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Article

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EconomiA

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Suggested Citation: Montibeler, Everlam Elias; de Oliveira, Daniel Ribeiro; Cordeiro, Daniel Rodrigues (2018) : Fundamental economic variables: A study from the leontief methodology, EconomiA, ISSN 1517-7580, Elsevier, Amsterdam, Vol. 19, Iss. 3, pp. 377-394, <https://doi.org/10.1016/j.econ.2018.07.001>

This Version is available at:

<https://hdl.handle.net/10419/266929>

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Fundamental economic variables: A study from the leontief methodology

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Received 24 April 2017; received in revised form 6 June 2018; accepted 30 July 2018

Available online 10 August 2018

Abstract

This paper aims to investigate the level of main “fundamental variables” of the Brazilian economy: rate of profit, surplus value, composition of capital, vertically integrated labor composition and productiveness. Using the national accounting system of 2009, Inverse Matrix of Leontief and Vertical Integration of Capital and Labor, by Pasinetti, the current investigation analyzes the level of competitiveness of Brazilian economy. The estimations cover a set of 53 productive sectors and it is designed to rank those sectors depending on their competitiveness. Final objective is to execute an analysis, from classical economic theory, that analyzes behavior between price and values, as well as, variation measurement and deviation.

Keywords: Fundamental variables; Brazil; Leontief Inverse; Input–output table

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1. Introduction

This study has its theoretical foundation in the work started in the 80s by Shaik (1984) who does an important research where the core objective is the development of empirical calculations for labor values, using the concepts developed by Leontief and data from national input–output matrix, bringing the work total when standardized and expressed monetarily called *direct prices*, also calculated the Sraffians prices and makes analyzes and measurements away from regression between the different prices, finding the values that get close to very precise market prices. Ochoa (1984, 1989) attempts a similar study for the United States, based on Shaikh, calculates values, direct production prices and Sraffians Marxist productions using input–output tables for several years, incorporating fixed capital measures in the estimates. Chilcote (1997) updates the input of product data for the 35 countries of the Organization for Economic Cooperation (OECE) examining the “alternative values”, the author goes deeper than Ochoa in trying to analyze different ways in which to calculate production prices and gradually adds different aspects: fixed capital, the amount of capital, capacity utilization. The author finally concludes that, producer prices are conceptually closer to market prices. Both authors used different distance measurements, and concludes that the direct prices are very close to production prices and further to market prices.

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Guerrero (2000) implements Chilcote a methodology similar to Chilcote but for the Spanish economy and achieves to find direct prices that are closer to the production through the inclusion of fixed assets, rotation, etc. Guerrero also conducts a thorough theoretical analysis of the developed categories estimated in this type of work and confirms that vertically integrated equity value compositions almost completely explain the differences between the direct prices and production, an idea theorized by Marx in Volume III.

After this introduction, our paper shows the empirical analysis and sources where the data is coming from. The first chapter will explain the fundamental Marxist concepts underlying this empirical analysis. In the second chapter, the focus will be the quantitative analysis for the estimation of variables, through the lens of Leontief's inverse matrix, and exclusion and inclusion of sectors. Finally the third and last chapter an analysis of the sectors in the Brazilian economy following the assumptions of Marxist theory will be done.

Therefore it is clear that the purpose of the work is to analyze the Brazilian economy through the input–output matrix, under Marxist prism. Trying to perform a mathematical calculation in order to show the behavior of the rate of profit by sector of the Brazilian economy. Furthermore the attempt is to measure the formation and deviation rates (direct, produce and market), organic composition, added value, direct and indirect requirements of work and vertically integrated wage share (as indirect and indirect wage per product).

2. Data base and sources

The methodology consists of two parts. The first one advocates a comprehensive study of the capital performance of the Brazilian economy and then, the input–output matrix of variables that expresses the direct price. In order to do that what it has been done is to calculate the inverse Leontief in order to estimate the values of the direct and indirect requirements of the job, finding the total requirements of the job, expressed monetarily, called: direct price. The input–output matrix was used after testing the difficulty of finding data on wages, domestic production and capital stock, and to the measurement of the capital stock and its depreciation, where there is not enough information for its calculation, and requiring then a proxy for the economy of U.S.

The second part of this section focuses on the analysis the data, and attempts to find a relation between the most competitive sectors, and greater appropriation of surplus value, and finally estimates price deviations, observing the difference between the measured, direct price, and practiced by the market.

It must be said, that due to the difficulty in finding the necessary data, it was necessary for the development of the article, some manipulations and adjustments to the data available to Brazil. In this section it will be shown in detail such adjustments.

One of the primary sources of data, used is the IBGE System of National Accounts (Brazilian Institute of Geography and Statistics), that mainly uses Resource Table (TRU) for the year 2009. From the TRU product, wages, labor input (number of jobs), gross fixed capital formation and consumption were chosen. Each of these variables is subdivided into the sector molds found in the matrix of intersectoral technical coefficients of 55 sectors of the IBGE itself.

The number of contracted hours worked weekly by sector is available at the RAIS (Annual Social Information), however the sectoral subdivision has to be found in the IBGE's National Accounts System and does not correspond to the subdivision available in RAIS platform. Therefore it was necessary to develop an adjustment of the respective sectors. two types of fine-tunes were used for the respective data sources: the first is a simple adjustment related to terminology (in some cases the same sector had different names depending on the source); the second corresponds to a more elaborate adjustment, as there were sectors, provided by RAIS, in which worked hours in certain groups not coincided with IBGE sectors proposed by the standards of CNAE (National Classification of Economic Activities). This time demanded up a proportion that related in which sectors of the IBGE had the highest percentage representation in the product, thus leading to the same percentage of hours worked.

To a large extent the data was easily found on the websites of their home institutions. However, some data was required for the development of this matter (eg, capital depreciation) that could not be found in reference to the data available for Brazil, so some, proxy variables were necessarily used for the mathematical method in order to obtain a more significant result.

Capital stock determines the capital of an existing economy at a particular time that and crucial to estimate the production capacity. Not having this information for the Brazilian economy, we sought one proxy. After diagnosing

the gap we used the stock capital amount found for the United States in Bureau of Economic Analysis (BEA), since the value is found in US dollars, this amount has been converted to Brazilian in the value real of average exchange rate of the months of 2007, with the value of the stock of north American capital is given only for this year and replicated in subsequent years.

Similarly to the “contracted hours of work”, the stock of US capital does not fit the sectoral subdivision found in IBGE either. Therefore, adjustments were made in the same manner as explained above with the variable “working hours contracted”. In the cases where some American industries did not have suitable values for the Brazilian sector and vice versa, the sectors were completed with zero to non-existent representation.

In addition to the adjustment of the capital stock, another proxy with American values were taken from the BEA time regarding the average capital life of each sector, the capitals stock depreciation rate for each sector and inversely proportional to the lifetime of this stock. As it happened with other variables, suffered depreciation by the sectoral adaptation process, but differently. Often an American sector accounted for two or more Brazilian sectors. When this happened it was considered that the different sectors of the Brazilian economy, which had correspondence with a single US industry would have the same average time of the US capital life. For the Brazilian economy there were no official data on capital matrix (K) which led us to use estimates of working capital, which according to [Morandi \(2011\)](#) “the MEP estimates the stock of fixed capital accumulating the raw macroeconomic investment flows for various categories of assets deducting the physical depreciation or loss of efficiency that occurs throughout life”.

2.1. Brazilian input–output tables (BIOT)

The input–output tables, better known as IO (Input–Output Tables), have a wide variety of applications. The entire structure of this work is based on these tables because they allow an important set of information. In this work we used the 2009 matrix estimated by the Regional Economics and Urban Center of the University of São Paulo (NEURUS). The BIOT adopted has 56 sectors and 110 products and is based on the year 2000 and the national accounts data for 2011. The choice of an estimated matrix, not informed by the IBGE, was given an option by working with more data current Brazilian economy.

Sectors	
Agriculture, forestry, logging	1
Livestock and fishing	2
Oil and natural gas	3
Iron ore	4
Other mining and quarrying	5
Food and beverage	6
Products tobacco	7
Textiles	8
Articles of apparel and accessories	9
Leather goods and footwear	10
Wood products — furniture exclusive	11
Pulp and paper products	12
Newspapers, magazines, records	13
Petroleum refining and coke	14
Alcohol	15
Chemicals products	16
Resin manufacturing and elastomers	17
Pharmaceuticals	18
Pesticides	19
Perfumery, hygiene and cleaning	20
Paints, varnishes, enamels and lacquers	21
Products and prepared several chemical	22
Rubber and plastic	23
Cement	24

Other non-metallic mineral products	25
Steel manufacturing and derivatives	26
Non-ferrous metallurgy	27
Metal products — except machinery and equipment	28
Machinery and equipment, including maintenance and repairs	29
Appliances	30
Office machinery and computer equipment	31
Machinery, appliances and equipment	32
Electronic material and communication equipment	33
Devices/medical and hospital instruments, measurement and optical	34
Cars, vans and utilities	35
Trucks and buses	36
Parts and accessories for motor vehicles	37
Other transport equipment	38
Furniture and products of various industries	39
Electricity and gas, water, sewage and urban sanitation	40
Construction	41
Trade	42
Transport, storage and postal services	43
Information services	44
Financial intermediation and insurance	45
Real estate and rental	46
Maintenance and repair	47
Accommodation and food services	48
Business services	49
Commercial education	50
Commercial health	51
Services provided to families and associations	52
Domestic services	53
Public education	54
Public health	55
Public administration and social security	56

Source: Authors.

In BIOT we find intermediate inputs, wage compensation, production levels, profits, private and public consumption, exports and imports and investments for the period. From the BIOT and the matrix method it was estimated representative values the significance of Brazilian competitiveness.

3. Methodology and input–output matrix

3.1. National accounts and matrix

Wassily Leontief, Russian economist of the last century, made a major contribution to the understanding of the interdependence of inputs and used products resulting from the production process in a given period, for example how the sectors are interrelated, which sectors supplying the other, the use services and products and industries which buy from whom. Leontief could therefore improve what the economist Quesnay physiocrat touched only tangentially: the interdependences of the different sectors of an economy and how these links depict the economic picture. The [Table 1](#) shows how each sector demand and supply to other sectors. These intermediate transactions, added to the final demand (households, government, investment, exports, imports), in line for determining the gross output of the economy. The more disaggregated are the most detailed national accounts will be the interconnection between sectors.

It is intended for the input–output matrix to analyze the structure of the economy, the computation of economic indicators as multipliers of production, income, employment and rates of intersectoral links. The results are used to identify key industries and also data base such as; for example, the estimation of regional matrices and their connections, since a large extent the economy intends to equate the demand and supply in a vast network of activities.

Table 1
Basic structure of an input–output table.

Input–output table		Producers	4	5	6	7	8	C	I	Final demand (X – M)
1	2	3								
Producers	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
Added value	Employees	Salaries								Gross national product (GNP)
	Owners	Export surplus								
	Stat	Direct tax								

Source: Miller and Blair (2009), apud (Guerrero, 2000).

In Brazil, the input–output matrix (IPM) uses different sources of information, for example, the Resource Tables and Uses (TRU’s) having the supply flows and demand of goods and services, and income and employment generated by various economic activities.

3.2. Leontief Inverse matrix and direct and indirect impacts

This section will show some calculations offered by linear algebra. To start with the simplest exercise will begin with the description of the production value of any sector of the economy (eg, *i* sector) as the sum of production that the industry sells to each sector (all are called sector *j*), and the production is destined for final demand. Putting the values of algebraic form of input–product matrices where *i* identifies with the row and *j* identifies with the column, we have the final demand indicated by *Y_i*, the *z* values that are intermediate consumption and *X* the total product.

From the inputs *z_{ij}*, the flow of inputs from *i* until *j*, and *X_j*, gross product *j*, forms the quotient between the input and the product, *z_{ij}/X_j*, what we call *a_{ij}*:

$$a_{ij} = z_{ij} / X_j \tag{1}$$

This ratio is presented as a technical coefficient.

On the technical coefficients some criticisms are placed, but the most important one is that it is a static indicator and does not reflect the technological changes taking place. The *z* values were monetary or physical, whereas the *a* values are coefficients. Thus we have the basic expression of determination of final demand.

$$(I - A).X = Y \tag{2}$$

The solution in this system takes the shape of a matrix (I–A) that is not unique. Like this, $|I - A| \neq 0$, its inverse exists and has a solution that is unique and given by:

$$X = (I - A)^{-1}.Y \tag{3}$$

For these reasons we have (I–A)^{–1} as the “Leontief Inverse”. This inverse enables us to estimate the direct and indirect values. It is possible, for example, to calculate the coefficients or working capital “vertically integrated”.

In this configuration we have in line the list of bidders sectors and columns the demanding sectors. All sectors buy and sell to themselves and other sectors, the higher the increased flow the higher the degree of interdependence. One of the assumptions of input–output model, is that intra-industrial flows arriving to the sector determines the configuration we have in line the list of bidders sectors and columns of demand. All sectors buy and sell to themselves and other sectors, the higher this increased flow is the degree of interdependence. The data in the tables are represented by time period, in this case for periods of one year. The more cars are produced in a year more input on how minerals will be demanded.

3.3. Equations and variables

The process of preparing the data and variables that will give rise to the calculations of the fundamental variables is laborious and complex, so that some rigorous organization and details of each equation used previously.

Firstly, it is necessary to obtain the working capital matrix, also called matrix of total transactions coefficients (A), which can be found in their own national account or it can be estimated from the estimation of the absolute values of intermediate transactions and the product total. The matrix A is the most important as it provides with information about the interdependencies between sectors.

Following is necessary to estimate the fixed capital depreciation matrix (D).

$$D: = K.diag(LT) \quad (4)$$

where K is the stock of capital vector of each sector and LT diagonalized is the time of annual depreciation of capital by sector. LT is given by the inverse of the capital life time (Tv)

$$LT: = Tv^{-1} \quad (5)$$

Taking into account the depreciation of fixed capital, dead labor is incorporated a merchandise and value is transferred. Formation Gross Fixed Capital Formation (GFCF) available in the matrix of national accounts reveals whether this capital will depreciate being reset or not. Once estimated the amount of capital that depreciates each year in the production process, this becomes a key factor in calculating the labor used in the production of goods.

$$CsGDP: = \left(\frac{\vec{s}}{GDP}\right)^T \cdot (I - A)^{-1} \quad (6)$$

The share of wages relative to Gross Domestic Product (GDP) is estimated, both directly and indirectly, that is calculating the share of wages in the present product production and incorporated into all inputs purchased by the same process in the present moment. It is also possible to estimate the CsGP in relation to gross production (GP).

As for the direct labor requirements (an) it is estimated by the equation:

$$an: = Ta^T \cdot diag(GP)^{-1} \quad (7)$$

And the direct and indirect requirements of work (v) estimated by:

$$v: = an \cdot (I - A - D)^{-1} \quad (8)$$

Before reaching v, the amount of concrete work (cW) must be estimated, and then the similarly the abstract (aW). The quantification of the actual work is due to the product of the number of workers (nW) by sector by the number of working hours that make up the average annual journey of each worker (average annual hours worked).

Thus, it is possible to estimate the concrete job:

$$cW = nW \cdot i \quad (9)$$

where i is the sectoral index of the number of hours worked per year. The i is calculated by adding all the average hours of work each sector (hm) and dividing by the number of sectors. If this result is the average time of the division of each sector by the average value.

Given the different complexities of work carried out in an economy increasingly complex, the concrete work cannot be taken as representative, but used for the estimation of the employee abstract work in each sector. Marx describes the more complex work equals multiple values the work simpler.

So, since we are able to advance in the calculation of abstract labor. Which is defined as:

$$Ta: = (Tc \cdot \vec{i} \cdot z) \quad (10)$$

The x value is the ratio of average wages in each sector relative to the lower wage sector. In case of the Brazilian economy, according to data of the national accounts of 2009 as will be presented later, this sector will be the agricultural.

The labor requirements are given in real Full time equivalent employees (or years-men). The quantities of concrete work (measured in years-men) of each sector are the product of the results of the number of workers for the hours worked by means of the same sector workers. Once calculated the amount of concrete work, it is necessary to estimate

the abstract works. For Marx, the actual work could be standardized and converted into abstract works ($w_a = w_s$), but this “transformation” of the concrete work for the abstract work can not be done simply by taking hours worked.

3.4. Exclusion of non-market sectors

The data used refers to 2009 and for the 56 sectors of the Brazilian economy. This study, from the update of concepts and Marxist variables, and estimate values generated by the capitalist production process. For this reason, it is necessary to exclude sectors that offer products and services that are not commercialized, but offered by the government, regardless of the criterion adopted to achieve certain product or service.

The methodologies used by Guerrero (2000), Shaikh (1990) it is recommended to remove those sectors that provide public services. In the case of the 2009 table out of the 56 sectors, sector 54 (public education), sector 55 (public health) and sector 56 (public administration) were removed, and therefore, the technical coefficients ended up with dimensions of 53×53 .

As stated previously, because of the problems encountered in obtaining data on wages at the national and capital production, among others, the alternative was working on the basis of input–output tables. This time matrices I (identity), A (total operations of the coefficient matrix), B (workers’ consumption), D (capital depreciation) and K (capital) are the main matrix calculations that are obtained from national statistical departments economic. From this we have the following equations:

The organic composition of capital

$$OCCv_{id} := \frac{d_u K \cdot (I - A - D)^{-1} \cdot GP}{d_u B \cdot (I - A - D)^{-1} \cdot GP} \quad (11)$$

$$OCCv_{ip} := \frac{p_u^T \cdot K \cdot (I - A - D)^{-1} \cdot GP}{p_u^T \cdot B \cdot (I - A - D)^{-1} \cdot GP} \quad (12)$$

$$OCCv_{im} := \frac{U^T \cdot K \cdot (I - A - D)^{-1} \cdot GP}{U^T \cdot B \cdot (I - A - D)^{-1} \cdot GP} \quad (13)$$

Tax added value

$$p_v := \frac{d_u \cdot (I - A - D - B) \cdot GP}{d_u \cdot B \cdot GP} \quad (14)$$

$$p_p := \frac{p_u^T \cdot (I - A - D - B) \cdot GP}{p_u^T \cdot B \cdot GP} \quad (15)$$

$$p_m := \frac{U^T \cdot (I - A - D - B) \cdot GP}{U^T \cdot B \cdot GP} \quad (16)$$

Tax profit

$$r_v := \frac{d_u \cdot (I - A - D - B) \cdot GP}{d_u \cdot K \cdot GP} \quad (17)$$

$$r_p := \frac{p_u^T \cdot (I - A - D - B) \cdot GP}{p_u^T \cdot K \cdot GP} \quad (18)$$

$$r_m := \frac{U^T \cdot (I - A - D - B) \cdot GP}{U^T \cdot K \cdot GP} \quad (19)$$

This data is part of a larger study, still new on the Brazilian economy, however the methodological basis is in previous works of Shaikh (1990), Guerrero (2000) and Sanches and Montibeler (2015), about the problematic difference between direct prices, production and marketing.

Therefore, it is from the manipulation of such data here disclosed that all mathematical calculations could be carried out and that they attempt to show a first approximation of the behavior of the rate of profit by sector of the Brazilian economy. Similarly they measure the formation and diversion rates (direct, produce and market), organic composition,

added value, direct and indirect requirements of work and vertically integrated wage share (as indirect and indirect salary per product).

4. Prices and fundamental variable

Similarly this methodology helps understand the price of an economy. The price of production, which appears in the neoclassical school as long-term equilibrium price, or physiocrat as necessary price and still set by classics such as natural price; set the level of the rate of profit between sectors of the economy and just how competitive (Warrior, 1997). Producer prices stem from competition between different sectors of the economy, which leads to a redistribution of surplus value between different sectors and leads to an approximation of intersectoral profitability. Capital tends then to move to the more profitable sectors. Production rates can be defined as from an average profit rate of the economy as a result of redistribution of surplus value, added to production costs. Mathematically we have:

$$p = p(A + D + B) + rp(K + A + B) \quad (20)$$

The transformation of production price values (PP) has the basic assumption that the sum of the profits must be equal to the sum of capital gains and the sum of the PP of the total social product, the sum of values. In Book III Marx begins his first chapter detailing how to get from transformation of surplus value to profit. It is then that he comes to the mathematics of value definition ($M = c + v + w$), where M is the value, c constant capital, v variable capital and surplus-value p, it makes a distinction between surplus value and profit. The value is defined at two form: surplus and surplus labor.

The organic composition of capital determines the rate of profit of individual capitals and the average rate of profit for a set of individual capital should be determined by the amount of organic compositions thereof. The higher the organic composition will be the competitiveness of the economy.

5. Results and discussions

5.1. Salary quota Vertically Integrated

The discussion on the international competitiveness is outlined in determining which country has lower production costs, according to the classical school of vision. Assuming an open economy that competes for prices internationally, we have to calculate the cost of production of the Brazilian economy in terms of wage composition. As an approximation of production costs, it worked, at first, the remuneration of labor: wages. These values reflect the share of wages in relation to both gross domestic product (gdp) and the gross product (gp).

Employing domestic production matrix, where the technical coefficients of production are achieved, it is located the sectors with the largest share of the work in relation to GDP. In addition to the estimate of the share of wages in GDP in the various stages of the process of production of goods, we used the method of vertical integration [Pasinetti \(1977\)](#) to determine vertically integrated payment rates (CSVI) The vertical integration process it means that you can estimate the proportion between wages and product of the inputs used in the above processes. For example, to produce an automobile use labor and inputs, we could estimate the proportion of wages paid in previous cases and incorporated the input that was used in the cars this production.

The industry with the highest wage quota, greater vertical share of labor in relation to GDP is for the car industry, coach and utilities (Sector 35), corresponding to 1.20 of GDP, and with lower participation alone is the sector real estate and rental. The sector 26 (trucks and buses) followed the same trend of the sector 36, obviously with a similar productivity. Although there are outliers, the Brazilian economy clearly follows a trend, a cloud in the sectors behave items between 0.6 and 0.8.

In calculating the CsVI (GDP) it can be defined according to mathematical expression:

$$CSVI(GDP) := \left(\frac{\vec{1}}{1 + P'} \right) \times (I - A)^{-1} \quad (21)$$

We note that expression that the calculation of CsVI (GDP) using the gain variable (P') and input matrix (A). The relationship wage/GDP ratio is an approximation of the rate of surplus value (for lack even add the depreciation of

Table 2
Measures deviation between prices.

Measures deviation	(d,m)	(d,p)	(p,m)
1. DAM	18,4	26,8	33,7
2. DAMP	19,8	38,4	43,2
3. DVN	27,7	47,8	54,3
4. Theil	7,4	9,8	15,6
5. Gini	15,1	8,9	24,3
6. C.V.	33,9	39,5	44,4
7. d	32,4	37,2	42,5
8. θ (grados)	18,7	21,4	23,9

Source: Authors

*d are of direc prices, p price are production and m are the market prices.

capital), but measuring the integrated compensation rates vertically to GDP ratio of the amount of all production costs are obtained, and all stages of production, for the salaries.

$$CSVI(GP): = \left(\frac{\vec{S}}{GP}\right) \cdot (I - A)^{-1} \quad (22)$$

But when we are vertically integrating wage share in the gross product included the constant capital.

When analyzing the CSV to GDP the result change, the domestic services sector (sector 55) appears above the rest followed at sector 50, mercantile education, and lower vertical participation are also to sector 46, as the GDP ratio, real estate and rental services.

5.2. Direct and indirect requirements of work

The gross output of an industry is given in market prices, but it would be interesting to know what the value of this quantity production required labor, or otherwise: what is the value of a monetary unit of the product?

To measure the work contained in national products, especially labor content absorbed by each sector, it is essential to develop the concepts of concrete and abstract labor as defined by Marx, and apply them to empirical data. The variety of types of work and products in each sector creates a gap between the estimation methods of abstract and concrete work. From equation concrete and abstract labor were obtained direct labor requirements (n) for each sector:

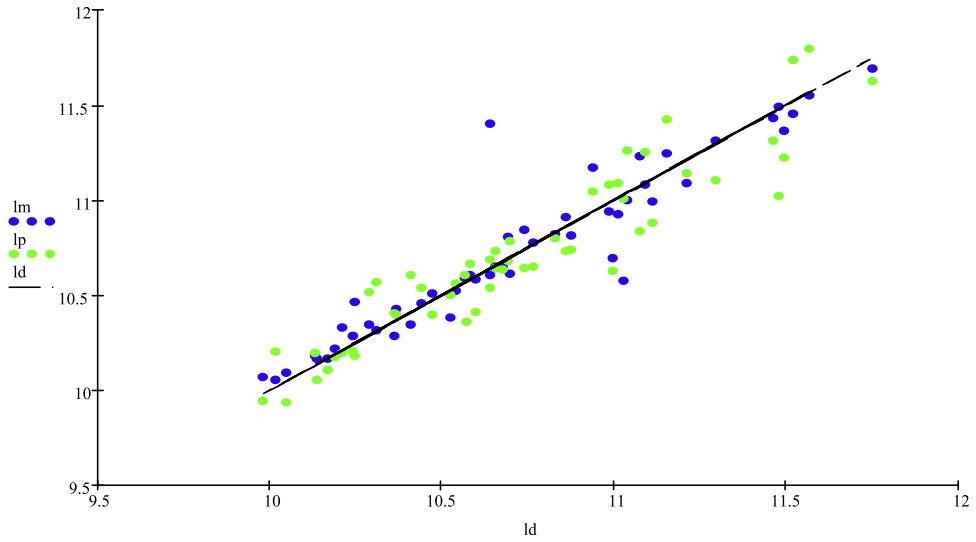
In order to measure the quantity of labor contained in national products, especially labor content absorbed by each we need to take the sector we found that once again the sector 46 is the least significant, following the trends of the vertical dimensions and sectors with higher direct labor, also following the vertical dimension of crude product after commercial education and higher isolation is the domestic service sector, confirming the diagnosis behavior in previous analyzes.

The indirect labor contained in national products, followed the trend seen earlier, in a cloud behavior. In particular work contents absorbed by each sector found that once again the sector 46 is the least significant, following the trends of the vertical dimensions and sectors with higher direct labor, also following the vertical dimension of the raw product later mercantile education and alone higher this the domestic service sector.

5.3. Proximity between values and prices in Brazil — 2009

In [Table 2](#) we observe distance measures between values. The weighted average distance (DAMP) direct and market prices is 18.4%, while the distance between those with production is 26.8%. As can be seen in [Table 2](#), the various measures do not alter the above conclusions, the direct and market prices are closer than direct prices, production or production and market prices.

The deviations between prices can be best illustrated in the following charts. [Graph 1](#) show that the direct prices determine the movement of prices of production and explain their behavior in 84%, and also explain 93.4% in the behavior of market prices. It is observed that the market prices are proportional to the value and that he, the value determines the movement of market prices ([Charts 1–4](#)).



Graph 1. Dispersion of different prices (market and production) in relation to direct prices.

Source: Authors

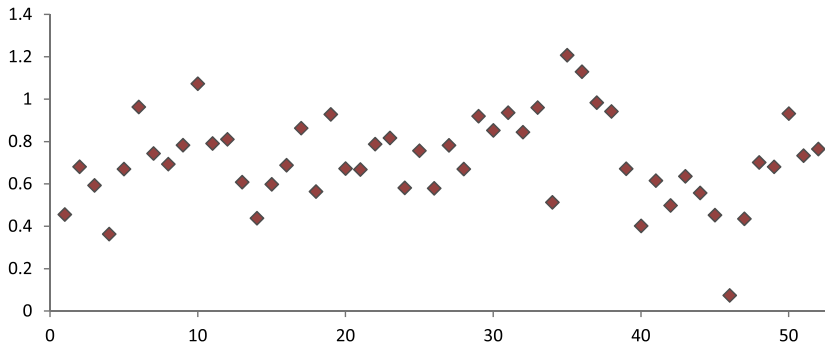


Chart 1. Cota wage vertically integrated with respect to GDP — $(C + V)/(V + PV)$ — 2009.

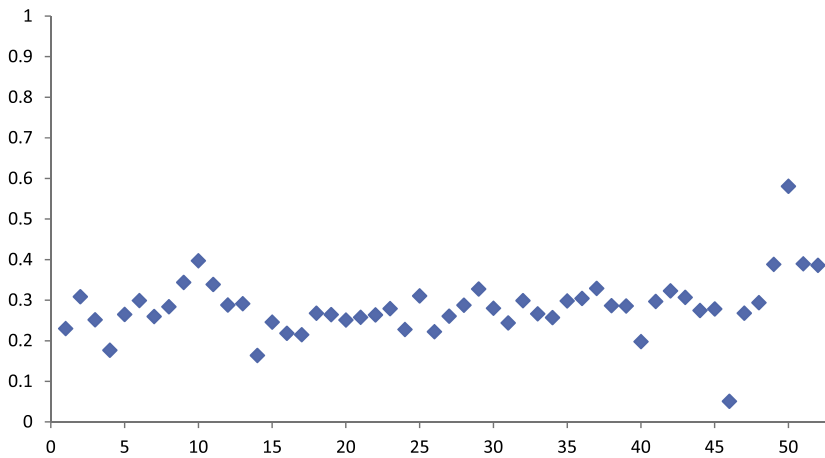


Chart 2. Cota wage vertically integrated in relation to GDP — $(C + V)/(C + V + PV)$ — 2009.

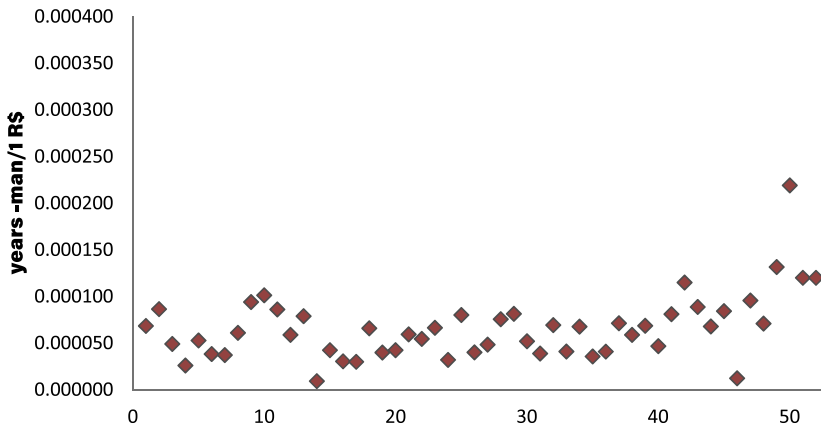


Chart 3. Requirements direct work — 2009.

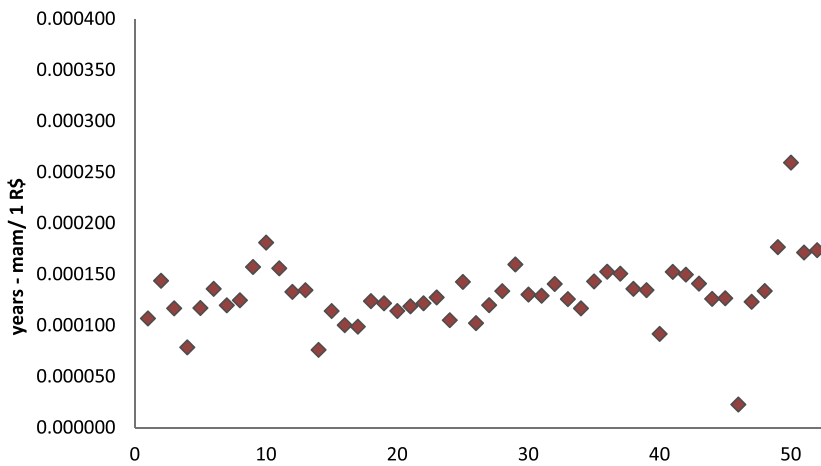


Chart 4. Requirements direct and indirect work.

Graphs 2 and 3 show the dispersion of the different rates expressed as natural logarithms, (2009), for direct rates (line 45). Each point represents a TiPb sector 53 sectors. It is slightly more dispersed the cloud of points of production costs than in relation to the market price. But overall, it's a good fit for different prices, in other words, the time to hand over indirect direct labor, expressed in money, is a good variable to explain the producer prices (Marxists and sraffianos) and market prices.

corr (d.m) = 93,40%

corr (d.p) = 84%

corr (p,m): 80,30%

Tax added value

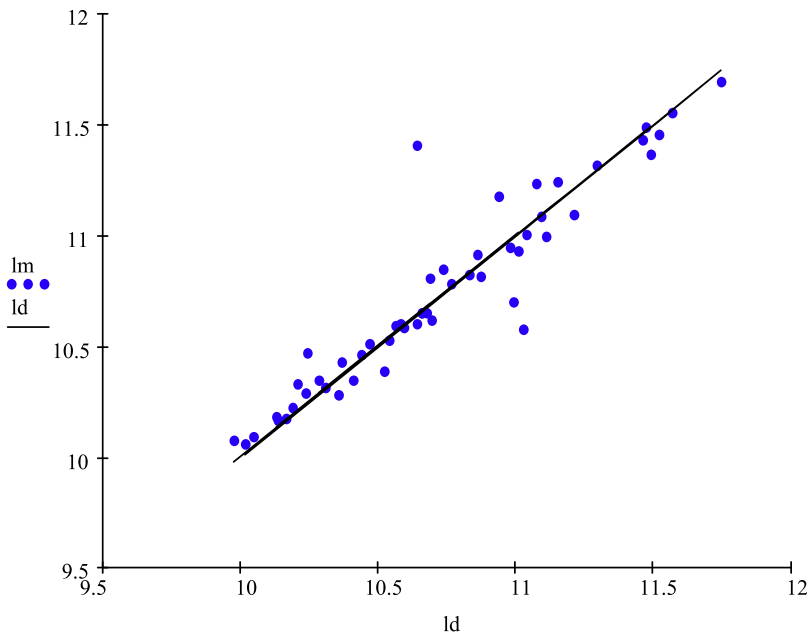
The process of production of goods is the process of value creation. For this to be possible, constant and variable capital must be considered. The most competitive economies are those that are able to produce at lower costs, lower cost involves selling at a lower price in the market. The value production process comprises:

$$V = c + v \tag{23}$$

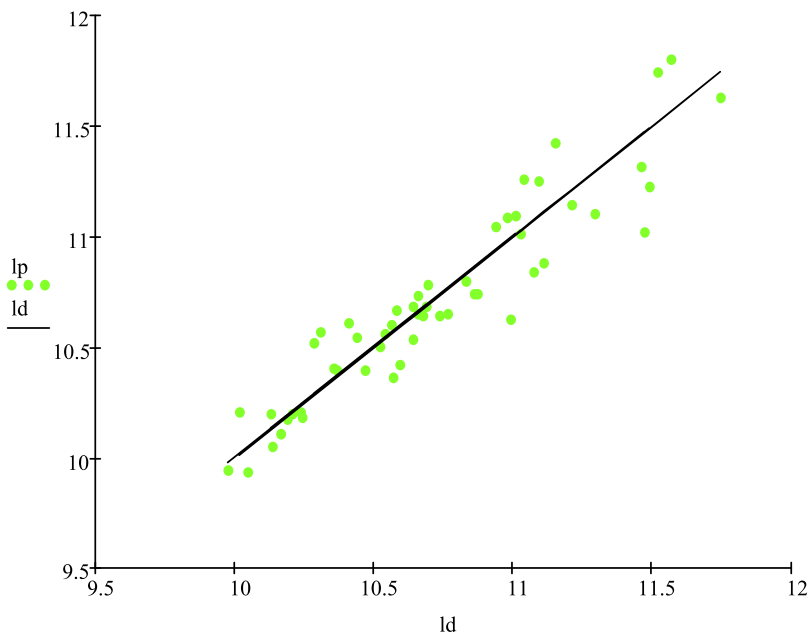
$$V \rightarrow \acute{V} \tag{24}$$

$$V \hat{=} c + v + p \tag{25}$$

The capital gain (p) produced by the capitalist pay workers the total capital employed (c + v) the production of goods. The capitalist does not care for the rate of surplus value ($P' = w/v$) but the rate of profit ($g' = p/c + v$). Both



Graph 2. Dispersion between market prices and direct price.



Graph 3. Scatter rates between direct price and price of production.

Source: Authors

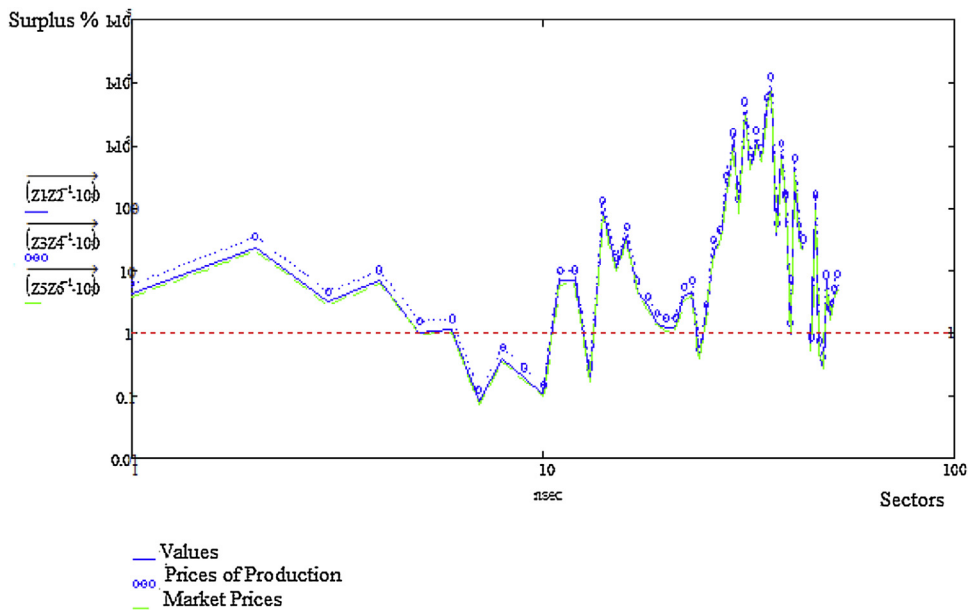
nationally and internationally, the most productive capital increasingly competitive sector will be the ones that at a given cost of production, achieve a higher profit rate as the highest rate of profit, which means at a cost equal to the competitor average power selling the same goods at the same or lower price.

Following the variables already highlighted in the methodology, we have:

Tax added value to direct price: $P_{iv} = z_1 \cdot z_2^{-1} \cdot 100$

Tax added value at producer prices: $P_{ip} = z_3 \cdot z_4^{-1} \cdot 100$

Tax added value at market prices: $P_{im} = z_5 \cdot z_6^{-1} \cdot 100$



Graph 4. Surplus rate by sector — 2009.

Source: Authors

It must be noted that the sectors of greatest asset exploitation rate are situated between the sector 28 and 37: Metal products — except machinery and equipment, machinery and equipment, including maintenance and repairs, home appliances, office machines and equipment computer, machinery and electrical materials, electronic material and communication equipment, appliances/medical and hospital instruments, measurement and optical, cars, vans and utility vehicles, trucks and buses, parts and accessories for motor vehicles.

5.4. Organic composition of capital

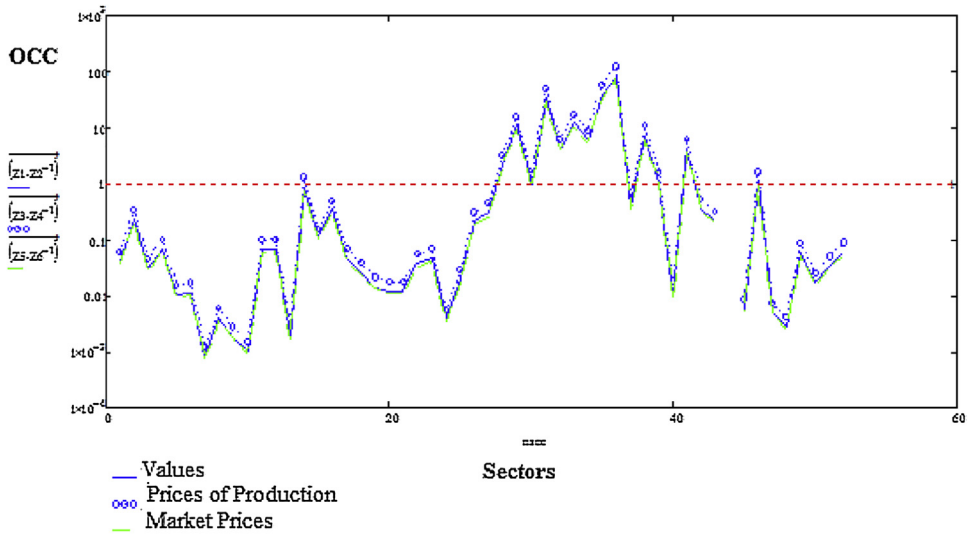
The mechanization process has led to increased capital composition (Graph 4). With globalization and intensified financialization process, investments in technology have reached unprecedented volumes. The proportional greed rate of surplus value production rate, but inversely proportional to the organic composition of capital. If two sectors have different organic compositions of capital then they will have different rates of profit. The rate of organic composition of capital is given by: $ccs = K/V$. Where ccs is the organic composition of capital, K is the stock of fixed capital and V is the variable capital. The variable capital does not create new value, but transfers its use value and exchange new merchandise. The trend in the long term and increase the organic composition of capital and possibly intensifying economic crises.

In Graph 5 it must be noted that the most capital-intensive sectors, machinery and equipment, appliances, computer equipment, electronic material and communication equipment, devices/medical and hospital instruments, measurement and optical, automobiles, trucks and utilities, trucks and buses, parts and accessories for motor vehicles, have higher organic composition. Sectors less developed, such as agriculture and mining, have low organic composition.

5.5. Profit rate

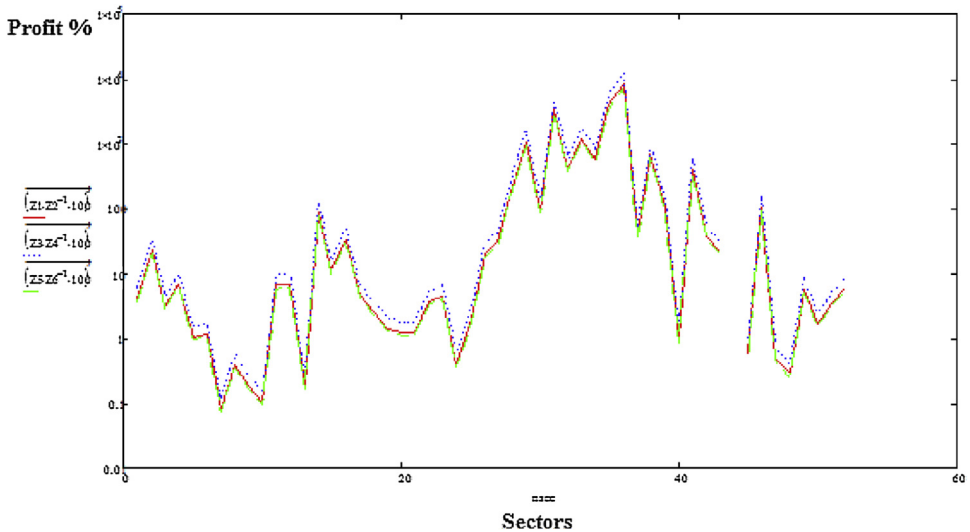
Among the most relevant key variables have the rate of profit. The estimation of the value of the sector enables a mapping via a point in time, to identify sectors that are obtaining larger and less profit rates. Capitalists seek to allocate their investments in productive activity higher rate of return on capital. From now on adopt the following notation profit:

Graph 6 shows profit rate values estimated direct prices, production and market. Direct prices measured what rate should be carried out when estimated by the labor theory of value. Already the rate measured in terms of market tells



Graph 5. Organic composition of capital (OCC) — 2009.

Source: Authors



Graph 6. Profit rate — 2009.

Source: Authors

us the true value measured by the capitalist. As might be expected, the highest organic composition industries are the most profitable capitalist sectors are, although not those with the highest rate of exploitation, surplus value.

6. Concluding remarks

As expected the results are no exception to the proposed theoretical assumptions, regarding the organic composition of capital, we note that the most capital-intensive sectors are: machinery and equipment, household appliances, computer equipment, electronic material and communication equipment, appliances/medical and hospital instruments, measurement and optical, automobiles, trucks and utilities, trucks and buses, parts and accessories for motor vehicles. Sectors less developed, such as agriculture and mining, have low organic composition.

Therefore, the sectors with higher organic composition are the most profitable sectors, although not those with higher extraction rate of surplus value. It can also be observed that the higher rate of value-added sectors are situated between the sector 28 and 37. The direct prices determine the movement of prices of production and explain their behavior in 84%, and also explain in 93.4% the behavior of market prices. It is observed that the market prices are proportional to the value and that he, the value determines the movement of market prices.

It is slightly more dispersed the cloud of points of production costs than in relation to the market price. But overall, it's a good fit for different prices, in other words, the time to hand over indirect direct labor, expressed in money, is a good variable to explain to producer prices and market prices.

Appendix A.

Cota wage vertically integrated in the relationship GDP — 2009.

Sectors	CsVI (GDP) BRAZIL				
		Sec		Sec	
1	45,55%	20	67,27%	39	67,14%
2	68,15%	21	66,76%	40	40,22%
3	59,33%	22	78,74%	41	61,55%
4	36,35%	23	81,68%	42	49,83%
5	66,97%	24	58,15%	43	63,59%
6	96,30%	25	75,70%	44	55,76%
7	74,41%	26	57,95%	45	45,30%
8	69,35%	27	78,24%	46	7,40%
9	78,26%	28	67,06%	47	43,54%
10	107,25%	29	91,97%	48	70,13%
11	79,08%	30	85,26%	49	68,05%
12	81,02%	31	93,61%	50	93,20%
13	60,84%	32	84,44%	51	73,37%
14	43,81%	33	96,04%	52	76,50%
15	59,80%	34	51,33%	53	92,34%
16	68,81%	35	120,77%		
17	86,34%	36	112,94%		
18	56,43%	37	98,36%		
19	92,79%	38	94,20%		

Cota wage vertically integrated in the relationship GP — 2009.

SECTORS	CsVI (GP) Brazil				
		Sec		Sec	
1	23,03%	20	25,14%	39	28,59%
2	30,87%	21	25,79%	40	19,82%
3	25,19%	22	26,41%	41	29,70%
4	17,69%	23	27,95%	42	32,31%
5	26,50%	24	22,80%	43	30,70%
6	29,92%	25	31,08%	44	27,48%
7	25,99%	26	22,27%	45	27,86%
8	28,40%	27	26,09%	46	5,10%
9	34,38%	28	28,77%	47	26,83%
10	39,73%	29	32,78%	48	29,41%
11	33,89%	30	28,04%	49	38,84%
12	28,83%	31	24,42%	50	58,08%

13	29,15%	32	29,91%	51	38,97%
14	16,41%	33	26,65%	52	38,60%
15	24,60%	34	25,75%	53	92,34%
16	21,86%	35	29,83%		
17	21,52%	36	30,45%		
18	26,81%	37	32,92%		
19	26,46%	38	28,66%		

Requirements working direct (V) (Men–year–R \$) — 2009.

An					
Sec.		Sec.		Sec.	
1	0,000068427	20	0,000042433	39	0,000068642
2	0,000086399	21	0,000059433	40	0,000046759
3	0,000049101	22	0,000054518	41	0,000081051
4	0,000026068	23	0,000066528	42	0,000114995
5	0,000052841	24	0,000032061	43	0,000088793
6	0,000038315	25	0,000080211	44	0,000067811
7	0,000037102	26	0,000040077	45	0,000084364
8	0,000060967	27	0,000048391	46	0,000012294
9	0,000094126	28	0,000075642	47	0,000095702
10	0,000101300	29	0,000081402	48	0,000070862
11	0,000086010	30	0,000052008	49	0,000131644
12	0,000058831	31	0,000038844	50	0,000219139
13	0,000078938	32	0,000069306	51	0,000120050
14	0,000009302	33	0,000041021	52	0,000120009
15	0,000042332	34	0,000067669	53	0,000371383
16	0,000030414	35	0,000035733		
17	0,000029945	36	0,000040932		
18	0,000065941	37	0,000071321		
19	0,000039898	38	0,000058887		

Requirements direct and indirect work (V) (Men–year–R \$) — 2009.

v					
Sec.		Sec.		Sec.	
1	0,000107	20	0,000114	39	0,000135
2	0,000144	21	0,000119	40	0,000092
3	0,000117	22	0,000122	41	0,000152
4	0,000078	23	0,000127	42	0,000150
5	0,000117	24	0,000105	43	0,000141
6	0,000136	25	0,000142	44	0,000126
7	0,000120	26	0,000102	45	0,000126
8	0,000125	27	0,000120	46	0,000023
9	0,000157	28	0,000133	47	0,000123
10	0,000181	29	0,000160	48	0,000134
11	0,000156	30	0,000130	49	0,000177
12	0,000133	31	0,000129	50	0,000259
13	0,000134	32	0,000140	51	0,000171
14	0,000076	33	0,000126	52	0,000174
15	0,000114	34	0,000117	53	0,000371

16	0,000100	35	0,000143
17	0,000099	36	0,000152
18	0,000124	37	0,000151
19	0,000122	38	0,000136

Description of variable

A	Matrix of technical coefficients
An	Direct labor requirements
aW	Abstract work
B	Vector consumption of employees
c	National basket working class consumption
OCCvid	Organic composition of capital to direct prices
OCCvim	Organic composition of capital at market prices
OCCvip	Organic composition of capital to production prices
CsGDP	Wage quota vertically integrated by GDP
CsGP	Wage quota vertically integrated by GP
cW	Concrete work
D	Vector capital depreciation coefficients
du	Unit direct prices
E	Workers consumption matrix
f	Vector sector participation column in the fixed gross capital formation
GDP	Gross Domestic Product
GP	Gross Product
i	Sector Relationship hours worked (1 is the average of the whole economy)
I	Identity matrix
k	Vector fixed capital stock of each sector
K	Matrix stock of fixed capital
KF	Coefficients of the matrix between fixed capital and product
ky	Each sector capital vector in relation to product
nW	Workers proportion working in each sector
p	Vector of output prices
pmP _v	Surplus at market price
pp	Surplus at production price
pTu	Unit production costs
pv	Surplus at direct price
r	Profit rate
rm	Profit rate at market prices
rp	Profit price of production
rv	Profit at direct prices
S	Vector of total wages of each sector (national currency)
T	Transactions total
Tv	Mean time vector of each industry life
UT	Unit market prices
v	Direct and indirect requirements of work
z	Relationship of the middle salaries each sector as small sector salary

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