possibilities (as well as the consequences of each choice) cannot be neglected. But it is important to point out that such restrictions can never, by themselves, provide what a society must decide about its wealth and, therefore, about its welfare and ecological sustainability. It is important to note that vector (R) consists of the flow of natural resources exploited at each production cycle and not in the stock of such resources, whether they are renewable or not. According to collective decisions of an extraeconomic nature on social wealth, such stocks can be exploited with different intensities, in a more or less sustainable way.

In the model proposed, the choice of techniques to be used stems from decisions regarding wealth. For example, if a society considers it more important to reduce its environmental problems by decreasing exploitation of natural resources and is willing to increase its labor time, the model provides the techniques consistent with such decisions. Thus, it is clear that the issue of ecological sustainability essentially concerns the fundamental decisions that a society makes about its material wealth. Once such decisions have been made, and given the existing technological universe, the model solution indicates the techniques that allow demand satisfaction. In this sense, the frontier of production possibilities of the economy depends on the decisions that society makes about its wealth, especially the exploitation degree of natural resources and, thus, cannot be

considered as something given, defined only by the available techniques, as proposed by neoclassical economy.

It is important to note that the results provided by the dual problem of the model herein proposed cannot be considered as values equivalent to labor time in physical terms (labor values). In fact, there are linear programming models that are used to calculate labor values, such as Morishima's (1973), whose primal problem minimizes labor time (as presented in this essay). However, the consideration of the scarcity of natural resources in these models (which implies the inclusion of technical alternatives) necessarily means that its dual solution does not provide labor values, as shown by Hoffmann & Cunha (2009), for example. This is because the consideration of scarce natural resources causes the emergence of rents, which are incorporated into the monetary values provided by the dual solution. This is clearly demonstrated by expressions (12) and (14) of the model described above. Therefore, the consideration of the values of the final products and the production means provided by the dual solution of the model as labor values is erroneous when considering the possibility of scarcity of natural resources. Thus, it is justified that the values of consumer products and the production means provided by the dual solution are considered as the prices that would be defined excluding other processes that disturb their composition (such as equalization of profit rates), which is necessary so that the equivalence between added value and the socially necessary labor time for production can be formally demonstrated according to the Marxist theory of value (Silva Neto, 2020b).

The model herein described does not exclude the notion of economic efficiency. Thus, at the same time that, at the macroeconomic level, the solution of the primal problem indicates the quantities, techniques, prices and rents that allow the reproduction of the economic system with a minimum of labor time; at the microeconomic level, the prices provided by the solution of the dual problem induce the use of techniques that provide the maximum added value, which is equivalent to labor time directly applied to production. It is in this sense that, in this essay, the prices and techniques indicated by the model solution are called "efficient". Therefore, these prices constitute informations that allows microeconomic decisions (in the case that they are taken according to maximization of the added value in the production units), related to the choice of production techniques, to be consistent with collective decisions, of an extraeconomic nature, related to the demand for final products, investments and the use of natural resources. Thus, the equivalence between labor time and added value observed in the economy as a whole is also obtained in production units, provided that they apply efficient techniques, that is, techniques necessary to satisfy demand that minimize the cost of socially necessary labor time for production, as will be shown below.

Initially, we emphasize that the restrictions related to price formation (expressions 12 to 18), described in the dual, macroeconomic problem, have the same structure as the equation used to calculate the added value in the production units. Each of these constraints describes the application of a specific technique. Active constraints (which determine the solution of the model) are those that become equalities (that is, whose value obtained on its right side is the same as that on the left side). These constraints are therefore those relating to efficient techniques.

However, it is important to note that, in the microeconomic equation, the differential rents generated by the scarcity of natural resources directly used to generate a product are added to the added value (insofar as they are incorporated into prices). For example, considering Expression (12), reproduced below,

$$p_i - \sum x_{zi}^l p_z - \sum x_{ni}^s p_n - \sum x_{ui}^l r_u \leq c_i^l$$

the total "added value" in the production unit can be calculated by multiplying it per unit by the quantity produced, that is,

$$Qc_i^l + Q\sum x_{ui}^l r_u = Qp_i - Q\sum x_{zi}^l p_z - Q\sum x_n^s p_n \qquad (20)$$

where the "added value" (which may actually be increased by rents) calculated from data obtained at the production units is,

$$AV = Qc_i^l + Q\sum x_{ui}^l r_u \qquad (21)$$

When Expression (20) is considered from a microeconomic point of view, the production means that are consumed in the cycle are called "intermediate consumption". Considering Expression (20), intermediate consumption is defined as,

$$IC = Q\sum x_{iz}^l p_z$$

However, in a production unit, it is not possible to replace only a part of the multicyclic production means (that is, those that require more than one cycle to be consumed). Thus, it is necessary to con-sider a "depreciation" in the cycle suffered by such production means. Considering Expression (20), depreciation of a multicyclic production means is defined as follows:

$$D = Q\sum x_n^s p_n \qquad (22)$$

The monetary value of production shown in Expression (20) and, in microeconomic terms, it is called "gross production", defined as:

$$GP = Qp_i \qquad (23)$$

From expressions (21), (22), (23) and (24), we obtain the expression that is used to calculate the added value in production units (Garcia Filho, 1999), described as:

$$AV = GP - IC - D \qquad (24)$$

In the case of productions that depend only indirectly on natural resources, when the added value calculated in the production units is the monetary equivalent of the labor time required for production, this indicates that efficient techniques have been employed. This equivalence makes the microeconomic decisions made in production units consistent with collective decisions about social wealth. As already discussed, in the case of the application of inefficient techniques, the added value will be lower than the labor directly applied in production. Therefore, added value is an efficient microeconomic criterion.

The same, however, cannot be said for the profit rate. Thus, considering,

$$IC + D = MP \qquad (26)$$

$$AV = S + L \qquad (27)$$

$$S = xAV \qquad (28)$$

$$L = (1 - x)AV \qquad (29)$$

where,

IC = intermediate consumption

D = depreciations

MP = monetary value of the production means

AV = added value

S = salary

P = profit

From expressions (26), (27), (28) and (29), the profit rate (tl) is defined as;

$$tl = \frac{(1 - x)AV}{xAV + MP} = \frac{(1 - x)AV}{(x + \frac{MP}{AV})AV} \qquad (30)$$

In other terms,

$$tl = \frac{(1 - x)}{(x + \frac{MP}{AV})} \qquad (31)$$

As the added value is proportional to the time directly applied to production and not to the time that was devoted to generation of the production means, Expression (31) shows that the profit rate is not necessarily proportional to the added value, therefore being an inefficient decision criterion. On the other hand, insofar as the maximization of the profit rate maximizes capitalists' access to the wealth produced by workers, it is the decision criterion normally adopted in Capitalism, both for the choice of techniques and for the selection of investments. Thus, the inefficiency of the profit rate as a decision criterion, by causing instability in the process of material reproduction of society, has been pointed out as one of the causes of the recurring crises of Capitalism (Silva Neto, 2020a).

The relationships between wealth, values and prices formalized by the model herein proposed indicate that, due to the qualitative character of wealth, its production and consumption cannot be defined by prices but, on the contrary, prices are defined from the decisions made in society about wealth. This conception is consistent with that of Marx (2011), according to which, as previously discussed, the amount and type of wealth demanded by society and, therefore, also the wealth extracted from nature to be transformed by labor to satisfy such demand, are fundamentally determined by the class struggle which, even under the aegis of capital accumulation, is not a strictly economic process. However, it could be argued that, at least from an environmental point of view, the very scarcity of natural resources might ensure their adequate exploitation, by causing their prices to increase and, thus, inducing the adoption (and generation) of techniques that save natural resources. In this case, the main obstacles to sustainability would be insufficiency of technical progress and, mainly, external interference in economic mechanisms related to price formation (such as State interventions). In this sense, economic processes themselves, provided they are "free" from any intervention, would be able to ensure the conditions for the ecological sustainability of human societies. However, this reasoning ignores the existence of negative externalities, which implies that it does not ensure that the exploitation level of

natural resources considered scarce cannot cause a degree of wealth destruction that exceeds the capacity of natural systems to renew them, or to ensure a compatible pace between the exploitation degree of natural resources and the development of techniques that allow their replacement, in the case of non-renewable resources. This is because one of the origins of the negative externalities caused by environmental problems lies in the fact that material reproduction of society is determined by human activities and not, at least immediately, by the dynamics of natural systems, which does not depend on economic processes (although it can be disturbed by them). While functioning of societies is determined by the immediate interests of human beings, the dynamics of natural systems, in turn, are determined by complex self-organization mechanisms based on irreversible energy transformations, responsible for maintaining the integrity of the biosphere (Silva Neto, 2020b). In addition, it is important to note that vector (R) corresponds to the flow and not to the stock of natural resources. Thus, the scarcity of natural resources may influence economic processes only after their exploitation reaches levels that are incompatible with the sustainability of human societies, which requires extraeconomic criteria for decision-making on the exploitation degree of natural resources. The consideration in this essay that wealth is an exogenous variable, the quantities of which cannot be determined by exclusively economic considerations, is consistent with this requirement.

The conceptions of wealth proposed in this essay pose important methodological problems with regard to the consideration of negative externalities caused by environmental problems. This is because the costs caused by these externalities cannot be measured in strictly technical-economic terms. Loss of biodiversity, degradation of soils, contamination of the environment and food by pesticides, disruption of the biosphere functioning due to the alteration of biogeochemical cycles (such as carbon and water), for example, represent a destruction of immeasurable wealth, which does not have any intrinsic monetary value (Harribey, 2013). In the model herein proposed, therefore, it is not the environmental costs themselves that are assessed monetarily, but the cost of the technological changes caused by differential rents resulting from the limitation of the exploitation of natural resources. And for these changes to happen, there is an evident need for technical alternatives that are more compatible with sustainability. In this sense, an important contribution that the model proposed in this essay can provide is that it allows for an accurate assessment of the technical feasibility of facing the problems arising from overexploitation of natural resources, which is also fundamental to guide the development of techniques that are more compatible with sustainability.

Thus, through the model, it is possible to define a price system that would allow monetary internalization of environmental costs (in the sense set out in the previous paragraph) and, thus, make economically feasible the techniques considered most desirable from the point of view of sustainability. This internalization process can be shown, for example, by expressions (15) and (17), described again below:

$$p_n - \sum x_{en}^s p_e \leq c_n^s$$
$$p_e - \sum x_{je}^o r_j \leq c_e^o$$

We recall that Expression (15) describes the price formation of multicyclic production means, which depend on the price formation of other multicyclic production means. In turn, and as shown by Expression (17), these depend on rents related to natural resources.

As already discussed, efficient techniques cause expressions (15) and (17) to become equalities. Thus, in the case where inefficient techniques are applied, the right side of Expression (15) will be higher than the value in the left side, that is, the price subtracted from the values per unit of the production means will be lower than the added value. When there is shortage of natural resources, the rents generated (r_j) cause an increase in the price of the production means (p_e), which in turn causes an increase in the price (p_n), increasing the added value (c_n) and, thus, enabling the application of a technique that employs fewer natural resources for the generation of the production means (x_n).

A practical example of a situation as described in the previous paragraph can help explaining it. Let us suppose that a shoe maker can choose between two machines (machine 1 or 2). With machine 1, the labor time the manufacturer has to apply is shorter than with machine 2. On the other hand, the manufacture of machine 1 requires more oil (a natural resource) than that required by machine 2. Let us initially assume that using machine 1 is the efficient technique. In this case, the labor time directly applied by the shoe maker is lower. However, in the event that a society decides to limit the use of oil (to reduce the emission of greenhouse gases, for example), which corresponds to increasing the oil shortage, the increase in the value of the differential rent resulting from this shortage causes an increase in the production costs of machine 1, rendering use of machine 2 efficient due to the fact that its manufacture requires less oil, despite requiring more labor. This results in an increase in the price of shoes produced by the manufacturer. Therefore, the differential rent caused by a political decision to face an environmental problem can be considered as internalization of the costs caused by such problem, insofar as there will be an increase in prices. However, it is important to note that this type of internalization does not concern the costs of environmental problems but the effects on prices caused by the costs of technological changes necessary to face them, in physical terms, as in our example where it is the physical oil amount that is intended to be reduced (and not the monetary cost of the problems arising from its use). Continuing with our example, in the case of the absence of a machine that can ensure the reduction of oil exploitation deemed necessary by society to face the environmental problems arising from using this natural resource, the only way to achieve such decrease is by reducing the consumption of final products whose production depends on oil, whether directly or indirectly. However, in this case, it would be up to society to assess which final consumer products should have their production reduced, which can only be done through an assessment, of a political nature, of the social need for these products. This point will be discussed in more detail in the next section.

5. Economic efficiency, politics and democracy

In the fourth section, we sought to analyze the fundamental structure of monetary economies (which includes the Capitalist system). In this

discussion, we show that extraeconomic decisions about social wealth that trigger the economic processes themselves, and not the other way around. These results induce us to think that the category of economic efficiency constitutes a mere ideological justification for the control exercised by capitalists over collective decisions regarding social wealth.

The discussion carried out in the second and third sections; however, it leads us to consider that the neoclassical conception of economic efficiency only reflects the fact that material reproduction of society takes place from the accumulation of capital and not from direct and objective assessments carried out by society as a whole, of its needs, including those related to its ecological sustainability. In this sense, the hegemonic category of economic efficiency constitutes a necessary element for the functioning of an economic system that presents profound contradictions between its material reproduction process and society's needs. The structural character of these contradictions, moreover, places important limitations on the heterodox theories that challenge neoclassical orthodoxy but do not call into question the hegemonic category of economic efficiency.

The main function of the Capitalist political system is the management of such contradictions, although it has to remain formally faithful to the foundations of the rule of law on which it has historically been based, as discussed in the second section. Machado (1997) calls this system the "Bourgeois Democracy", which emphasizes that it can only work within the limits of the economic interests of capitalists. According to this author, the functioning mechanisms of the Bourgeois Democracy that ensure satisfaction of these interests, to the detriment of the interests of the other classes,

are the most diverse. The discussion carried out in this essay shows that, among these mechanisms, control of investments by capitalists is probably the most decisive. This is because capitalists are always about to suspend the main social function that would justify their existence as a class, which would be a supposed ability to direct investments in the most productive way possible. However, such capacity has never been formally demonstrated (Felipe & MacCombie, 2014) or historically evidenced (Polany, 1980). In this sense, the results indicate that the demand for a simple more equal distribution of income (which as a whole corresponds to the added value), although sometimes based on solid statistical bases (Piketty, 2013), would be of doubtful effectiveness without a direct control of investments by the community (Husson, 2014).

As shown by the model presented, in order for the price system to be efficient, it is necessary that, within the production units, the added value (and not the profit rate) is considered as the basic criterion for decisions on existing technical alternatives. It turns out that the distribution of added value in capitalist production units takes place through maximization of the profit rate, which, as has been shown, is an inefficient decision criterion. Thus, democratization of the management of companies through the workers' active participation in the management of production units is necessary to make them more efficient, insofar as it could result in the adoption of added value as a decision criterion. However, effective workers' participation in the distribution of added value in production units, as well as social control of investments, can only be achieved by overcoming the capitalist relations of ownership and production.

6. Final considerations

As discussed in this essay, material reproduction of societies becomes subordinate to accumulation of capital from the clashes fought by the bourgeoisie for its rise and, afterwards, maintenance, as a hegemonic social class. It is in this context, in which capital accumulation is insistently presented by the bourgeoisie as a process that cannot be subjected to any social control, that the conception of an autonomous economic efficiency in relation to political considerations about social needs arises. In this sense, the emergence of this category is one of the expressions of the contradiction, fundamental in the Capitalist system, between capital accumulation and social needs.

It turns out that this contradiction becomes increasingly evident from worsening of the environmental problems, which have exerted a strong influence on the public debate, mainly based the on the functioning of natural systems in physical, chemical and biological terms, and not in economic-monetary terms. Such debate clearly indicates the serious insufficiency of the neoclassical conception of economic efficiency, carried out exclusively in monetary values, as imposed by the utility value theory, for the analysis of the material conditions of reproduction of societies.

In this sense, the profound socio-ecological crisis of the contemporary Capitalist system reveals the exhaustion of the economic categories that represent it, which no longer reflect the material reproduction conditions of society, once characterized by a relative abundance of natural resources and greater integrity of the Biosphere (which, as shown by Steffen *et al*. (2015), is currently seriously threatened). Therefore, the socio-ecological crisis of Capitalism has resulted in an extreme deepening of the ideological decay of the bourgeoisie. Unable to detach itself from the ideological representations necessary for its support as a ruling class, which prevents it from understanding the current reality, the bourgeoisie is less and less able to play a relevant role in society (at this point, it is interesting to note that capitalists find themselves in the same situation as the aristocracy, which they have fought so hard in the past). Thus, the neoclassical category of economic efficiency can only be effectively replaced by another more adequate for the analysis of the material reproduction conditions of contemporary societies, even with regard to their relations with the dynamics of natural systems, in the perspective of overcoming the social relations that structure the Capitalist system.

It was in this perspective that, in the fourth section, an analysis of the fundamental structure of monetary economies was carried out. This analysis showed that it is possible to conceive economic efficiency as a process associated with the political decisions that a society makes about the exploitation, production and distribution of its wealth. In addition, in this analysis, it was shown that, based on a clear distinction between wealth, values and prices, grounded on the labor theory of value, it is possible to objectively integrate the negative externalities caused by environmental problems in the debate on measures to promote sustainability. On the other hand, it is important to point out that the degree of freedom that political decisions on social wealth possess is limited by the existing technical conditions (that is, by the development level of the productive forces, in the terms normally used in the context of Historical Materialism). Therefore, if it

is objectively possible to assert the nonexistence of any autonomy of the economy in relation to politics, contrary to what neoclassicals seek to do, it is also not possible to state that political decisions can overlap with the technical conditions that define the limits of economic efficiency. Therefore, economy and politics are inseparable activities. As discussed in the fifth section, recognition of this indivisibility, in turn, implies a radical democratization of society, such that its material reproduction becomes guided by direct and objective assessments of social needs, rather than by the capital accumulation.

References

Alcântara, N. *Lukács*: ontologia e alienação. São Paulo: Instituto Lukács, 2014. Disponível em: https://www.institutolukacs.com.br/single-post/2015/04/02/luk%C3%A1cs-ontologia-e-aliena%C3%A7%C3%A3o. Acesso em set. 2022.

Baarsma, B; Lambooy, J. G. Valuation of externalities through neo-classical methods by including institutional variables. *Transportation Research Part D*, 10, 459-475, 2005.

Beck, R.; Di Nino, V.; Stracca, L. Globalisation and the efficienct-equity trade-off. *Working Paper Series*, 2546, 2021. Disponível em: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3841555. Acesso em set. 2022.

Clouscard, M. *Les métamorphoses des luttes des classes*: pour une alternative progressiste. Paris: Les temps des cérises, 1996.

Clouscard, M. *Refondation progressiste*: face à la contre-révolution libérale. Paris: L'Harmattan, 2003.

Felipe, F.; McCombie, J. S. L. The aggregate production function: 'not even wrong'. *Review of Political Economy*, 26(1), 60-84, 2014.

Gala, P. A teoria institucional de Douglas North. *Revista de Economia Política*, 23(90), 276-292, 2003.

Garcia Filho, D. P.; *Guia Metodológico - Análise-diagnóstico de sistemas agrários*. Brasília, INCRA/FAO, 1999. Disponível em: http://beneweb.com.br/outros-autores.php, Acesso em jul. 2023.

Gorz, A. Leur écologie et la nôtre. *Le monde diplomatique*, abril de 2010, p. 28 [1974]

Guerrien, B. *La théorie néo-classique*. Bilan et perspectives du modèle d'équilibre général. Paris: Économica, 1989.

Harribey, J.-M., *La richesse, la valeur et l'inestimable*: fondements d'une critique socio-écologique de l'économie capitaliste. Paris: Les Liens qui Libèrent, 2013.

Hoffmann, R.; Cunha, M. S. da. Valores-trabalho e preços de produção em sistemas econômicos sraffianos com terra homogênea. *RBE*, 55(1), 53-76, 2001. Disponível em: https://www.scielo.br/j/rbe/a/GJmjTD3L8xTj5SMptCRL-43g/?lang=pt. Acesso em set. 2022.

Husson, M. Reprendre le controle. *In*: Etiévant, G.; Neveu, N. (Eds.) *Le coût du capital*, Paris: Bruno Leprince, 2014.

Lacey, H. *Is Science value free?* Values and scientific understand. London and New York: Routledge, 1999.

Laibman, D. Rhetoric and Substance in value theory: an appraisal of the new orthodox marxism. *In*: Freeman, A.; Kliman, A.; Wells, J. (Eds.) *The New Value Controversy and the Foundations of Economics*. Cheltenham, UK; Northampton, USA: Edward Elgar Publishing, Inc., 2004.

Latouche, S. Haverá uma vida após o desenvolvimento? *Estudos de Sociologia*, 16(2), 217-230, 2010. Disponível em: https://periodicos.ufpe.br/revistas/revsocio/article/view/235295/28293. Acesso em set. 2022.

Loureiro, M. R.; Abrucio, F. L. Democracia e eficiência: a difícil relação entre política e economia no debate contemporâneo. *Revista de Economia Política*, 32, 4(129), 615-633, 2012. Disponível em: https://www.researchgate.net/publication/262762204. Acesso em set. 2022.

Lukács, G. *Ontologie de l'être social:* le travail, la reproduction. Paris: Éd. Delga, 2011.

Machado, E. R. Os limites da democracia burguesa e a prática política elitista. *Lutas Sociais*, 3, 123-138, 1997.

Marx, K. *O capital,* Livro I. São Paulo: Boitempo, 2011

[1867].

Marx, K. *O capital,* Livro III. São Paulo: Boitempo, 2017 [1894].

Marx, K. *Sobre a questão judaica*. São Paulo: Boitempo, 2010.

Morishima, M. *Marx's Economics*: a dual theory of value and growth**.** Cambridge: University Press, 1973.

Netto, J. P. *Lukács e a crítica da filosofia burguesa*. Lisboa: Seara Nova, 1978.

Netto, J. P.; Braz, M. *Economia política*: uma introdução crítica. São Paulo: Cortez, 2006.

Pareto, V. *Manual de economia política*. São Paulo : Ed. Nova Cultural, 1996.

Piketty, T. *Le Capital au XXIème siècle*. Paris: Seuil, 2013.

Polanyi, K. *A grande transformação:* as origens da nossa época*.* Rio de Janeiro: Ed. Campus, 1980.

Possas, M. L. Eficiência seletiva: uma perspectiva neo-Schumpeteriana evolucionária sobre questões econômicas normativas. *Revista de Economia Política*, 24(93), 77-99, 2004. Disponível em: https://www.scielo.br/j/rep/a/JWP-9J7b79vsfDZWm8bfGXvx/?lang=pt. Acesso em set. 2022.

Sen, A. *Sobre ética e economia*. São Paulo: Companhia das Letras, 1988.

Steffen, W. *et. al*. Planetary boundaries: guiding human development in a changing planet. *Science*, 347, 2015. Disponível em https://www.researchgate.net/publication/270898819_%27. Acesso em set. 2022.

Silva Neto, B. A promoção do desenvolvimento sustentável e a teoria marxista dos preços: a importância das rendas diferenciais na teoria dos preços de Marx. *Desenvolvimento em Questão,* 16(44), 9-41, 2018. Disponível em: https://www.revistas.unijui.edu.br/index.php/desenvolvimentoemquestao/article/view/6896. Acesso em set. 2022.

Silva Neto, B. Trabalho, reprodução material e formação dos preços no desenvolvimento capitalista. *Desenvolvimento em Questão*, 8(53), 10-31, 2020a. Disponível em: https://www.revistas.unijui.edu.br/index.php/desenvolvimentoemquestao/article/view/10580. Acesso em set. 2022.

Silva Neto, B. *Com Marx, para além de Marx*: ensaios sobre riquezas, valores e preços. Rio de Janeiro: Ed. Telha, 2020b.