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On Marx and accounting: An empirical study of the transformation of values into prices of production in the Brazilian contemporary economy, 2010-2022

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Abstract:
The purpose of this paper is to present some notes on the contemporary Brazilian economy between 2010 and 2022, translating items from the value added statement (VAS) and the balance sheet of a sample of 48 companies that make up the Bovespa Index (Ibovespa, in Portuguese) portfolio into Marxist economic theory.
The information was obtained from InvestSite (https://www.investsite.com.br/) and Economatica (https://economatica.com/) databases. In this sense, we observed some general trends and countertrends of real competition in the Brazilian economy, based on the empirical formulation of the concepts of constant capital, variable capital, surplus-value, turnover of capital, cost-price, price of production, rate of profit, and rate of surplus-value. In this way, we hope to contribute to a research agenda on the criteria for production and appropriation of surplus-value in Brazil, as well as to use the Marxian procedure of transformation of values into prices of production as a macroeconomic tool.

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1. Marx's theory of value and the methodological difference between national accounts and accounting

In *The Method of Political Economy*, Marx (1993a, p. 100-108) presents the procedure for investigation that would guide him in the elaboration of the price definitions in *Capital*. The first step of the method, the path from concrete to abstract, had already been exhaustively followed by representatives of classical political economy.

> The economists of the seventeenth century, e.g., always begin with the living whole, with population, nation, state, several states, etc.; but they always conclude by discovering through analysis a small number of determinant, abstract, general relations such as division of labour, money, value, etc. (Marx, 1993a, p. 100).

Marx recognizes that Adam Smith and David Ricardo also started from the concrete data of the quantitative relation between different commodities to construct the economic dimension of the concept of value. The failure of classical political economy, according to Marx, is that it never completed the second step of the method, that is, the return to the concrete as concrete in thought.[1] It is not enough to identify the origin of value in labour without returning to exchange value as a form of manifestation of value. Without moving from the abstract to the concrete in thought, political economy cannot identify the historical character of its findings and only sees natural forms in the simplest categories of capitalism.

> It is one of the chief failings of classical political economy that it has never succeeded, by means of its analysis of commodities, and in particular of their value, in discovering the form of value which in fact turns value into exchange-value. Even its best representatives, Adam Smith and Ricardo, treat the form of value as something of indifference, something external to the nature of the commodity itself. The explanation for this is not simply that their attention is entirely absorbed by the analysis of the magnitude of value. It lies deeper. The value-form of the product of labour is the most abstract, but also the most universal form of the bourgeois mode of production; by that fact it stamps the bourgeois mode of production as a particular kind of social production of a historical and transitory character. If then we make the mistake of treating it as the eternal natural form of social production, we necessarily overlook the specificity of the value-form, and consequently of the commodity-form together with its further developments, the money form, the capital form, etc. We therefore find that economists who are entirely agreed that labour-time is the measure of the magnitude of value, have the strangest and most contradictory ideas about money, that is, about the universal equivalent in its finished form (Marx, 1992a, p. 174, footnote n. 34).

Marx insists that this last step, of admitting exchange value as a form of manifestation of value, corresponds to the understanding of the historical character of capitalist production. But what does it mean to carry out this second step of Marx's *critique* as a method and how does accounting differ from national accounts in this task? According to Shaikh and Tonak (1996, p. 2), the basic problem with the national accounts methodology is that it does not distinguish between "productive activities" and "unproductive activities", and, in fact, certain economic activities result in the real addition of social wealth beyond that consumed. However, other economic activities configure mere social forms of consumption of the wealth produced or also relatively autonomous forms of capital that act to preserve and maintain a certain concrete social formation.

Along these lines, in our understanding, records in companies' accounting books and reports from manufacturing inspectors, among other documents of this type, are, to a large extent, the concrete from which the economic theory of Marx starts. This information expresses the core of principles and practices in his historical time that will constitute modern business accounting. As Bryer (1999) argues, such principles are not only consistent with the critique of political economy but also help to operationalize the Marxian theory of surplus-value. In this sense, we propose that the procedure for transforming values into prices of production, formulated by Marx in chapters 8, 9 and 10 of Volume 3 of *Capital*, consists precisely of the qualitative transition from individual capital (company) to total capital (economy). This procedure, in turn, is not a neoclassical microfoundation of macroeconomics, as real competition implies that the surplus-value effectively appropriated by a company is not necessarily produced by it, but it is the expression

[1] We comprehend the ontological critique of Duayer (2020), among others, against the idea that *rising from the abstract to the concrete and to the concrete in thought* would be the scientific method of Marx, but we consider that the possibility of a new social ontology beyond capitalism requires the positive development of Marx's critique of political economy. In this sense, the translation of accounting data into Marxist concepts, and its application towards a critique of contemporary Brazilian economy, is a contribution to a concrete analysis of the concrete situation whose theoretical foundations do not presuppose the totality as the sum of its constituent parts.

after the fact (*ex-post*) of the equalization of individual profit rates under the distributive principle of competition between individual capitals (Shaikh, 2016, chapter 7; Grespan, 2019, pp. 39-59).

Bryer (2017, p. 37) further states that, in theoretical terms, as in modern accounting, "Marx saw 'capital' as a 'social relation', a system of accountability that produced surplus-value for capitalists". However, the author does not consider that Marx derived or explained his economic theory from accounting but that he used it to explain phenomena described in companies' accounting records, such as *profit, fixed capital,* and *circulating capital*, among others. In a previous text, Bryer (2006) argues that Marxist theory indicates the role played by accounting in controlling the work process and the performance of companies in accordance with the interests of capital. This is due to the fact that accounting incorporates, in an incipient way, the law of value and leads to its fulfillment through methods and procedures that guarantee the validity of the financial statements of the capitalist company and its purpose of unlimited self-expansion of the capital invested for its owner.

When translating the items of the value added statement (VAS) and the balance sheet – as it is defined according to Brazilian legislation – into Marxist economic theory, the details of which will be presented in the next section, we take as a starting point the prices as they appear for companies in real competition. Therefore, there is no "transformation problem" but the transformation of values into prices of production, which is a theoretical mediation procedure for the analysis of competition through which the average rate of profit can be calculated. In other words, in order to return to concrete as concrete in thought, accounting data enable us to define an expression of the total surplus-value produced each year. In this way, we understand that the translation of information from modern accounting into Marxist economic theory allows, first, the determination of an economic totality and, second, the possibility of mapping the transfer of values between its departments.

There is definitely another operation at play in the case of national accounts. In the latter, the aggregated data are constituted by the sum of the parts. The masses of profits and wages do not reveal the relation they have with each other when they simply appear juxtaposed; nor do they indicate that it is the power to command living labor that is precisely what forges the relation between them. In this sense, we evaluate the use of accounting in an empirical Marxist study to complement other investigations that employ national accounts. To this end, this study is guided by the attempt to reproduce Marx's method, which requires the definition of a totality and the forms of participation in that same totality.

2. Marxist study of added values (EMVA, acronym in Portuguese)

The EMVA 1.0 database consists of a proposal for organizing the accounting information of companies mentioned in the Ibovespa index – the main indicator of the performance of shares traded on the Brazilian stock market – with the purpose of translating items from the VAS and the balance sheet into Marxist economic theory.[2] The objective is to analyze some general trends and countertrends of real competition in the Brazilian economy, as well as to map criteria of production and appropriation of total surplus-value. The study begins in 2010, as it was only after

[2] The accounting data comprising the Ibovespa's portfolio were organized and translated into EMVA by professors Leonardo Segura Moraes and Raquel de Azevedo, both from the Instituto de Economia e Relações Internacionais (IERI) of the Universidade Federal de Uberlândia (UFU), in Brazil. The EMVA 1.0 database is available for download (Azevedo and Moraes, 2024: EMVA 1.0).

Law no. 11.638 of 2007 that the Value Added Statement (VAS) became mandatory for publicly traded companies in Brazil (Assaf Neto, 2021, p. 102).[3]

In this paper, we present the theoretical foundation for an organization and translation into Marxist terms of the accounting information collected, as well as some general observations about contemporary Brazilian economy from 2010 to 2022, based on a sample containing data from 48 of the main companies in terms of volume of advanced capital listed on Ibovespa. The companies were separated into four departments of national production, as indicated by Marx (1992b, chapter 20-21; 1993b, chapter 16): D-I – Production of Means of Production, D-II – Production of Means of Consumption, D-III – Money-Dealing, and D-IV – Commercial.

It is important to highlight that, although Marx discusses in Volume 2 of *Capital* that capital employed in the specific functions of transport and storage should be viewed as "[…] a production process *within* the circulation process" (1992b, p. 229), when observing the global process of capitalist production, that is, capital in real competition, such activities act effectively only in the metamorphosis of expanded commodity-capital into money (M'-D').

Table 1 – *Sample of Ibovespa companies by department of production*

Production of means of production (D-I)	Production of means of consumption (D-II)	Money-dealing (D-III)	Commercial (D-IV)
BRASKEM	ALPARGATAS	B3	CASAS BAHIA S.A.
CEMIG	AMBEV	BANCO PAN	CCR SA
ELETROBRAS	BRF SA	BRADESCO	ECORODOVIAS
EMBRAER	COGNA ON	BRADESPAR	GOL
ENERGISA	CYRELA	BRASIL	IGUATEMI S.A
GERDAU	GUARARAPES*	BTGP BANCO	LOCALIZA
KLABIN S/A	JBS	CIELO	LOJAS RENNER
PETROBRAS	MARFRIG	ITAUUNIBANCO	MAGAZ LUIZA
SABESP	MINERVA	ITAUSA	MULTIPLAN
SID NACIONAL	MRV	PORTO SEGURO*	P. ACUCAR-CBD
VALE	SLC AGRICOLA	QUALICORP	RAIADROGASIL
WEG	ULTRAPAR	SANTANDER BR	RUMO S.A.

* Companies not listed on Ibovespa, but with shares traded on B3 (also known as Bovespa). Given the absence of a company within the textile branch with VAS information available for the entire period of 2010 to 2022 in the Ibovespa index in February 2024, we decided to include it in the sample so that the sample would contain a representative of the textile branch. In the case of the company Grupo de Moda Soma S.A., although it was listed on the Ibovespa in February 2024, we found only VAS information from 2017 onwards. In the case of Porto Seguro, it is listed on the BM&FBOVESPA Financeiro index (IFNC B3).

Source: EMVA 1.0.

2.1. Sample of companies listed in Ibovespa

The scarcity of research that deals with companies' accounting information to analyze the Brazilian economy from a critical perspective is a fact that draws attention, given the number of references and citations from reports and accounting records that can be observed, for example, in Marx's *Capital* (1992a; 1992b; 1993b) and in Kalecki (2007). Some notable exceptions are

[3] See: https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/lei/l11638.htm

Maldonado Filho (1989, 1996) and Loural (2016). Other examples are the studies by Centro de Estudos do Instituto Brasileiro de Mercado de Capitais (CEMEC-IBMEC. One example is Note CEMEC 08/2015, which deals with the relation between investment and recession in the Brazilian economy between 2010 and 2015; Pinto et al. (2019) analyze the economic and political situation in Brazil from 2016 to 2018 through some accounting information from companies and their profitability indicators, demonstrating how the intensification of the class struggle in the period ended up turning into a structural crisis.

In order to analyze the evolution of the rate of profit and its determinants in the Brazilian economy for the period from 2010 to 2022, we delimited that in departments D-I and D-II there is production of surplus-value at a global level and in D-III and D-IV there is none, as the latter corresponds to the sphere of circulation of capital, whether in the form of money-dealing capital or of commercial capital.

2.2. List of selected accounting items

- Constant Capital (c)
  - Circulating (c_c)
    - Custos Prods., Mercs. e Servs. Vendidos (Costs of Products, Commodities and Services Sold) (1)
    - Materiais, Energia, Servs. de Terceiros e Outros (Materials, Energy, Third-Party Service, and Others)
    - Perda/Recuperação de Valores Ativos (Loss/Recovery of Active Values) (2)
    - Outros (Others)
    - Amortização de mais valia de ativos (Amortization of surplus-value of assets) (3)
    - Depreciação, Amortização e Exaustão (Depreciation, Amortization, and Depletion) (4)
  - Fixed (c_f)
    - Intangível líquido (Net Intangible Assets)
    - Imobilizado (Property, Plant, and Equipment – PP&E)
    - Estoques (Stocks) (5)
- Variable Capital (v)
    - Remuneração Direta (Direct Payment)
    - Benefícios (Benefits) (6)
    - FGTS (Fund of Guarantee of Time of Service)
- Total Revenues → ($Revenues_{total} = RT_1 + RT_2 + RT_3 + RT_4$)
    - Valor Adicionado Recebido em Transferência (Added Value Received in Transfer)
    - Vendas de Mercadorias, Produtos e Serviços (Sell of Commodities, Products, and Services) (7)
    - Outras Receitas (Other Revenues) (8)
    - Provisão/Reversão de Créds. Liquidação Duvidosa (Provision/Reversion of Doubtful Liquidation)
- Surplus-Value (s)
    - Surplus-value produced ($s_p = RT_2 + RT_3 + RT_4 - c_c - v$)
    - Surplus-value appropriated ($s_\alpha = RT_{total} - c_c - v$)
- Division of Appropriated Surplus-Value (t, j, h)

    - Impostos, Taxas e Contribuições (t) (Levies, Taxes, and Excises) (9)
    - Remuneração de Capitais de Terceiros (Payment to Third-Party Capital Providers) (j)
        - Juros (Interests)
        - Aluguéis (Renting)
        - Outras (Others)
    - Remuneração de Capitais Próprios (Payment to Capital Providers) (h)
        - Juros sobre o Capital Próprio (Interests on Equity)
        - Dividendos (Dividends)
        - Lucros Retidos/Prejuízo do Período (Accrued Profits/Losses in the Period) (10)
- Other Accounting Items
    - Ativos Totais (Total Assets)
    - Patrimônio Líquido (Equity)

Considering the definitions contained in Assaf Neto (2021) and in the Commission on Accounting Statements about the VAS (CPC, acronym in Portuguese) technical document no. 9 (CPC, 2008), we assume as circulating constant capital (c_c) the sum of constant capital that enters in one period of turnover in the formation of commodities' values. By doing this, we include the depreciation of fixed capital. To do so, we added the items Insumos Adquiridos de Terceiros (Inputs Purchased from Third Parties) and Depreciação, Amortização e Exaustão (Depreciation, Amortization, and Depletion) found for each company's reports. In turn, the fixed constant capital (c_f) is constituted by the items Imobilizado (PP&E), Intangível Líquido (Net Intangible Assets), and Estoques (Stocks). Although Estoques is by definition circulating capital, it acts as fixed capital in accounting statements.[4] Variable capital (v) was calculated from the data collected in item Distribuição do Valor Adicionado (Distribution of Added Value).

The mass of surplus-value produced (s_p) consists of the sum of all revenues ($Revenues_{total}$), not considering the "Valor Adicionado Recebido em Transferência" (Added Value Received in Transfer) (RT_1), less the amount of circulating constant capital and variable capital ($c_c + v$), that is, the cost-price of the company (k). On the other hand, the mass of the surplus-value appropriated (s_α) is the result of the sum of all revenues ($Revenues_{total}$) less the cost-price (k). In other words, one considers not only the surplus-value produced by individual capital but also the surplus-value appropriated from other spheres of production, "like financial revenues, equity equivalence, dividends, renting, royalties, etc." (CPC, 2008, p. 4, our translation)[5]. From Receitas (Revenues), one deduces the company's consumed circulating constant capital and variable capital to obtain the mass of surplus-value appropriated by the end of one period of turnover (one year). The other deductions that characterize the division of appropriated surplus-value appear in the items Impostos, Taxas e Contribuições (Levies, Taxes, and Excises) (t), Remuneração de Capitais de Terceiros (Payments to Third-Party Capital Providers) (j), and Remuneração de Capitais Próprios (Payment to Capital Providers) (h).

2.3. Economic indicators

Based on this organization of companies' accounting information in the EMVA 1.0 database, we propose the construction of micro and macroeconomic indicators. As Germer (2022) argues,

[4] On the subject, see "Methodological notes on accounting items" in the appendix.

[5] "Como por exemplo receitas financeiras, de equivalência patrimonial, dividendos, aluguel, royalties, etc".

the importance of capital turnover must be considered when calculating the individual profit rate. To do so, we based the formulation of the individual profit rate for each company on Jefferies (2022, p. 2). Therefore, the economic indicators calculated are:

- Rate of exploitation or rate of surplus-value: $\frac{s_\alpha}{v}$
- Organic composition of capital: $\frac{c_f + c_c}{v}$
- Number of turnovers of the variable capital: $T_v = \frac{Revenues_{total}}{v}$
- Variable capital advanced: $v_a = \frac{v}{T_v}$
- Number of turnovers of the constant capital: $T_c = \frac{Revenues_{total}}{c_c}$
- Constant capital advanced: $c_{c_a} = \frac{c_c}{R_c}$
- Individual rate of profit after discounts and incorporating the turnover of capital:

$$r' = \frac{s_\alpha}{c_{f1} + c_{f2} + c_{f4} + c_{c_a} + v_a + t + j_1 + j_2 + j_3}$$

- Cost-price: $k = c_c + v$
- Value of commodities: $M' = k + s$
- Average profit rate: $r'_{average} = \frac{m_p(D_I + D_{II})}{[c(D_I + D_{II} + D_{III} + D_{IV})] + [v(D_I + D_{II} + D_{III} + D_{IV})]}$
- Price of production: $p_p = k + ([c + v] * r'_{average})$

For Marx (1993b, chapters 8 to 10), the determination of the cost-price and the price of production does not occur successively, or as Grespan (2019, p. 45, our translation) says, "[in] the permanent game of equalization and deviations, these different forms are established in one fell swoop"[6] ; however, in order to calculate indicators at a macroeconomic level, one must be careful with methodological strategies of simultaneous determination of values and prices because they can hide the source of profit (Kliman, 2001). In this way, the macroeconomic indicators must be understood as 'macro' at the level of an economy based on the sample of 48 companies. Our argument is that the procedure of the transformation of values into prices of production reflects the passage from micro to macro; also, that the sample is not only representative of the most important business entities in Brazil but also a spearhead of real competition in the Brazilian economy.

Thus, we consider the information collected for each company to be already accounting expressions of prices of production, given that the selected items cover the different asset evaluation criteria (Assaf Neto, 2021, p. 65), whether as fair value, adjusted present value, impairment test, or equity equivalence test.

3. The transformation of values into prices of production: a micro-macroeconomic synthesis

In Volume 1 of *Capital*, Marx demonstrates the nature of the production of capital and how it forges its specific relations of production, that is to say, the relation of wage-labour to capital. In Volume 2, Marx (and, one could add, Engels as well because of his editorial work), explains the movement of individual capital in three ways: as the circuit of money-capital,

$$M - C_L^{Mp} \ldots P \ldots C' - M'$$

[6] "No jogo permanente da equalização e dos desvios, essas formas diferentes se estabelecem de um só golpe".

as the circuit of productive capital,

$$P \dots C' - M' - M - C_L^{Mp} \dots P$$

and as the circuit of commodity-capital,

$$C' - M' - M - C_L^{Mp} \dots P \dots C',$$

where M is the amount of money-capital advanced, C_L^{Mp} is the first form of commodity-capital subdivided into an amount of value correspondent to the means of production (Mp) and another to the labour (L) both required, $\dots P \dots$ represents the passage of the sphere of circulation to the sphere of production, C' is the second form of commodity-capital in which is expressed the valorization, and M' is the valorization expressed in terms of money-capital.

The Marxian critique goes further, to investigate real competition among types of capital (capitals) and how it proceeds through the conversion of surplus-value into profit, the conversion of profit into average profit, and the transformation of values into prices of production. As is clear by the subtitle of Volume 3 of *Capital* – the process of capitalist production as a whole – at the level of the totality, values and prices of production are not necessarily equal for each individual capital because the general rate of profit is equalized through real competition.[7]

In table A1 (see appendix), with the accounting data for the companies of the sample, we reproduce the transformation of values into prices of production presented by Marx (1993b, chapter 9). In Marx's formulations, the aim of the procedure is to reconcile the law of value with individual capitals in competition. In other words, the purpose is to make compatible the circumstance according to which capitals with different compositions of constant and variable capital produce different amounts of surplus-value, but, due to competition, the individual different rates of profit are equalized into a general rate.

This means that the surplus-value appropriated by each individual capital does not come necessarily from the branch of production in which it operates, that is, from the specific exploitation in its sphere of production. The mass of profit added to the cost-price corresponds to the average mass of surplus-value produced by all individual capitals in the departments of production of the means of production (D-I) and production of the means of consumption (D-II). The profit appropriated in each department is due to it as an aliquot part of the total capital corresponding to the sample of selected companies.

Marx elaborates the procedure of transformation of values into prices of production with five branches of production. In EMVA, we replicate the same procedure by dividing total capital into four departments of production. In Marx's formulation, the relation between *branches* and *departments* of production is as follows: the set of branches composes a department, and the set of departments composes an expression of the national economy.

It is important to note that, in table A1, we incorporated an addition to the operation presented by Marx (1993b, chapter 9). While Marx considers the distribution of total surplus-

[7] "By 'equalization', Marx comprehends the phenomena related to the distribution of values among individual capitals in competition" ("Por 'equalização' Marx compreende os fenômenos relativos à distribuição de valores pela concorrência entre os capitais individuais", Grespan, 2019, p. 39, our translation). Grespan mentions as well that the German term used by Marx, *die Ausgleichung*, "[...] could also be translated as 'nivelation' or 'compensation', in the sense of a balance, of an operation by which the differences are compensated" ("[...] poderia também ser traduzido por "nivelação" ou "compensação", no sentido de um balanço, de uma operação pela qual diferenças são compensadas", ibid., our translation).

value only between departments in which surplus-value is produced, our proposal is to calculate the equalization of the rate of profit among the four departments considered as an expression of a totality called the Brazilian economy. This means that the procedure of transformation of values into prices of production for the sample of selected companies is an expression of the real competition in Brazil. Therefore, the aim is to include the departments that at the level of the totality appropriate only surplus-value. Although Marx indicates the need for this additional procedure in his discussion of commercial profit, the author never reconstructed the structure proposed in chapter 9 of Volume 3. In chapter 17 he says:

> If the purchase prices that the merchant pays for commodities are equal to their prices of production, and in the last analysis therefore to their values, so that the production price, and in the last instance the value of commodities, expresses the cost price to the merchant, then in fact the excess of his sale price over his purchase price – and this difference forms the only source of his profit – must be an excess of its commercial price over its production price, and in the last analysis the merchant sells all commodities above their values. But why did we assume that the industrial capitalist sold commodities to the merchant at their prices of production? Or rather, what was involved in this assumption? That merchant's capital (and here we are still dealing with this only as commercial, commodity-dealing capital) does not enter into the formation of the general rate of profit. In explaining the general rate of profit, we necessarily proceeded from this assumption, firstly because merchant's capital as such did not yet exist for us and secondly because the average profit, and therefore the general rate of profit, had necessarily to be developed as an equalization of the profits or surplus-values that are actually produced by industrial capitals in different spheres of production. In connection with commercial capital, on the other hand, we are dealing with a capital that takes a share in profit without participating in production. It is now necessary, therefore, to supplement the earlier presentation (Marx, 1993b, chapter 17, p. 397).

Thus, in table A1, we calculate the average rate of profit ($r'_{average}$) for each year, considering the sum of the surplus-value produced (s_p) in the departments that produce the means of production and the means of consumption, respectively, D-I and D- II, divided by the total capital advanced in the four departments (D-I, D-II, D-III, and D-IV). In turn, the production price (p_p) for each department was calculated by adding the cost-price (k) correspondent to the department to the average rate of profit applied to the advanced capital:

$$p_p = k + ([c + v] * r'_{average})$$

It is worth highlighting that, in this procedure, we do not use the surplus-value produced (s_p) nor the surplus-value appropriated (s_α) of the money-dealing and commercial departments, respectively, D-III and D-IV, as these departments do not contribute to the production of total surplus-value. There is no creation of surplus-value by departments D-III and D-IV at the level of the totality. The profitability of both departments is due to the ability of their companies to appropriate values produced in other departments of social production.

We verified that there is a difference between the sum of values ($\sum M'$) and the sum of prices of production ($\sum p_p$). For Marx (1993b, chapter 9), the identity between both terms is what guarantees the compatibility of the law of value with the behavior of individual capitals in competition. Distinct from the Marxian description reproduced below, in which the dynamics of value transfer occurs between the productive branches of social production, in this paper we consider the distribution of surplus-value between the departments in which there is creation of surplus-value (D-I and D-II) and those in which there is not (D-III and D-IV).

> Let us suppose that the five different capital investments in the above example, I-V, belong to one and the same person. The variable and constant capital consumed in the production of the commodities in each particular investment I-V would be given, and this share in the value of commodities I-V would obviously form a portion of their price, since this is the least price required to replace the portion of capital that is advanced and consumed. These cost prices would thus be different for each kind of commodity I-V and would be fixed differently by the proprietor. As far as the different masses of surplus-value or profit produced in I-V were concerned, however, the capitalist might very well count them all as profit on the total capital he advanced, so that a definite aliquot part would fall to each capital of 100. The cost prices would therefore be different for each of the commodities produced in the individual investments I-V; but the share of the sale price that arose from the profit added per 100 units of capital would be the same. The total price of commodities I-V would thus be the same as their total value, i.e. the sum of the cost prices I-V plus the sum of the surplus-value or profit produced; in point of fact, therefore, the monetary expression for the total quantity of labour, both past and newly added, contained in commodities I-V. And in the same manner, the sum of prices of production for the commodities produced in society as a whole – taking the totality of all branches of production – is equal to the sum of their values (Marx, 1993b, chapter 9, p. 259).

The difference observed in table A1 does not constitute an inconsistency, as it precisely designates the transfer of values from departments in which there is production of surplus-value to those in which there is not. In this sense, the difference between the sum of values and the sum of prices of production in the departments in which surplus-value is produced, $\sum M' - \sum p_p$, expresses how much surplus-value is transferred from D-I and D-II towards D-III and D-IV. In other words, the difference between the price of production and the cost-price in D-III and D-IV, $p_p - k$, indicates the absorption of values from these departments, given that the average profit they appropriate is effectively produced in D-I and D-II.

Just like industrial capital, represented by departments D-I and D-II, commercial capital, represented by departments D-III and D-IV, constitutes a phase of the process of capital reproduction as a whole and this is the reason why, according to Marx (1993b, chapter 17), capital that functions autonomously in the circulation process also appropriates the average profit. Table A1 translates, on the one hand, Marx's formulation that, from the point of view of total capital, commercial capital does not produce value or surplus-value, by indicating that the total surplus-value to be distributed comes from the departments D-I and D-II. On the other hand, it indicates, in terms of total capital, the concept of commercial profit, which Marx identifies with the fact that the merchant sells above the purchase price because the industrial capitalist sells him below the price of production,[8] indicating that the difference between values and prices of production corresponds to the sum of the values absorbed by D-III and D-IV in each year.

What the analysis of table A1 tells us is that, when considering commercial capital in the calculation of the average rate of profit, the nature of the identity between values and prices of production changes. The difference between them in the productive departments D-I and D-II corresponds exactly to the values absorbed by the unproductive D-III and D-IV.

4. Analysis of the Brazilian economy between 2010 and 2022

In table A1 (see appendix), the column that indicates the difference between the price of production (p_p) and the value of the commodities produced (M') allows us to state that, on the

[8] "If he [the merchant] still does not sell the commodities above their value or price of production, this is precisely because he bought them from the industrial capitalists below their value or price of production" (Marx, 1993b, p. 398).

one hand, departments of production of the means of production (D-I) and of production of the means of consumption (D-II) transfer values to departments of money-dealing (D-III) and commercial (D-IV). On the other hand, we also see that it is the department of production of the means of production (D-I) that transfers a higher share of value in the period analyzed. This trend reversed only in 2015 – the year that the lowest average rate of profit was recorded in the period – so that the department of production of the means of consumption, D-II, surpasses department D-I in transferring value to D-III and D-IV. Considering that, in the period studied, D-I presents a higher organic composition of capital than D-II, the data indicate a reversal of what was highlighted by Marx as the most labor-intensive branches transferring value to the less intensive ones. Only at the height of the crisis, in 2015, was the value transferred from D-II to D-III and D-IV higher than that from D-I. We therefore verified that, for the sample of companies, it is the department with the greatest organic composition of capital that transfers value to the others.

In the case of department D-I, the trajectory of the difference between $p_p - M'$ also stands out. Between 2014 and 2015, there was a significant reduction in the magnitude of the value transferred: in 2013, it was -R$ 57.220.991.000; in 2014 it fell to -R$ 32.599.457.000; and in 2015 it fell even more to -R$ 25.273.542.000, the lowest number of the period. From 2016 to 2022, the movement changes abruptly with the increase in the transfer of values by department D-I. To understand this characteristic, one must consider the weight of the companies Petrobras S.A. and Vale S.A. in industrial investments in the Brazilian economy (Loural, 2016, pp. 82-96), as well as the economic impacts of Operation Car Wash, between 2014 and 2022, especially on Petrobras S.A. (Borges, 14/09/2018), and the tragedies with dam collapses in Mariana and Brumadinho (both in Minas Gerais), in 2015 and 2019, respectively. Although it is not clear, it is possible that such tragedies had some impact on Vale S.A.'s profitability, for example, to the extent that the company's liability for socio-environmental damage may have affected investment decisions.[9]

Another aspect to be highlighted is that, in the period in which Dilma Rousseff's government induced a reduction in interest rates through the actions of public banks, between the years 2011 and 2013, department D-III appears to have reduced its absorption of values. The difference between the price of production and the cost-price, $p_p - k$, fell from +R$ 62.677.922.000 in 2011 to +R$ 46.779.238.000 in 2012, remained practically stable in 2013 at +R$ 47.410.442.000, decreased again in 2014 to +R$ 43.067.631.000, and did not change significantly in 2015, at +R$ 44.451.994.000. In 2016, there was a reversal of this movement towards a growth trend, with fluctuations in some years, reaching +R$ 57.590.347.000 in 2022. There was growth of 29,56% in the period from 2015 to 2022.

If we observe the situation at the time, there seems to be adherence to the reality of the facts. By reducing interest rates and expanding credit lines from Banco do Brasil and Caixa Econômica Federal, Dilma's government promoted, between 2011 and 2013, an effort to reduce the spread charged by the banking system. "The measure, which directly affected the banks' profits and was the great gesture of confronting the financial power of the period, was received with enormous ill will by analysts and representatives of the financial market" (Carvalho, 2018, p. 75, our

[9] In the spreadsheet with the data for each company in EMVA 1.0 (See Azevedo and Moraes 2024), the movement of the individual rate of profit of Petrobras S.A. and Vale S.A. seems to corroborate the observations. In the case of Petrobras S.A., see column AO, rows 834 to 846. Between the years 2013 and 2015, there was a significant fall in the profitability of the company, whereas the period between 2016 and 2021 were years of recovery. In the case of Vale S.A., see column AO, rows 1120 to 1132, with emphasis on the period between 2015 and 2019. In column AF, rows 1120 to 1132, the item Lucros Retidos/Prejuízos do Período (Accrued Profits/Losses in the Period, freely translated into English) registers, respectively, for each year of the tragedies, -R$ 45.996.622 and -R$ 8.696.040. It is worth highlighting that, in the following years of the aforementioned tragedies, the company Vale S.A. showed accrued profits of R$ 15.735.334 in 2016 and R$ 24.902.341 in 2020.

translation).[10] However, as Carvalho (2018) observes, "the reduction in interest rates in credit operations was certainly insufficient from the point of view of stimulating private investments" (ibid., p. 75, our translation).[11]

Table 2 – *Macroeconomic indicators of the Brazilian economy, 1999-2016*

	1999-2002	2003-2005	2006-2010	2011-2014	2015-2016
Minimum wage (% per year, in annual terms)	1.8	6.8	5.9	3.0	1.2
Commodity prices – IMF (% per year)	10.3	19.1	10.5	–7.0	–6.5
Federal investments (% per year, in real terms)	–2.0	–4.7	27.6	1.0	–28.4
GDP (% per year, in real terms)	2.3	3.4	4.5	2.3	–3.5
Household consumption (% per year, in real terms)	1.6	2.6	5.8	3.5	–3.8
Total investment (% per year, in real terms)	–1.2	2.0	9.1	2.2	–12.1
Exports (% per year, in real terms)	8.5	11.7	2.5	1.6	4.3
Inflation – IPCA (% per year)	8.8	7.5	4.7	6.2	8.5

Source: Carvalho (2018, p. 12, our translation).

Between 2011 and 2013, there was a varied impact of interest and credit policy on the individual rates of profit of each company in the money-dealing department (D-III).[12] In the case of Bradesco, there was a moderate upward trend in the sub-period from 2011 to 2013 ($\Delta\%r'$ from around 32% to around 36%), although it fell between 2012 and 2013 ($\Delta\%r'$ from around 37% to around 36%). In the same sense, with even greater increases in individual rates of profit, there are the cases of BTG Pactual, Itaú S/A and ItauUnibanco. In the case of BTG Pactual, $\Delta\%r'$ went from around 32% in 2011 to around 53% in 2013; in the case of Itaú S/A, $\Delta\%r'$ increased from around 24% in 2011 to around 86% in 2013; in the case of ItauUnibanco, $\Delta\%r'$ rose from around 34% in 2011 to around 40% in 2013. It is worth noting that, specifically between 2012 and 2013, BTG Pactual showed a fall in its individual profitability ($\Delta\%r'$ fell from around 64% to around 53%), while Itaú S/A and ItauUnibanco showed an increase ($\Delta\%r'$ went from around 24% to around 86% and from 34% to 40%, respectively). In the case of Banco do Brasil and Santander,

[10] "A medida, que atingia diretamente o lucro dos bancos e foi o grande gesto de enfrentamento com o poder financeiro do período, foi recebida com enorme má vontade por analistas e representantes do mercado financeiro".

[11] "A redução dos juros nas operações de crédito certamente deixou a desejar do ponto de vista do estímulo aos investimentos privados".

[12] In the spreadsheet with the data for each company in the file EMVA 1.0, see column AO, rows 86 to 98 (B3), 104 to 116 (Banco Pan), 130 to 142 (Bradesco), 143 to 155 (Bradespar), 156 to 168 (Banco do Brasil), 195 to 207 (BTG Pactual), 256 to 268 (Cielo), 639 to 651 (ItauUnibanco), 626 to 638 (Itaúsa), 873 to 885 (Porto Seguro), 899 to 911 (Qualicorp), and 977 to 989 (Santander).

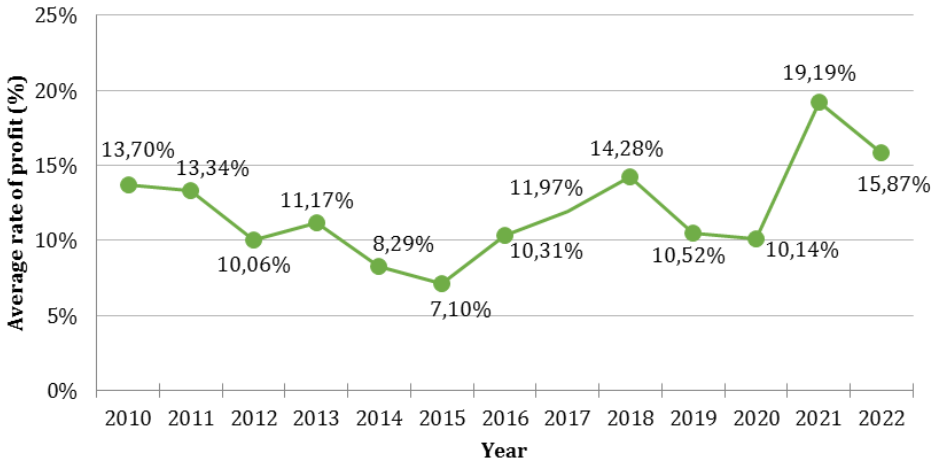
however, what is observed is a downward trajectory in the sub-period from 2011 to 2013. For Banco do Brasil, $\Delta\%r'$ fell from around 24% in 2011 to around 22% in 2013; for Santander, $\Delta\%r'$ decreased from around 17% in 2011 to around 9% in 2013. Between 2012 and 2013, Banco do Brasil's $\Delta\%r'$ remained stable at around 22%; for Santander, $\Delta\%r'$ fell from around 12% in 2012 to around 9% in 2013.

In the case of Cielo, it is worth highlighting that, although the company is in the money-dealing department, its specific activities are restricted to providing financial services for capturing, transmitting, and settling debit and credit card transactions. Therefore, it is not a bank, as Cielo's operations are restricted to providing electronic payment services. Thus, between 2011 and 2013, the strong fall in $\Delta\%r'$ (from around 117% in 2011 to 83% in 2013) is probably associated with the fall in household consumption and the reduction in the minimum wage growth in the period from 2011 to 2014, compared to the period from 2006 to 2010, as seen in table 2.

As can be seen in the data in table 2, between 2011 and 2014 the variation in total investment in the Brazilian economy was 2,2% per year, lower than that observed between 2006 and 2010, which was 9,1% per year. Between 2015 and 2016, the variation was -12,1% per year. Despite the low growth trend in the second half of the last decade, what the analysis of the data in table A1 (see appendix) indicates is that, from 2016 onwards, there was a recovery in the average rate of profit for the sample of selected companies. Between 2010 and 2015, the sample's average rate of profit trended downward, from 13,7% to 7,1%, although with a small upward oscillation between 2012 (10,06%) and 2013 (11,17%).

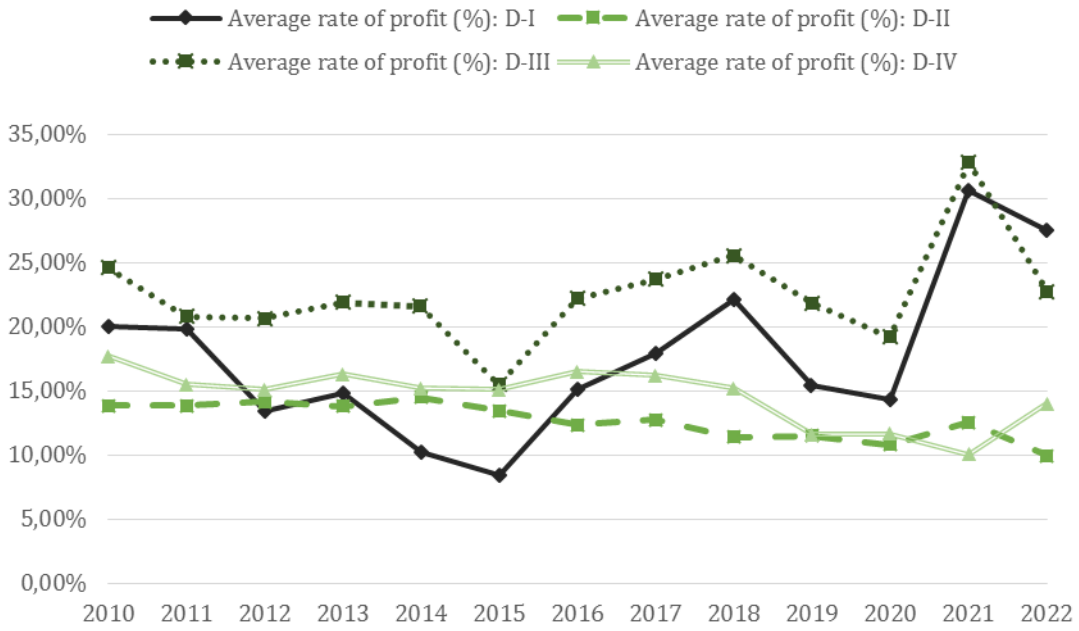
Between 2013 and 2015, there seems to have occurred an intensification of the profitability crisis, when the average rate of profit in the sample fell until it reached its lowest level in 2015. This period of crisis was followed by a period of recovery until 2018 (when the average rate of profit in the sample reached 14,28%). In 2020, there is a sign of a fall in the average rate of profit in the sample, probably due to the economic consequences of the COVID-19 pandemic, but it remained relatively stable between 2019 (10,52%) and 2020 (10,14%). Subsequently, the average rate of profit in the sample recovered significantly at the end of 2021 (19,19%) and declined again in 2022 (15,87%).

Figure 1 – *Average rate of profit in the sample, 2010-2022*



Source: EMVA 1.0.

Figure 2 – *Average rate of profit in the sample for each department, 2010-2022*



Source: EMVA 1.0.

Table 3 – *Real annual variation in gross fixed capital formation (FBKF) in Brazil, 2010-2021*

Year	Real annual Δ% of FBKF
2010	17.85
2011	6.83
2012	0.78
2013	5.83
2014	–4.22
2015	–13.95
2016	–12.13
2017	–2.56
2018	5.23
2019	4.03
2020	–1.75
2021	16.49
Average (2010-2015)	**2.19**
Average (2016-2021)	**1.55**

Source: IBGE/SCN.

Marquetti et al. (2023, p. 320) also observed an increase in the average rate of profit in the Brazilian economy between 2016 and 2020, even though they use data from national accounts and another methodology for estimation. What is worth highlighting is that the recovery in profitability from 2016 onwards occurred with a slowdown in capital accumulation. As can be seen in table 3, if between 2010 and 2015 the average growth in gross fixed capital formation was 2,19% per year, between 2016 and 2021 it was only 1,55% per year. The period from 2014 to 2017 stands out as a negative sequence.

It remains to be explained how the average rate of profit in the sample could recover from 2016 onwards, considering that the average annual percentage variation in gross fixed capital formation was lower (1,55%) than that observed in the first half of the decade (2,19%). One possible explanation is that there was an increase in the rate of surplus-value and a reduction in the organic composition of capital in the period considered (see table 4). Since the rate of surplus-value is given by

$$s' = \frac{s}{v}$$

the rate of profit corresponds to

$$r' = \frac{s}{c+v}$$

the organic composition of capital is equal to

$$\frac{c}{v}$$

then the relation between s' and r' can be expressed as:[13]

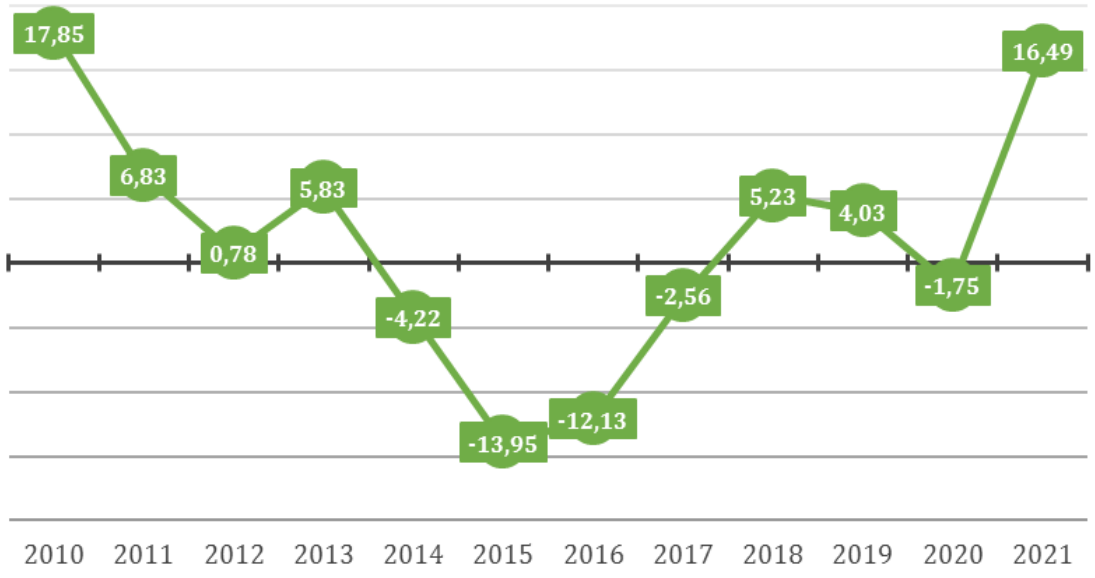
$$r' = \frac{s\prime}{(\frac{c}{v})+1}$$

As Marx said, "rate of profit is to rate of surplus-value as variable capital is to total capital" (Marx, 1993b, p. 142).

According to data from the EMVA 1.0 database, the average rate of surplus-value in the sample was 229% in 2010, fell to 130% in 2015 and began a recovery trajectory until reaching, in 2022, 298% (see figure 4). Marquetti et al. (2020), using data from national accounts, pointed out that, between 2011 and 2014, there was a relative reduction in the share of profits in national income due to the growth in real wages above labour productivity. However, from 2015 onwards, there was an increase in the share of profits in national income, while from 2014 onwards real wages began a downward trend. Martins and Rugitsky (2021), in turn, found a cyclical compression of profits between 2009 and 2014, which played an important role in worsening the political crisis that began in 2013. Therefore, the recovery in profitability from 2016 onwards appears to be associated, at least in part, with the increase in labour exploitation as a political reaction to the flattening of profits in the previous period.

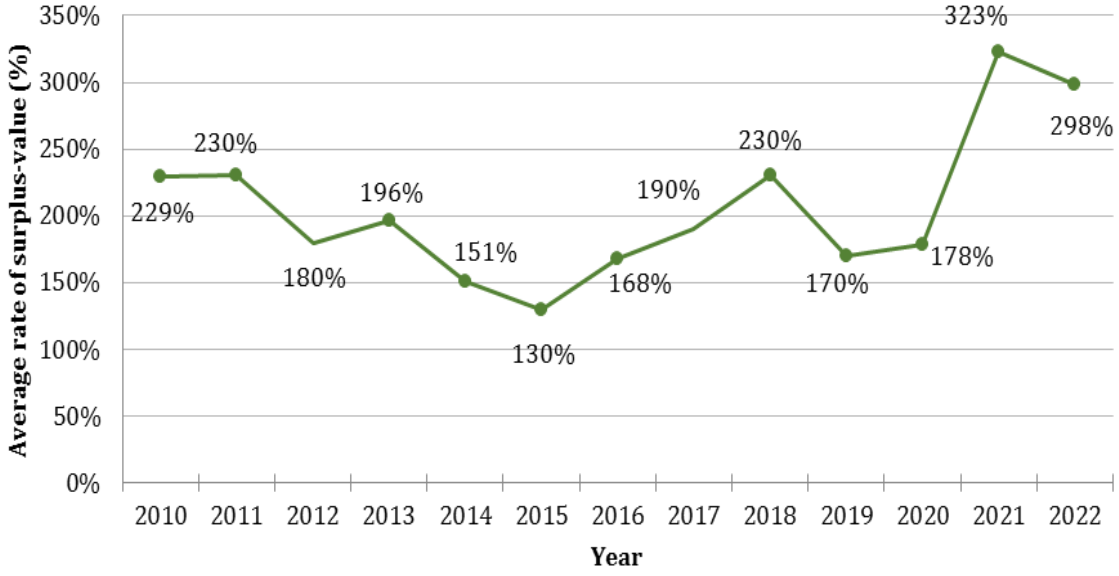
[13] A discussion of this relationship is presented in Marx (1993b, chapter 3). One can demonstrate such a formula by taking the rate of profit ($r' = \frac{s}{c+v}$) and dividing both numerator and denominator by v: $r' = \frac{s/v}{c/v+v/v} = \frac{s\prime}{(\frac{c}{v})+1}$.

Figure 3 – *Real annual Δ% of FBKF in Brazil, 2010-2021*



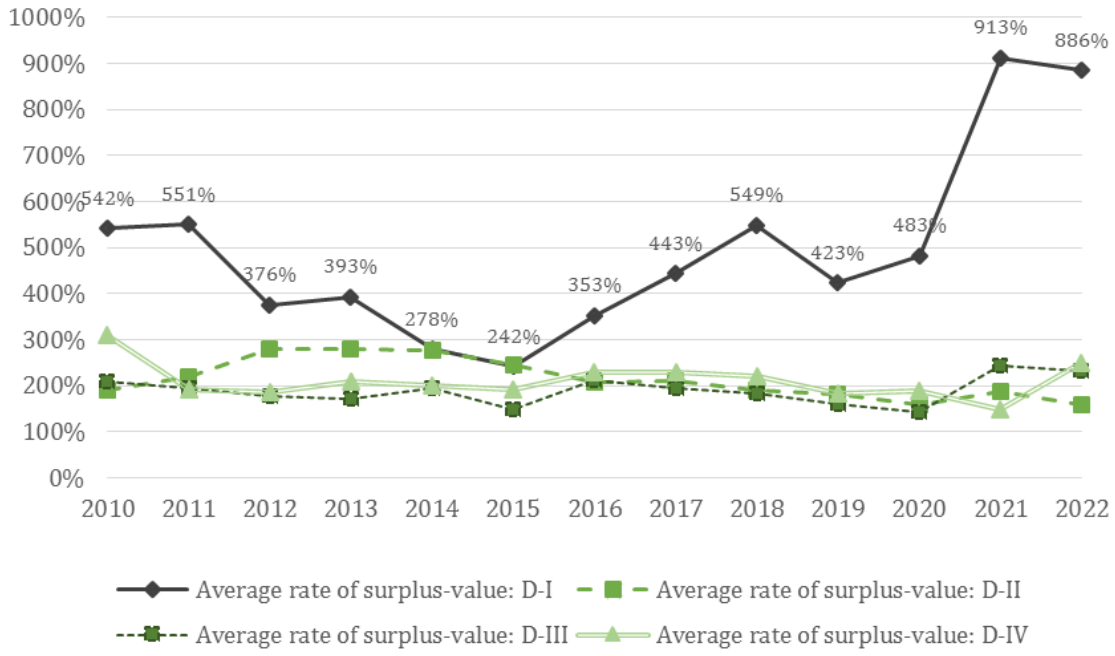
Source: IBGE/SCN; our elaboration.

Figure 4 – *Average rate of surplus-value in the sample, 2010-2021*



The particular movements of the series of the rate of surplus-value in departments D-I in comparison to D-II, D-III, and D-IV must be noted (see figure 5). In fact, the movement of the average rate of surplus for the sample of companies basically reflects the trend of D-I. In the case of, D-II, D-III, and D-IV, although oscillating over the years, the movement is quite different from what can be observed in D-I and indicates that the recovery in the rate of surplus-value after 2015 was basically carried out by the department of production of the means of production (D-I).

Figure 5 – *Average rate of surplus-value in the sample for each department, 2010-2022*



Source: EMVA 1.0.

Figure 6 illustrates for the sample of companies the behavior of the organic composition of capital $\left(\frac{c}{v}\right)$ in relation to the movement of the average rate of surplus-value ($s' = \frac{s}{v}$) in the period analyzed. Regarding the organic composition of capital, Marx (1996, chapter 25) argues:

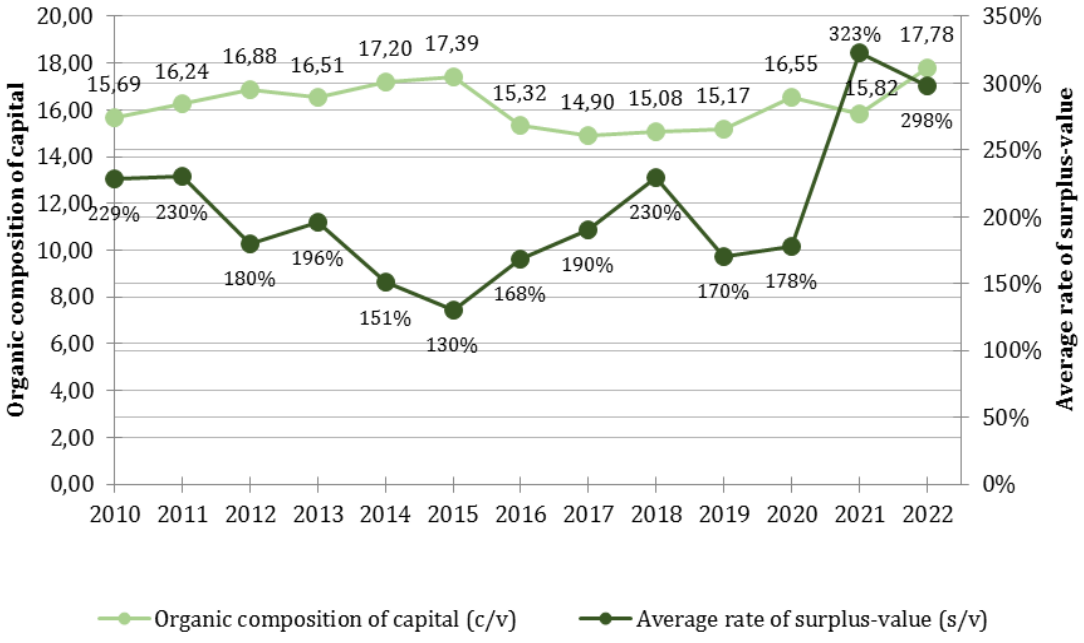
> As material, as it functions in the process of production, all capital is divided into means of production and living labour-power. This latter composition is determined by the relation between the mass of the means of production employed on the one hand, and the mass of labour necessary for their employment on the other. I call the former the value-composition, the latter the technical composition of capital. There is a close correlation between the two. To express this, I call the value-composition of capital, in so far as it is determined by its technical composition and mirrors the changes in the latter, the organic composition of capital. Wherever I refer to the composition of

capital, without further qualification, its organic composition is always understood (Marx, 1992a, chapter 25, p. 762).

It seems clear, therefore, that the concept of organic composition of capital has two dimensions. The first one expresses the values of the means of production and labour power mobilized for production, which is its value composition. The second expresses the amount of labour – dead and alive – required for production, which is its technical composition.

> The distinction between technical composition and value composition shows itself in every branch of industry by the way the value ratio between the two portions of capital may change while the technical composition remains constant, whereas, with a changed technical composition, the value ratio may remain the same (Marx, 1993b, chapter 8, p. 244-245).

Figure 6 – *Average rate of surplus-value (s′) and organic composition of capital ($\frac{c}{v}$) of the companies in the sample, 2010-2022*



Source: EMVA 1.0

Marx (1993b, chapter 7) adds new elements to the relation between the organic composition of capital and the rate of profit by explaining that a change in the value of the composition of capital can occur due to a change in the reproduction time of its constant and variable parts. If this change in the circumstances of reproduction of the elements of capital alters the proportions between constant capital and variable capital in the organic composition, "[...] if other circumstances remain the same, the profit rate will rise with a relatively rising share of variable capital and fall with a relatively falling share" (Marx, 1993b, chapter 7, p. 238).

According to the empirical observation of the mentioned formula ($r' = \frac{s'}{(\frac{c}{v})+1}$), which expresses the relation between the profit rate ($r' = \frac{s}{c+v}$), the rate of surplus-value ($s' = \frac{s}{v}$), and the organic composition of capital ($\frac{c}{v}$), the behavior of r', s' and $\frac{c}{v}$ in the EMVA 1.0 database corresponds to Marx's theoretical formulation. Between 2010 and 2015, the downward trend in the average rate of profit (from 13,70% in 2010 to 7,10% in 2015) was accompanied by an increase in the organic composition of capital during the period (fluctuating from 15,69 in 2010 to 17,39 in 2015), whose impact on profitability seems to have been reinforced by a downward trend in the average rate of surplus-value (varying from 229% in 2010 to 130% in 2015).

From 2016 onwards, although with fluctuations, the direction of both the average rate of profit (10,31% in 2016; 14,28% in 2018; and 15,87% in 2022) and the average rate of surplus-value (168% in 2016; 230% in 2018; and 298% in 2022) were reversed. The organic composition of capital remained relatively stable upwards (15,32 in 2016; 15,08 in 2018; and 17,78 in 2022).

According to Marx, assuming that

> [...] this gradual change in the composition of capital does not just characterize certain individual spheres of production, but occurs in more or less all spheres, or at least the decisive ones, and that it therefore involves changes in the average organic composition of the total capital belonging to a given society, then this gradual growth in the constant capital, in relation to the variable, must necessarily result in a gradual fall in the general rate of profit, given that the rate of surplus-value, or the level of exploitation of labour by capital, remains the same. (Marx, 1993b, chapter 13, p. 317-318).

By comparing the average annual percentage variation in the rate of profit ($\Delta\%_{average} r'$), in the rate of surplus-value ($\Delta\%_{average} \frac{s}{v}$) and in the organic composition of capital ($\Delta\%_{average} \frac{c}{v}$), as shown in table 4, the conclusion is that, in the period as a whole, there was an increase in the average rate of profit mainly due to greater labour exploitation (the average annual percentage variation in the rate of surplus-value between 2011 and 2022 was +6,74%). The growth in the organic composition of capital during the whole period was lower than the increase in the rate of surplus-value (the average annual percentage variation in the organic composition of capital between 2011 and 2022 was 1,23%).

By decomposing the analysis into two sub-periods, namely, from 2011 to 2015 and from 2016 to 2022, an empirical validation of the Marxist theoretical formulation is reinforced: in the first sub-period (2011 to 2015), the ($\Delta\%_{average} r'$) was -11,26%, and in the second sub-period (2016 to 2022), it showed a strong recovery of +17,52%; the ($\Delta\%_{average} \frac{s}{v}$) in the first sub-period (2011 to 2015) was -9,86%, while in the second sub-period (2016 to 2022), it was +20,58%; in turn, the ($\Delta\%_{average} \frac{c}{v}$) in the first sub-period (2011 to 2015) was +2,11%, and it fell in the second sub-period (2016 to 2022) to 0,61%.

If, in the sub-period from 2011 to 2015, the fall in the average rate of profit (r') seems to be explained, at least in part, by the decrease in the average rate of surplus-value, notably between 2011 and 2014, in the sub-period from 2016 to 2022 the sharp reduction in household consumption combined with relatively lower growth in the minimum wage, compared to the years 2006 to 2010 (see table 2), seems to indicate some apparent forms of greater exploitation of the labour power. The impact of the 2017 Labour Reform must also be considered, given that the average rate of surplus-value increased significantly between 2017 and 2018 (from 190% to 230%) and reached its highest level in 2021 (323%).

Table 4 – *Average annual percentage variation in the rate of profit, in the rate of surplus-value and in the organic composition of capital for the sample of selected companies, 2016-2021*

Period	Variation in the average rate of profit ($\Delta\%_{average} r'$)	Variation in the average rate of surplus-value ($\Delta\%_{average} \frac{s}{v}$)	Variation in the organic composition of capital ($\Delta\%_{average} \frac{c}{v}$)
2011-2022	5.52%	6.74%	1.23%
Sub-period 1: 2011-2015	–11.26%	–9.86%	2.11%
Sub-period 2: 2016-2022	17.52%	20.58%	0.61%

Source: EMVA 1.0.

Regarding the organic composition of capital $\left(\frac{c}{v}\right)$, it would be worth reflecting on the determining causes of its movement throughout the period as a whole, as well as on its behavior in the sub-periods. In this sense, considering that the decade of 2006 to 2016 showed a certain resurgence in inflation as measured by the IPCA (see table 3), combined with a compression of profits observed by the reduction in the share of profits in national income between 2011 and 2014 (Marquetti et al., 2020), even though between 2009 and 2014 there was already an intensification of the distributive conflict (Martins and Rugitsky, 2021), this explains, at least in part, the increase in the organic composition of the period due to the increase in the cost of variable (v) elements of capital. About the constant (c) elements of capital, its increase in terms of value must have been greater than the increase in variable capital, although other causes beyond inflation could explain its increment and are related to what Marx appointed as the use of science by capital and the economy in the employment of constant capital. In fact, these are expressions of the tendency towards increasing fixed capital as a characteristic feature of the development of capitalism. In any case, in the first sub-period (2011 to 2015), the average annual percentage variation in the organic composition of capital ($\Delta\%_{average} \frac{c}{v}$) was +2,11%. With the reduction of inflation, notably between 2016 and 2017,[14] it can be seen that the $\Delta\%_{average} \frac{c}{v}$ for the second sub-period (2016 to 2022) was +0,61%, clearly a lower growth.

Thus, it seems evident that the higher amount of value mobilized by the department of production of the means of production (D-I) in comparison with the other departments affects the transformation of values into prices of production. This seems to contradict what Marx discusses about the relation of the organic composition of capital and the profit rate. Following Marx (1993b, chapter 9), one must expect an indirect relation between them, that is to say, when the organic composition of capital rises, the profit rate goes down. This was clearly observed in the analysis

[14] According to the historical data series of IPCA (National Consumer Price Index, in English), between 2015 and 2017 there was a slowdown in the trajectory of inflation in Brazil. It was 10,67% cumulative in December 2015, fell to 6,29% cumulative in December 2016, and fell even more in the next year, when it was 2,95% cumulative in December 2017. Between December 2018 and December 2022, one observes new recrudescence of inflation. See: https://www.ibge.gov.br/estatisticas/economicas/precos-e-custos/9256-indice-nacional-de-precos-ao-consumidor-amplo.html?=&t=series-historicas

based on EMVA. However, we can see as well through EMVA that the department D-I is the one with the higher organic composition of capital and also with the higher rate of profit. What is different from Marx's hypothetical example is the scale of the amount of value mobilized. The amount of value mobilized in D-I is much greater than the average amount of total capital. This affects the formation of the rate of profit and the difference between the price of production and value. It also reveals how important is the industrial investment of D-I, because its movement can impact the whole Brazilian economy.

Another possible cause for the increase in the average rate of profit in the sample of selected companies is the destruction of capital, notably through the spoliation of state assets from 2016 onwards, through an official disinvestment policy in the case of Petrobras S.A. In the spreadsheet with the information for each company, we observe that the item referring to Property, Plant, and Equipment (PP&E) assets (column K) of Petrobras S.A. shows a downward trend between 2015 and 2018, as well as in the cases of Gerdau and Vale. A similar movement was observed in the case of Eletrobras, between 2014 and 2017.

In this sense, investigations regarding the impact on the Brazilian economy of the institutional changes that have occurred since then, such as Constitutional Amendment No. 95 of 2016, the Labour Reform of 2017, and the modification in the pricing policy and in the strategy of Petrobras in 2016, can help to explain such a contradictory phenomenon of profitability recovery without a real counterpart in economic growth.

5. Final remarks

One possible study to be developed from the EMVA 1.0 database is the construction of Marx's reproduction schemes from accounting data. Such additional development in the research would allow us to map interdepartmental disproportions in the Brazilian economy during the period analyzed, as well as the external markets they evoke, as proposed by Rosa Luxembourg (1951). This would enable us to think about modalities of economic action by the State in the face of the possibility of a crisis of disproportion.

It is also worth highlighting that in this work we do not incorporate the effect of capital turnover on the average rate of profit at the total level. This is an important development to be carried out in the next stage of the research, since, as Marx (1993b, chapter 8) argues, both the increase in organic composition of capital and the increase in capital turnover make possible the appropriation of a greater mass of surplus-value. Another point for future development concerns the estimation of the average rate of profit, considering the deduction of the appropriate surplus-value, more specifically the items Impostos, Taxas e Contribuições (*t*) (Levies, Taxes and Excises, in English) and Remuneração de Capitais de Terceiros (Payment to Third-Party Capital Providers) (*j*).

It would still remain to be analyzed whether the consideration that the capital advanced by the different departments is already a price of production, and not value. This adds an additional chapter to the discussions. We verified that there is no inconsistency in our calculation of the transformation of values into prices of production, but it remains to be investigated which contributions the assumption that accounting information are already prices of production provides to the debate. It might be a good starting point to avoid the so called inconsistency problem in the Marxian procedure.

Appendix

Methodological notes on accounting items

1. In the case of financial institutions, we consider item 7.02 as Financial Intermediation Expenses.
2. We must consider an inverted sign in this table, because, if there is loss (recovery) of active values, it means that the amount of circulating constant capital increased (decreased).
3. Regarding amortization of surplus-value of assets (*amortização de mais-valia de ativos*, in Portuguese), we consider the concept of surplus-value of assets in accordance with RFB No. 1.700/17:http://normas.receita.fazenda.gov.br/sijut2consulta/link.action?naoPublicado=&idAto=81268&visao=anotado
4. When applicable, we add item 7.04.02 Others, including Impairment. If there is a discrepancy between the information in the Value Added Statement (VAS) and in Economatica, we consult the company's cash flow statement to check whether there is an impairment test (deterioration). In the case of different values in the cash flow statement and in the VAS, we register what is in the cash flow statement.
5. We consider stocks as part of fixed capital because we understand that, in Marxist terms, within one capital rotation the value of stocks remains fixed in the company's sphere of production. Even though stocks are part of current assets, in practice they act as if they are part of fixed capital, given that their accounting refers to the entire year recorded up to December/31.
6. When applicable, we add item 7.08.01.04 Others, including Fees. In Eletrobras data, the items 7.08.01.04.02 (Employee Profit Sharing) and 7.08.01.04.03 (Retirement and Pension Plan) are considered benefits.
7. In the case of financial institutions, the items 7.01.01 Financial Intermediation and 7.01.02 Provision of Services are considered together.
8. When applicable, we add item 7.01.03 Revenues referring to the Construction of Own Assets. It is the revenue that comes from tax incentives for the construction of a production unit for use.
9. When the value of Levies, Taxes, and Excises is negative, it is considered as tax recovery, so, instead of deducting the appropriate surplus-value, we add it.
10. When applicable, we add items 7.08.04.04 Non-Controlling Participation in Retained Profits and 7.08.05 Others. The latter may involve the items 7.08.05.01 Constitution of Reserves and 7.08.05.02 Discontinued Operation.

Table A1 – *Transformation of values into prices of production*

Year	Departments	Capital		Proportion of constant capital	Proportion of variable capital	Organic composition of capital	Rate of surplus-value	Total surplus-value produced	Rate of profit in each department /sector	*c* consumed in one turnover	Value of commodities	Cost-price (*k*)	Price of production (*pp*): pp = k + ([c+v]*average rate of profit)	Difference between price of production and value (cost–price)
		c	***v***											
2010	D-I	1.066.307.673	40.816.331	96%	4%	26,12	542%	221.359.754	19,99%	350.056.390	612.232.475	390.872.721	542.566.715	–69.665.760
	D-II	254.052.767	19.786.794	93%	7%	12,84	191%	37.842.134	13,82%	145.847.204	203.476.132	165.633.998	203.154.471	–321.661
	D-III	338.123.791	45.465.141	88%	12%	7,44	207%	0	24,59%	226.144.226		271.609.367	324.167.289	52.557.922
	D-IV	119.932.501	7.275.017	94%	6%	16,49	309%	0	17,70%	60.541.746		67.816.763	85.246.262	17.429.499
	Total	1.778.416.732	113.343.283	94%	6%	15,69	229%	259.201.888	13,70%					
	Média	444.604.183	28.335.821					64.800.472	13,70%					
2011	D-I	1.243.279.683	46.288.196	96%	4%	26,86	551%	254.978.094	19,77%	406.335.637	707.601.927	452.623.833	624.640.708	–82.961.219
	D-II	286.421.529	19.405.571	94%	6%	14,76	218%	42.319.419	13,84%	172.609.621	234.334.611	192.015.192	232.809.805	–1.524.806
	D-III	419.424.698	50.456.145	89%	11%	8,31	193%	0	20,76%	306.731.992		357.188.137	419.866.059	62.677.922
	D-IV	150.361.804	13.128.141	92%	8%	11,45	193%	0	15,50%	86.066.613		99.194.754	121.002.857	21.808.103
	Total	2.099.487.714	129.278.053	94%	6%	16,24	230%	297.297.513	13,34%					
	Média	524.871.929	32.319.513					74.324.378	13,34%					
2012	D-I	1.441.700.441	53.450.418	96%	4%	26,97	376%	201.097.821	13,45%	507.078.929	761.627.168	560.529.347	710.875.346	–50.751.822
	D-II	323.253.249	17.148.119	95%	5%	18,85	281%	48.132.203	14,14%	195.498.283	260.778.605	212.646.402	246.875.713	–13.902.892
	D-III	411.527.084	53.679.958	88%	12%	7,67	179%	0	20,61%	290.890.457		344.570.415	391.349.653	46.779.238
	D-IV	163.446.441	14.320.409	92%	8%	11,41	187%	0	15,06%	96.069.954		110.390.363	128.265.840	17.875.477
	Total	2.339.927.215	138.598.904	94%	6%	16,88	180%	249.230.024	10,06%					
	Média	584.981.804	34.649.726					62.307.506	10,06%					
2013	D-I	1.520.354.704	59.441.817	96%	4%	25,58	393%	233.646.904	14,79%	514.681.082	807.769.803	574.122.899	750.548.812	–57.220.991
	D-II	359.829.064	18.558.653	95%	5%	19,39	281%	52.151.002	13,78%	215.761.871	286.471.526	234.320.524	276.577.484	–9.894.042
	D-III	370.116.447	54.417.849	87%	13%	6,80	171%	0	21,87%	260.058.285		314.476.134	361.886.576	47.410.442
	D-IV	162.717.872	13.725.845	92%	8%	11,85	210%	0	16,30%	99.307.539		113.033.384	132.737.975	19.704.591
	Total	2.413.018.087	146.144.164	94%	6%	16,51	196%	285.797.906	11,17%					
	Média	603.254.522	36.536.041					71.449.477	11,17%					

2014	D-I	1.682.830.427	63.728.424	96%	4%	26,41	278%	177.348.698	10,15%	614.205.985	855.283.107	677.934.409	822.683.650	–32.599.457
	D-II	415.260.158	22.876.193	95%	5%	18,15	277%	63.423.429	14,48%	249.099.965	335.399.587	271.976.158	308.287.505	–27.112.082
	D-III	461.833.285	57.825.069	89%	11%	7,99	193%	0	21,51%	347.084.425		404.909.494	447.977.125	43.067.631
	D-IV	185.650.588	15.176.473	92%	8%	12,23	201%	0	15,19%	113.162.414		128.338.887	144.982.795	16.643.908
	Total	2.745.574.458	159.606.159	95%	5%	17,20	151%	240.772.127	8,29%					
	Média	686.393.615	39.901.540					60.193.032	8,29%					
2015	D-I	1.801.970.782	65.284.431	97%	3%	27,60	242%	157.773.876	8,45%	642.554.274	865.612.581	707.838.705	840.339.039	–25.273.542
	D-II	510.098.906	29.583.626	95%	5%	17,24	245%	72.501.479	13,43%	301.450.874	403.535.979	331.034.500	369.330.345	–34.205.634
	D-III	561.593.821	64.843.983	90%	10%	8,66	150%	0	15,48%	436.472.501		501.316.484	545.768.478	44.451.994
	D-IV	195.019.378	16.750.528	92%	8%	11,64	190%	0	15,06%	116.490.219		133.240.747	148.267.929	15.027.182
	Total	3.068.682.887	176.462.568	95%	5%	17,39	130%	230.275.355	7,10%					
	Média	767.170.722	44.115.642			17,39		57.568.839	7,10%					
2016	D-I	1.554.191.896	69.287.075	96%	4%	22,43	353%	244.599.531	15,07%	504.284.018	818.170.624	573.571.093	740.929.239	–77.241.385
	D-II	517.376.181	32.675.442	94%	6%	15,83	208%	67.916.035	12,35%	313.544.423	414.135.900	346.219.865	402.922.552	–11.213.348
	D-III	599.333.151	70.359.362	89%	11%	8,52	211%	0	22,20%	463.695.029		534.054.391	603.090.393	69.036.002
	D-IV	174.895.881	13.477.985	93%	7%	12,98	230%	0	16,48%	96.073.119		109.551.104	128.969.835	19.418.731
	Total	2.845.797.109	185.799.864	94%	6%	15,32	168%	312.515.566	10,31%					
	Média	711.449.277	46.449.966					78.128.892	10,31%					
2017	D-I	1.524.486.682	64.228.469	96%	4%	23,74	443%	284.457.032	17,90%	455.925.571	804.611.072	520.154.040	710.260.301	–94.350.771
	D-II	517.292.176	33.270.580	94%	6%	15,55	211%	70.040.704	12,72%	307.905.606	411.216.890	341.176.186	407.056.735	–4.160.155
	D-III	535.905.631	73.753.511	88%	12%	7,27	196%	0	23,69%	279.566.390		353.319.901	426.271.946	72.952.045
	D-IV	198.492.839	15.102.341	93%	7%	13,14	229%	0	16,20%	110.362.796		125.465.137	151.024.018	25.558.881
	Total	2.776.177.328	186.354.901	94%	6%	14,90	190%	354.497.736	11,97%					
	Média	694.044.332	46.588.725					88.624.434	11,97%					
2018	D-I	1.646.292.014	69.031.948	96%	4%	23,85	549%	379.206.392	22,11%	510.193.591	958.431.931	579.225.539	824.178.042	–134.253.889
	D-II	584.066.704	36.954.408	94%	6%	15,81	191%	70.524.034	11,36%	353.142.840	460.621.282	390.097.248	478.780.598	18.159.316
	D-III	498.466.793	73.331.288	87%	13%	6,80	184%	0	25,55%	240.465.093		313.796.381	395.450.561	81.654.180
	D-IV	224.629.800	16.545.248	93%	7%	13,58	222%	0	15,20%	124.781.586		141.326.834	175.767.227	34.440.393
	Total	2.953.455.311	195.862.892	94%	6%	15,08	230%	449.730.426	14,28%					
	Média	738.363.828	48.965.723					112.432.607	14,28%					

2019	D-I	1.800.192.367	67.932.180	96%	4%	26,50	423%	287.567.562	15,39%	560.815.742	916.315.484	628.747.922	825.334.948	–90.980.536
	D-II	644.946.038	43.185.445	94%	6%	14,93	183%	78.867.683	11,46%	391.352.091	513.405.219	434.537.536	506.951.189	–6.454.030
	D-III	533.910.707	84.942.798	86%	14%	6,29	159%	0	21,83%	257.048.940		341.991.738	407.115.110	65.123.372
	D-IV	287.705.379	19.340.998	94%	6%	14,88	184%	0	11,57%	146.129.173		165.470.171	197.781.365	32.311.194
	Total	3.266.754.491	215.401.421	94%	6%	15,17	170%	366.435.245	10,52%					
	Média	816.688.623	53.850.355					91.608.811	10,52%					
2020	D-I	1.923.418.972	58.906.133	97%	3%	32,65	483%	284.351.286	14,34%	602.779.876	946.037.295	661.686.009	862.331.309	–83.705.986
	D-II	755.384.783	55.172.098	93%	7%	13,69	157%	86.648.589	10,69%	465.271.419	607.092.106	520.443.517	602.485.776	–4.606.330
	D-III	486.783.200	75.113.109	87%	13%	6,48	143%	0	19,18%	210.661.710		285.774.819	342.648.363	56.873.544
	D-IV	291.387.580	19.219.583	94%	6%	15,16	188%	0	11,64%	151.749.293		170.968.876	202.407.648	31.438.772
	Total	3.456.974.535	208.410.923	94%	6%	16,59	178%	370.999.875	10,12%					
	Média	864.243.634	52.102.731					92.749.969	10,12%					
2021	D-I	2.095.258.620	72.792.143	97%	3%	28,78	913%	664.326.021	30,64%	703.021.538	1.440.139.702	775.813.681	1.185.245.997	–254.893.705
	D-II	940.427.342	63.005.122	94%	6%	14,93	187%	117.510.406	11,71%	598.489.489	779.005.017	661.494.611	850.990.948	71.985.931
	D-III	530.844.841	82.575.540	87%	13%	6,43	243%	0	32,77%	256.671.386		339.246.926	455.090.213	115.843.287
	D-IV	331.270.048	23.853.880	93%	7%	13,89	149%	0	10,02%	168.193.313		192.047.193	259.111.680	67.064.487
	Total	3.897.800.851	242.226.685	94%	6%	16,09	323%	781.836.427	18,88%					
	Média	974.450.213	60.556.671	94%	6%			195.459.107	18,88%					
2022	D-I	2.302.558.761	73.682.409	97%	3%	31,25	886%	652.813.879	27,47%	823.968.986	1.550.465.274	897.651.395	1.269.245.095	–281.220.179
	D-II	1.140.406.290	70.942.086	94%	6%	16,08	159%	113.021.566	9,33%	725.823.989	909.787.641	796.766.075	986.195.259	76.407.618
	D-III	849.999.211	91.847.071	90%	10%	9,25	233%	0	22,74%	493.187.703		585.034.774	732.319.549	147.284.775
	D-IV	347.319.001	20.555.625	94%	6%	16,90	250%	0	13,99%	158.267.894		178.823.519	236.351.305	57.527.786
	Total	4.640.283.263	257.027.191	95%	5%	18,05	298%	765.835.445	15,64%					
	Média	1.160.070.816	64.256.798	95%	5%			191.458.861	15,64%					

Source: EMVA 1.0.

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