Perspectivas em Políticas Públicas

LOOKING BEYOND INCOME: an analysis of Multidimensional Poverty in Brazil from 2016 to 2019

PARA ALÉM DA RENDA: uma análise da Pobreza Multidimensional no Brasil de 2016 a 2019

MÁS ALLÁ DE LOS INGRESOS: un análisis de la pobreza multidimensional en Brasil de 2016 a 2019

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ABSTRACT

The Multidimensional Poverty Index (MPI) was developed by the Oxford Poverty,Human Development Initiative (OPHI) in 2010. The concept of multidimensionality is based on the theory of poverty and human development created by the Indian economist Amartya Sen in the 80's. The aim of this work is focused on the application of the MPI constituted by indicators of education, work, and standard of living in Brazil using the National Household Sample Survey Continuos - NHSSC produced by IBGE from 2016 to 2019 . The methodology used for modeling this study is based on Alkire and Foster - AF (2009) and measures the incidence and intensity of poverty and the MPI at the national level as well as disaggregated by nine Brazilian metropolitan regions. The results regarding the metropolitan regions point to a great interregional contrast of multidimensional poverty in the country. In turn, the national MPI has shown a relative growth during the years from 2016 to 2019, but significant in terms of comparison with previous years with an evident observation concerning the progress of country's multidimensional poverty in recent years.

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KEYWORDS: multidimensional poverty index. incidence; intensity. metropolitan regions. Brazil.

RESUMO
O Indice de Pobreza Multidimensional (IPM) foi desenvolvido pelo Oxford Poverty,Human Development Initiative (OPHI) em 2010. O conceito de multidimensionalidade está ancorado na teoria da pobreza e desenvolvimento humano elaborada pelo economista indiano Amartya Sen na década de 80. O objetivo deste trabalho centra-se na aplicação do IPM constituído por indicadores de educação, trabalho e padrão de vida no Brasil com uso da Pesquisa por Amostra de Domicílios Contínua - PNADC produzida pela IBGE para o período de 2016 a 2019. A metodologia utilizada para a modelagem deste estudo baseia-se em Alkire e Foster – AF (2009) e mensura a incidência e a intensidade da pobreza e o IPM em nivel nacional; bem como desagregados por nove regiões metropolitanas brasileiras. Os resultados para as regiões metropolitanas apontam um acentuado contraste interregional da pobreza multidimensional no pais. Por sua vez, o IPM nacional apresenta um relativo crescimento entre os anos de 2016 a 2019, mas significativo em termos de comparação com os anos anteriores com uma evidente constatação do avanço da pobreza multidimensional do país nos últimos anos.

PALAVRAS-CHAVE: índice de pobreza multidimensional. incidência. intensidade. regiões metropolitanas. Brasil.

RESUMEN
El Índice de Pobreza Multidimensional (IPM) fue desarrollado por Oxford Poverty , Human Development Initiative (OPHI) en 2010. El concepto de multidimensionalidad está anclado en la teoría de la pobreza y el desarrollo humano cumplido por el economista indio Amartya Sen en los 80s. El objetivo del trabajo se centra en la aplicación del IPM constituido por indicadores de educación, trabajo y nivel de vida en Brasil utilizando la Encuesta Nacional de la Muestra de Hogares Contínua - ENMHC producida por IBGE para el período de 2016 a 2019. La metodología utilizada para modelar este estudio, se basa en Alkire y Foster - AF (2009) y mide la incidencia e intensidad de la pobreza y el IPM a nivel nacional; así como desagregada por nueve regiones metropolitanas brasileñas. Los resultados para las regiones metropolitanas apuntan a un marcado contraste interregional de pobreza multidimensional en el país. A su vez, el IPM nacional muestra un crecimiento relativo entre los años 2016 a 2019, pero significativo en términos de comparación con años anteriores con una evidente observación del avance de la pobreza multidimensional del país en los últimos años.

PALABRAS CLAVES: índice de pobreza multidimensional. incidencia. intensidad. regiones metropolitanas. Brazil.

1. INTRODUCTION

The analysis of poverty in Brazil has taken on relevant outlines in recent years due to the worsening of the economic crisis that pushes an expressive population contingent population strata.

Monetary-based analyzes of poverty in Brazil have already pointed to a significant worsening of the economic situation of the poorest in Brazil in recent years, indicating a trend towards its systematic intensification. In addition to this monetarist dimension, it is interesting to demonstrate, through this study, that the process of the precariousness of the socioeconomic conditions of the poorest involves other social dimensions of human life that are strategic for leveraging the living conditions and social mobility of the population. The multidimensional view amplifies the debate and the practice of combating poverty, creating the need to rethink human needs as multifaceted and integrated in order to fully guarantee their social and economic development.

This paper initially approches the emergency of debates on Human Development and its interactions with the design of public welfare policies; the concept of Multidimensional Poverty and its relevance and specifically its contribution to the production of a propositional diagnosis for the implementation of assertive social policies to overcome the multiple deprivations of the populations. In the empirical analysis of this paper, the incidence, intensity, and index of multidimensional poverty of the Brazilian population are estimated using the IBGE's Continuous National Household Sample Survey[3] (Continuous PNAD, from this point forward called as PNADC) from 2016 to 2019

[3] The Brazilian Institute of Geography and Statistics - IBGE is the main provider of data and information about the Country. Such information meets the demands of several types of segments of civil society, as well as the bodies at the federal, state and municipal level (IBGE, 2020d). The Continuous PNAD was inaugurated in October 2011, covering the whole National Territory. Its sample was planned in order to produce results for Brazil, Major Regions, Federation Units, Metropolitan Areas with the Municipalities of the Capitals, and Capitals' Municipalities. Since its implementation, the survey has been gradually expanding the indicators investigated and disseminated. The Continuous PNAD discloses short-term (monthly and quarterly) and long-term (annual and variable) information. Monthly short-term information encompasses a limited set of indicators related to the labor force covering the geographic level of Brazil (mobile quarters), while the quarterly disclosure includes indicators related to the labor force (conventional quarters) for all the levels of the survey. The long-term information of annual periodicity corresponds to the other permanent topics of the supplementary survey and complementary

with methodology proposed by Alkire, Foster (2009) as outlined by the guidelines of the United Nations Development Programme (UNDP, 2015). To customize the measurement of recent Multidimensional Poverty for Brazil, with the unprecedented use of the PNADC, there is a reconfiguration of its dimensions and component indicators based on its founding theoretical principles and the availability of official secondary data for the period 2016 to 2019. Moreover, in addition to the national indices, separeted analyses are carried out in the most important Metropolitan Areas (MAs) of the country.

1.1. The human development perspective

The establishment of the UNDP in 1990, provided greater visibility to the ideas of economists such as Mahub ul Haq, Sudhir Anand, and the best known among them, Amartya Sen, who pointed out the need to change the focus of the measures for the development of the classical indicators for calculating formation of wealth, Gross Domestic Product - GDP and GDP per capita, for pluralistic indicators that express a systematic examination, with greater information, on how human beings live in each society, including their education, health, living standards, among others (SEN, 2000).

Thus, the concept of human development, initially disseminated by Mahub ul Haq, presents itself as a tribute to the old political and economic thinkers, based on the conception that social arrangements should be judged by the extent to which they promote "good for human beings" (UL HAQ, 2008). This conception goes back to the vision of Aristotle (IV B.C.) who argued that wealth is not limited to the good that is sought, but to something useful, which is used for the benefit of something else that can provide a "prosperous life". Aristotle saw human life as a combination of "doing and being", which in Amartya Sen's (SEN, 2000) reinterpretation is called "functioning",

indicators related to the workforce, while those of variable periodicity are derived from the investigation of other subjects or topics of the permanent subjects to be searched more frequently or occasionally (IBGE, 2020c).

relating to the quality of life that is taken with the ability to make this life of good quality work. Life is defined as a set of activities that are valued combined with the ability to carry out these activities through free choices.

The concept of human development is based on this philosophical approach to the construction of a moral vision of the economy. Therefore, the evaluation of the quality of life based on the functioning and the assessment of the ability to make this good quality life work cannot be subject to a metric whose focus is the number of goods, and the level of income that will collaborate with these operations and these capabilities. If wealth is evidently not what people seek, but what people use to achieve other things, the task is then to assess the importance of the human functionings and to overcome what Marx defined, even in a different context, as commodity fetishism (SEN, 2003). Sequentially, the measure of utilities, as an expression of economic well-being ends up limiting its evaluation only to the level of pleasure, happiness, and satisfaction of desires, under a solely individual and subjective approach. Therefore, the significance of the social character of human life is lost from this perspective and fails to capture the real deprivations. People vulnerable to severe deprivation tend to accommodate themselves over time, not expressing a proportional measure of dissatisfaction, sadness, or suffering (SEN, 2003).

Deprivations can make those who are subject to them resigned or resilient. Thus, these deprivations, which are real, are not expressed in demand, with the force proportional to the suffering they produce, and thus appear to justify the lack of action of the policies that could be implemented to face them. Therefore, the concept of human development, based on capabilities and functioning, reposition the human being at the center of the issue of development when it seeks to reconcile all these elements, by displacing subjective utilities or from another point of view, when it criticizes hidden or fetish characteristics of goods, embodied in the product and income, materialized in an instrumental plan of economic and social life (SILVA, 2018).

Thus, Sen's focus is based on two interrelated concepts: i) functionings related to the states and the actions that individuals wish to live; ii) capability, which refers to the possibility of the person being able to exercise their freedom of choice concerning the different possible paths. In this sense, the relevant functionings can vary from something elementary, such as being properly nourished, being in good health, avoiding escapable morbidity and premature mortality, to more complex accomplishments, such as being happy, having self-respect, and being part of community life. Closely related to the concept of functioning is the idea of autonomy, that is, the ability to make an informed, uncoerced decision. This represents the various combinations of functioning (states and actions) that a person can perform. Capability is, therefore, a set of functioning vectors that reflect personal freedom to choose one lifestyle or another.

In this sense, it is possible to observe the impact of economic dynamics on people's lives, based on an assessment that gives income an instrumental function, not a central one in this observation. Capability, for Amartya Sen, consists of the set of valuable functionings that a person has effective access to, which represents the effective freedom of an individual to choose between different functioning combinations – between different kinds of life – that he or she has reason to value. Functionings, in their Aristotelian root, reflect "the things that a person may consider valuable doing or being" (SEN, 2000, p. 95). These functionings range from having access to food and health, to being able to participate in community life or having self-respect. In this context, having an insufficient income can be a determining factor for an individual's capability deprivation, but income is not the only element that generates capabilities, and its impact is conditional. That means that the relationship between an individual's income and ability is highly susceptible to conditions such as age, social responsibilities (such as motherhood or caring for the elderly), insecurity or violence, precarious housing or labour conditions (susceptibility to floods or other natural disasters), health conditions and other variations beyond the control of individuals or social groups (SEN, 2000).

Summarily, the concept of human development emphasizes the centrality of people in the discussion of development policies, their analysis and evaluation are made in terms of advances in their living conditions. On the other hand, in this conception of development, there are two sides: one is the formation of human capabilities, such as health, knowledge, and skills, the other side is to provide the use of those capabilities acquired by people, with employment, productive activities, political involvement or recreation, and leisure. The social product is configured in the construction of human capabilities and equal opportunities for enjoyment. Therefore, this concept brings with it the need to incorporate into the process of production and distribution of goods and services, democratic participatory elements for its full articulation (ALKIRE, 2010).

2. MULTIDIMENSIONAL POVERTY AND PUBLIC POLICIES

The issues of poverty are widely discussed in the literature, but the recognition as a multidimensional phenomenon proves to be counter-hegemonic and innovative. Multidimensional measurement expands the scope of poverty analysis and is an advanced alternative to explain this phenomenon (FHAEL, THELLES, CAMINHAS, 2016).

In this perspective, the evolution of social and institutional thinking expressed in the Human Development Report from United Nations Program for Development - UNDP changes the focus from poverty analysis to human development. According to the UNDP, human development is characterized by the process of expanding individual choices. In this sense, if human development means expanding choices, in poverty there is a denial of more basic opportunities, interfering with the achievement of a long, healthy, and creative life (UNDP, 1997).

Sen's analysis (SEN, 2000), supported by the concept of multidimensional poverty, introduces parameters based on the principles of social justice together with the creation of a new concept of well-being, considering poverty as a phenomenon no longer restricted

to means and resources than individuals have, but that covers their freedom of choice concerning their life proposition.

It is important to consider that the breadth and flexibility of the multidimensional perspective of poverty requires a new scope of social policies. Thus, supporting its premises in the choice-opportunity binomial as a founding dimension of individuals' capabilities and attributes induces a reconfiguration of social policies. In other words, there is a binding demand for its effectiveness that social policies incorporate the multiple dimensions of development: economic, social, political, environmental, and cultural to provide individuals with a condition of full and sustainable well-being.

The analysis of poverty in a multidimensional view, contextualized in the examination of the constituent aspects of each society and with a range of its multiple structural dimensions, can provide a comprehensive basis for directing the purposes and goals of social policies. It is, therefore, necessary to think about the strategic transition from a one-dimensional concept of poverty, still adopted by several multilateral organizations and governments, to a multidimensional perspective and focused on the structuring social dimensions of human life. The arrangement of a multidimensional diagnosis of poverty can contribute in a relevant way to the (re) design the aim of social policies, generating a structural transformation in its scope and dimension, as well as significantly altering its effectiveness. "Thus, there is a latent intention with this new conceptualization of poverty of generating impact on the decanonization of the process of social policies for emergency footwear assumptions in the ethics of human and sustainable development" (FHAEL, THELLES, 2018,P.390).

Regarding observing people's living conditions, through a plural view, the importance of using a multidimensional measure of poverty is emphasized. Thus, the one-dimensional measure of poverty based exclusively on income is insufficient to represent the universe of the needs of the poorest, which manifests itself through various dimensions, such as health, education, employment, and living standards. In this perspective, the configuration of the multidimensionality of poverty and its measures are

part of the scope of social policies in the country, with the introduction of a new agenda in the social arena.

A multidimensional view also recognizes that human lives suffer from all sorts of difficulties and limitations, understood as deprivations of their ability to lead a full and meaningful life, in the most diverse forms in each society, and it is necessary to recognize it as a first task in this perspective, to accommodate these different deprivations in a general and coherent framework, without ignoring the pluralities involved, which can easily be distorted by generic measures of success and failure. This approach is the recognition that the well-being of human beings must be the primary goal and that human beings are the main means of building development. These two elements synthesize complexity, due to the need to understand the particular demands that must be met in order to meet these two conditions. This is the main commitment of the Human Development approach, to demonstrate the feasibility of incorporating human beings into the economic development process, which will ultimately have as its final objective the improvement of their living conditions (SEND, ANAND, 2000).

Sen states that this issue is part of the general task of building a social index, the opportunity to give the correct valuation to the functionings that express the correct relationship between the concept and measure that "in the case of functionings and capabilities, the weighting exercise has to be done in terms of explicit validations, drawing on the prevailing values in a given society" (SEN, 2008, p. 25).

Now, it is also necessary to emphasize that the multidimensional approach to poverty as a concept for the creation of measure indices of people's living conditions brings with it the question of arbitrariness in the choice of the dimensions and indicators that will produce these measures, being this an intrinsic aspect to the synthetic type indexes (COBO, ATHIAS, MATTOS, 2014). to be detailed in the empirical part of this paper. Therefore, this new paradigm of the conception of poverty has been expanding its acceptance in the world along with the use of the conceptual and measurable parameters of multidimensional poverty and, also, it has been increasingly influencing

the design and implementation of social policies. In Brazil, especially, and in the Latin America's context, these trends are manifested, mainly through the reconfiguration of their social protection systems with the construction of multidimensional protective strategies covering the multiple aspects of the living conditions of vulnerable and poor populations.

3. MPI METHODOLOGY USING THE CONTINUOUS PNAD 2016 – 2019[4]

The multidimensional poverty index (MPI) methodology applied in this research was developed by the Oxford Poverty, Human Development Initiative (OPHI), as part of the Millennium Development Goals, proposed at the United Nations Millennium Summit, in particular its first goal, which is the eradication of extreme poverty (JANNUZZI, VAZ, 2014). One of its main objectives was the formulation of a method that would allow the calculation of an index that could be done in many countries, based on sets of microdata from household sampling surveys. The result is a synthetic index composed of ten indicators that relate to the same three dimensions of the Human Development Index (HDI): Education, Health, and Living Conditions. It can be applied in 104 developing countries, whose population represents 78% of the whole world (ALKIRE, SANTOS, 2010).

All data must be collected from the same household survey (UNDP, 2015). For this reason, the present MPI was calculated based on data from the PNADC collected by the Brazilian Institute of Geography and Statistics (IBGE), on its first visit, from 2016 to 2019. All calculation routines follows the parameters developed by the UNDP, as part of the Human Development Report. This research uses the mathematical structure of the

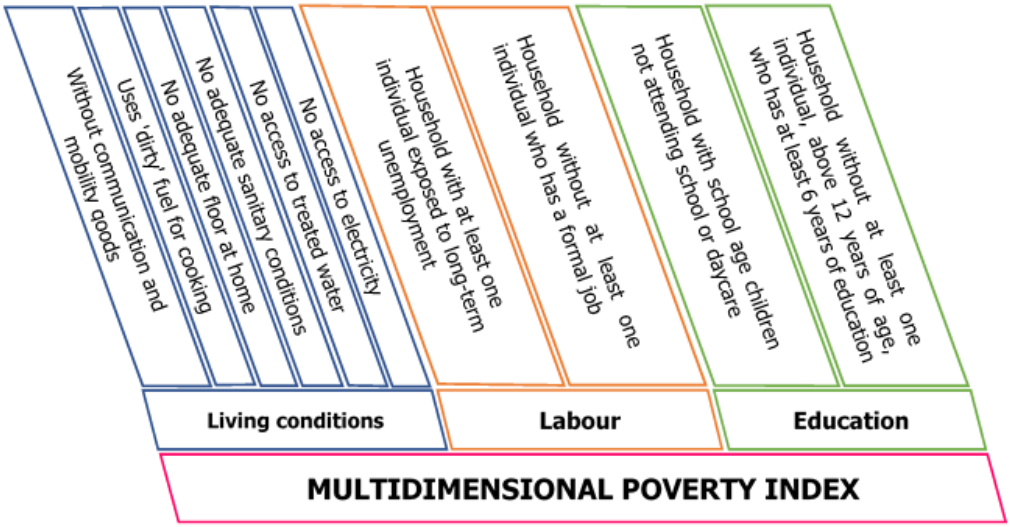
[4] The entire methodology presented here is adapted from the MPI methodology, based on PNADC data, harmonized by Dario Rodrigues da Silva (SILVA, 2018), who is also responsible for data manipulation and assessments of this research supported by the first author of this paper.

multidimensional measures of poverty developed by the methodology Alkire and Foster (ALKIRE, FOSTER, 2009).

According to the Technical Notes of the Human Development Report (UNDP, 2015), multidimensional poverty is defined by ten dichotomous indicators for three dimensions: health, education, and living condintions. Dimensions, and indicators within each dimension, are equally weighted, and the cut-off for the number of (weighted) deprivations is set at three out of a maximum of ten. Due to a lack of data in the PNADC, the health dimension was replaced by the labour dimension (Figure 1).

The multidimensional poverty encompasses the various deprivations experienced by poor people in their daily lives – such as poor health, lack of education, inadequate living standards, disempowerment, poor quality of labour, the threat of violence, and living in hazardous areas, among others.

Figure 1 – PNADC 2016-2019 MPI's Dimensions and Indicators



Source: (ALKIRE, FOSTER, 2016), own elaboration

In the MPI the three dimensions are equally weighted, so that each of them receives a 1/3 weight. The indicators within each dimension are also equally weighted. The indicators reflect the concepts of Sen's functioning and capabilities (SEN, 2000), on which the premises of the MPI are based.

3.1. Counting deprivations at the household *(C)*

The sum of the weighted deprivations ***(c)*** in each household will determine the household deprivation score ***(C)***, and its position concerning multidimensional poverty. All individuals in a household receive a score of all the deprivations found in their household in each of the indicators (UNDP, 2015).

Equation 1 – Total weighted household's deprivations (*C*)

$$C = \sum_{i=1}^{10} c_i$$

Source: (UNDP, 2015)

3.2. Definition of multidimensional poverty

Multidimensional poverty is identified by checking the deprivation score per household, as shown in Table 1:

Table 1 – Total weighted deprivations and poverty states

Total weighted depriviations	Multidimentional Poverty states
C<1/5	Household is considered not multidimensionally poor
1/5 ≤ ***C***< 1/3	Household is considered near of multidimensionally poverty
1/3 ≤ ***C***<1/2	Household considered multidimensionally poor
C ≥ ½	Household considered severely multidimensionally poor

Source: (KOVACECIC, CALDERON,2014) – own elaboration.

The deprivation score is defined in 1/3, that is, every person belonging to a household with a deprivation score equal to or greater than 1/3 is identified as multidimensionally poor. By contrast, a household with a score between 1/5 and 1/3 is identified as vulnerable to multidimensional poverty.

3.3. Multidimensional poverty headcount ration (% of total population) *(H)*

The proportion of the multidimensionally poor population ***(H)*** is the result of the number of multidimensionally poor people ***(q)*** divided by the total number of individuals in the population ***(n)***, multiplied by one hundred.

Equation 2 – Percentage of multidimensionally poor in the population (H)

$$H = \frac{q}{n} x100$$

Source: (UNDP, 2015)

3.4. Percentage of Multidimensional poverty intensity *(A)*

The percentage of the intensity of poverty ***(A)*** is calculated by adding the deprivation score of multidimensionally poor households ***(C_i)*** by the number of residents of these households ***(q_i)***, by the total number of multidimensionally poor people ***(q)***, multiplied by one hundred. The intensity indicates the mean percentage of the deprivation score that affects multidimensionally poor individuals.

Equation 3 – Percentage of muldimensionally poverty's intensity (A)

$$A = \frac{\sum_i^q C_i . q_i}{q} x100$$

Source: (UNDP, 2015)

3.5. Multidimensional Poverty Index *(MPI)*

The Multidimensional Poverty Index (***MPI***) is the multidimensional poverty headcount ratio and the intensity of multidimensional poverty in this population, divided by one hundred.

Equation 4 – Multidimensional Poverty Index (MPI)

$$MPI = \frac{H.A}{100}$$

Source: (UNDP, 2015)

3.6. Percentage contribution of each dimension *(T)*

The percentage contribution ***(T)*** of each dimension ***(j)*** is calculated by the ratio between the sum of the product of the deprivation count of each dimension ***(c)*** by the private population of this dimension ***(q)***, divided by the total population ***(n)***, multiplied by the inverse of the MPI (the same as dividing by the MPI), multiplied by 100.

Equation 5 – Percentage of contribution of deprivation on each MPI dimension (T)

$$T_j = \frac{\sum_1^q c_{ij} \cdot q_{ij}}{n} x \frac{100}{MPI} x100$$

Source: (UNDP, 2015)

The calculation of each dimension contribution can be a relevant indicator of the overall arrangements of the deprivations in a country. In turn, it could denote different policy responses in different areas, making the MPI useful for monitoring the effects of policy shifts and program changes (UNDP, 2015).

4. METHODOLOGIES ADEQUATION FOR MPI'S CALCULATION USING PNADC 2016–2019'S DATA

The PNADC provides permanent information on education's conditions, labour, income, and living standards of the Brazilian population, from a single source, as recommended by the methodology, for the calculation of MPI from 2016 to 2019, as seen in Table 2.

This study used the microdata from the PNADC 2016 to 2019, converted to the IBM SPSS software format, based on files provided by IBGE (IBGE, 2019a)[5]. The data from the first visit of each year provide all variables used for MPI construction.

Table 2 – Indicators weights adjusted to PNADC data

Dimension	Indicator	Weight
Education	***CA*** – No one has completed six years of schooling	1/6
	CB – At least one school-age child not enrolled in school or daycare	1/6
Labour	***CC*** – No one has a formal job	1/6
	CD – At least one individual exposed to long-term unemployment	1/6
Living conditions	***CE*** – No eletricity	1/18
	CF – No access to clean drinking water	1/18
	CG – No access to adequate sanitation	1/18
	CH – House has dirt floor	1/18
	CI – Household uses 'dirty' cooking fuel	1/18
	CJ – Household has no access to information or mobility assets	1/18
	Deprivations score sum	**1**

[5] PNADC data can be revised, based on IBGE technical and methodological criteria, without prior notice. Thus, these databases may undergo changes, which did not impact the final results of this study.

Sources: Alkire (2010), Kovacevic (2014) and Angulo (2016) – own elaboration.

All the references used in this research, to describe the methods of calculating the indicators, the nomenclature, and descriptions of the variables in the Continuous PNAD Dictionary (Table 3) come from the information collected in the first visit (IBGE, 2019b).

Table 3 - Dictionary of PNADC 2016 to 2019 variables and its conditionals for use in MPI

	Indicator	MPI description	Deprivation condition		PNADC variable description	Intermediary variable	Value in case of deprivation	Aggregate household			Weight
			PNADC variable	condition				Deprivation variable	Value in case of deprivation	Value in case of no deprivation	
Education	*c1*	No one has completed six years of schooling	V2009	>=12 e	individual's age	ICA	0	CA	1/6	0	1/3
			VD3005	<6	individual's years of schooling						
	c2	At least one school-age child not enrolled in school or daycare	V2009	≥6 e	individual's age	ICB	1	CB	1/6	0	
			V2009	<15 e	individual's age						
			V3002	=2	Does she or he go to school or daycare? (yes=1; no=2)						
Labour	*c3*	No one has a formal job	V4009	>=1 e	How many jobs did you have?	ICC	1	CC	1/6	0	1/3
			V4028	=2 e	Were you a civil servant as your main job? (yes=1; no=2)						
			V4029	=2 e	Was the main job a formal one? (yes=1; no=2)						
			V4012	<>5 e	Were you an employer as your main job? (yes=5; no <>5)						
			V4047	=2 e	Were you a civil servant as your secondary job? (yes=1; no=2)						
			V4048	=2 e	Was the secondary job a formal one? (yes=1; no=2)						
			V4043	<>5	Were you an employer as your secondary job? (yes=5; no<>5)						
	c4	At least one individual exposed to long-term unemployment	V4076	>2	How long are you without a job? (less than 1 month=1; less than 1 year=2; less than 2 years=3; more than 2 years=4)	ICD	1	CD	1/6	0	
Living conditions	*c5*	No eletricity	S01014	=2	Does the household use electricity? (yes=1; no=2)	ICE	1	CE	1/18	0	1/3
	c6	No access to clean drinking water	S01010	=3	Is there piped water at home? (in at least one room=1; only on the ground=2; there is not=3)	ICF	1	CF	1/18	0	
	c7	No access to adequate sanitation	S01011A	<1 ou	How many bathrooms for the exclusive use of the household are there?	ICG	1	CG	1/18	0	
			S01011B	>=1 ou	How many shared bathrooms are there?						
			S01012	>2	Way of draining the sewage: (sewage net=1; Trench=2; Ditch=3; River lake or sea=4; Other=5)						
	c8	House has dirt floor	S01004	>3	Floor material (Ceramics, stone or flagstone=1; Wood=2; Cement=3; Earth=4; Other=5)	ICH	1	CH	1/18	0	
	c9	Household uses 'dirty' cooking fuel	S01016	=1 e	Do you use eletricity or cooking gas as fuel for cooking? (yes=1; no=2)	ICI	0	CI	1/18	0	
			S010161	=2 e	Do you use cooking gas as fuel for cooking? (yes=1; no=2)						
			S010163	=2 e	Do you use eletricity for cooking? (yes=1; no=2)						
			S010162	=1 ou	Do you use firewood or charcoal as fuel for cooking (yes=1; no=2)						
			S010164	=1	Do you use any other fuel for cooking? (yes=1; no=2)						
	c10	Household has no access to information or mobility assets	S01021	<1 e	How many residents have a cell phone?	ICJ	0	CJ	1/18	0	
			S01022	=2 e	Do you have a landline? (yes=1; no=2)						
			S01029	=2 e	Does any resident have internet access at home? (yes=1; no=2)						
			S01025	=4 e	Do you have a TV set? (LED,LCD=1; Tubo=2; Ambas=3; Não tem=4)						
			S01031	=2 e	Do any residents own a motorcycle or automobile? (yes=1; no=2)						
			S01023	=3	Do you have a refrigerator? (yes 1 door=1; yes 2 doors=2; no=3)						
										Deprivations score sum	**1**

Source: IBGE variable dictionaries for PNADC (IBGE, 2019b) – own elaboration.

4.1. Adjustment of the Education dimension indicators

The education dimension, which also represents 1/3 of the total deprivation score, has two indicators, weighing 1/6 each. The first indicator registers households where all members have less than six years of schooling ***(CA)***. The next indicator marks households with school-age children, who are not regularly enrolled ***(CB)***.

The National Education Council of the Ministry of Education defined that all children older than 6 years old must be enrolled in elementary school, for 9 years (BRASIL, 2010). Therefore, they should be enrolled, in elementary school, from age 6 to 15 years old.

4.1.1. Calculation conditions for Education indicator *(CA)*

A household is considered deprived of access to basic education ***(CA)*** if there is no individual in the household, aged enough, who has at least 6 years of schooling. Therefore, any individual who started their studies at 6 years old would have access to 6 years of schooling when they reached 12 years.

The first condition to be observed for the education indicator ***(CA)*** count must be to identify individuals who are old enough to reach 6 years of education. The age of the individual (variable V2009[6]) must be greater or equal to 12 years:

$$\boldsymbol{V2009 \geq 12}$$

Then, check if each of them has at least 6 years of education:

$$\boldsymbol{VD3005 < 6}$$

When at least one person in the household declares having at least 6 years of study, the household is considered to be non-deprived of education.

4.1.2. Calculation conditions for indicator of school attendance *(CB)*

A household is deprived of school attendance ***(CB)*** if at least one child of age between the primary school entering age +1 and the primary school entering age +8 is not attending school.

[6] All variables codes in this section refer to the PNADC in 2019, (IBGE, 2019b).

The first condition must be to identify school-age members. The member's age (variable V2009) must be greater than or equal to 7 years and less than 16 years:

$$7 \leq V2009 < 16$$

Then, check if the individual attends school (variable V3002):

$$V3002 = 2 \ (no)$$

If at least one of the members is in school-age, but not attending school, the household is considered to be deprived of enrolled children.

Kovacevic and Calderon (2014) recommend that households without children of school age are assumed to be not-deprived in school attendance.

4.2. Adjustment of the Labour dimension indicators

Continuous PNAD does not provide information for measuring individuals' health conditions. In its previous form, the conventional PNAD, discontinued in 2016, made it possible to use the health dimension in the MPI, within the parameters of UNDP (2015), by verifying the occurrence of infant mortality at home (SILVA, 2018).

4.2.1. Selection of Labour dimension criteria

In this MPI calculation, the health dimension was replaced by the Labour dimension. The Labour dimension is part of the list of potential dimensions to be used in MPI calculations, as indicated by Alkire, Santos (2010). The choice of this dimension obeys all the selection mechanisms presented by these authors, since their social recognition, as an elementary capacity in overcoming poverty, thus being part of an "established consensus" (ALKIRE, SANTOS, 2010), part of the UNDP 2030 agenda, expressed as the 17th Sustainable Development Goals[7], to have the theoretical recognition of a universal value and human right, and finally, by meeting the requirement of data availability for its use. In this particular aspect, the adoption of the Labour dimension also

[7] Promote sustained, inclusive, and sustainable economic growth, full, productive employment, and decent employment for all (UN, 2014, p. 14).

contributes to the compatibility of this MPI in establishing comparisons with surveys of this type in other countries[8].

Two indicators are measured to verify the deprivation of employment capabilities that can influence the functioning of individuals in their quest to overcome or avoid poverty. The first indicator registers the households in which none of its individuals has any formal employment[9]. The second indicator records households in which there is at least one individual exposed to the condition of long-term unemployment[10]. These two conditions are recognized for their contribution to the poverty condition.

4.2.2. Deprivation of formal employment indicator conditions *(CC)*

The first indicator of this dimension refers to the deprivation of formal labour on the household (***CC***). The condition of deprivation is assumed by registring that no individual, aged 14 years or older, meets the following criteria:

- To be considered an "employed person", having at least one job in the reference week: $\boldsymbol{V4009 \geq 1}$, also;
- In the main employment, not being a civil service worker: $\boldsymbol{V4028 \neq 1}$, also;
- In the main employment, not being legally registered: $\boldsymbol{V4029 \neq 1}$, also;
- In the main employment, not being an employer: $\boldsymbol{V4012 \neq 5}$, also;
- In secondary employment, not being a civil service worker: $\boldsymbol{V4047 \neq 1}$, also;
- In secondary employment, not being legally registered: $\boldsymbol{V4048 \neq 1}$, also;
- In secondary employment, not being an employer: $\boldsymbol{V4043 \neq 5}$.

In case of all individuals, in a household, fit into these conditions, the indicator of deprivation of formal employment (***CC***), will receive the weight of 1/6.

[8] See Roberto Angulo (2016).
[9] Formal employment is characterized as being legally registered, or contracted under the statutory regime by a public agency of any sphere and the condition of an employer.
[10] Long-term unemployment is defined as during one year or more.

4.2.3. Conditions for calculating the long-term unemployment indicator *(CD)*

The long-term unemployment indicator (***CD***) shows that a member, older than 14 years old, has been unemployed for 12 months or more. This condition is expressed by the variable $V4076 > 2$.

4.3. Adjustments of the living standards dimension indicators

The dimension of living standards, like the other two, has a 1/3 weight in the total deprivation score of a household, and has six indicators, as shown in Table 4:

Table 4 – Living conditions' indicators

Indicador	Description	Weight
CE	Household without access to eletricity	1/18
CF	Household without access to clean drinking water	1/18
CG	Household without access to adequate sanitation	1/18
CH	Household has dirt floor	1/18
CI	Household uses 'dirty' cooking fuel	1/18
CJ	Household without access to information or mobility assets	1/18

Source: (UNDP, 2015) – own elaboration.

A household is considered without electricity *(**CE**)* if it is not connected in any way to the electricity distribution network. A household is considered without treated water *(**CF**)* if it is not connected in any way to the treated water distribution network, or if the source of drinking water is more than the equivalent of 30 minutes of walking, round trip, home. A household is considered without basic sanitation *(**CG**)* if it does not have a bathroom installed with a latrine and water flushing systems, connected to some form of sewarage system and/or covered septic tank, or if it has any type of these facilities, but shared with another house. A household is considered without a suitable floor *(**CH**)* if the floor has not received any type of finishing; if it is made of clay, natural straw, or any temporary covering. A household is considered deprived of clean cooking fuel[11] *(**CI**)*, if firewood, charcoal or other collected fuel is regularly used for this purpose. A household is considered deprived of access to information *(**CJ**)* if it does not have one of the

[11] Clean fuels, as defined by the Continuous PNAD, are: cylinder gas, piped gas, and electricity.

following items, radio, TV, landline, cell phone; Internet access; or deprived of accessory goods if he does not have a refrigerator or a freezer, or deprived of mobility items, if he does not own at least a car, or a motorcycle. The household is not considered private in this indicator if it has at least one item in the group of goods of access to information and one more item of the items of accessories for sustenance or mobility (KOVACECIV, CALDERON, 2014). For accessory items for sustenance, access to the property of a refrigerator, or of an automobile or motorcycle is considered. Table 5 presents the rules for indicators of living standards.

Table 5 - Living condition's variables and it depriving rules

Deprivation	Variable	Deprivation condition	Description	Intermediary variable
No eletricity	S01014	=2	Does the household use electricity? (yes=1; no=2)	ICE
No access to clean drinking water	S01010	=3	Is there piped water at home? (in at least one room=1; only on the ground=2; there is not=3)	ICF
No access to adequate sanitation	S01011A	<1 ou	How many bathrooms for the exclusive use of the household are there?	ICG
	S01011B	>=1 ou	How many shared bathrooms are there?	
	S01012	>2	Way of draining the sewage: (sewage net=1; Trench=2; Ditch=3; River lake or sea=4; Other=5)	
House has dirt floor	S01004	>3	Floor material (Ceramics, stone or flagstone=1; Wood=2; Cement=3; Earth=4; Other=5)	ICH
Household uses 'dirty' cooking fuel	S01016	=1 e	Do you use eletricity or cooking gas as fuel for cooking? (yes=1; no=2)	ICI
	S010161	=2 e	Do you use cooking gas as fuel for cooking? (yes=1; no=2)	
	S010163	=2 e	Do you use eletricity for cooking? (yes=1; no=2)	
	S010162	=1 ou	Do you use firewood or charcoal as fuel for cooking (yes=1; no=2)	
	S010164	=1	Do you use any other fuel for cooking? (yes=1; no=2)	
Household has no access to information or mobility assets	S01021	<1 e	How many residents have a cell phone?	ICJ
	S01022	=2 e	Do you have a landline? (yes=1; no=2)	
	S01029	=2 e	Does any resident have internet access at home? (yes=1; no=2)	
	S01025	=4 e	Do you have a TV set? (LED,LCD=1; Tubo=2; Ambas=3; Não tem=4)	
	S01031	=2 e	Do any residents own a motorcycle or automobile? (yes=1; no=2)	
	S01023	=3	Do you have a refrigerator? (yes 1 door=1; yes 2 doors=2; no=3)	

Source: (IBGE, 2019b) – own elaboration

5. MPI BRAZIL

Table 6 lists data referring to the MPI calculation, in each year of the studied period. It shows values of the estimated population, by the samples of the respective PNADC weighted according to the IBGE criteria, for the number of individuals and households selected after applying the exclusion criteria. Table 6 also shows the number

of poor individuals and poor households, a criterion that includes the poor and the extremely poor, based on the defined criteria.

Table 6 – MPI PNADC Brazil 2016-2019's results

PNADC MPI's components and results		2016	2017	2018	2019
Total population	n	201,940,501	203,090,129	204,753,804	206,416,376
Total households	N	67,680,163	67,971,394	69,497,255	70,857,455
Poor individuals' counting	q	25,494,013	26,069,760	25,938,098	26,828,600
Poor households' counting	Q	10,966,725	10,904,144	11,070,226	11,488,023
Percentage of poor in the population H=q/n x	H	12.62	12.84	12.67	13.00
Sum of the product of deprivations' counting of poor households by the number of household individuals	∑Pcq	9,390,415	9,585,917	9,533,401	10,263,888
Poverty intensity A=∑Pcq/q x 100	A	36.83	36.77	36.75	38.26
Multidimensional Poverty Index MPI=(HxA)/100	**MPI**	**4.65009**	**4.72003**	**4.65603**	**4.97242**
Sum of the product of deprivations in the Education dimension by the number of	∑DE	2,779,210	2,603,410	2,575,251	2,497,258
Sum of the product of deprivations in the Labour dimension by the number of individuals	∑DT	5,464,851	5,789,354	5,759,324	5,880,950
Sum of the product of deprivations in the Living conditions dimension by the number of	∑DC	1,146,354	1,193,153	1,198,827	1,885,680
Contribution of dimension Education to the	CTDE	29.60	27.16	27.01	24.33
Contribution of dimension Labour to the index	CTDS	58.20	60.39	60.41	57.30
Contribution of dimension Living conditions to the index	CTDC	12.21	12.45	12.58	18.37

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

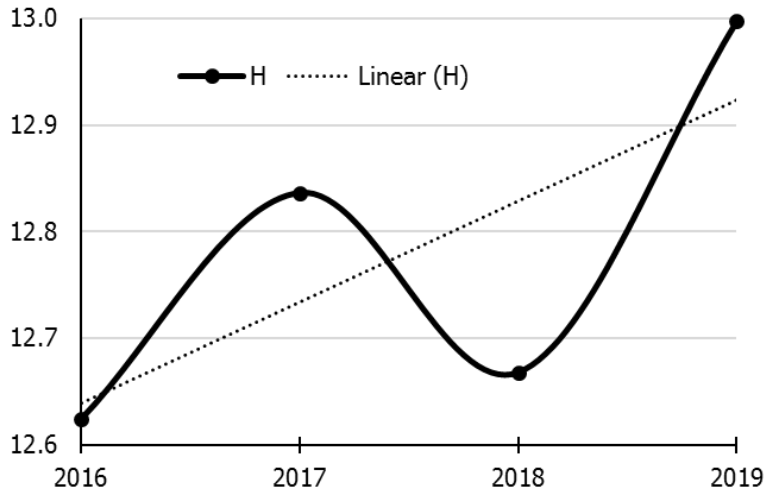
From these data, the percentage of poor individuals in the population are obtained, which together with the intensity of poverty percentage allow to calculate the MPI final result. The table also shows the deprivation values in each of the dimensions that build the index, so that it is possible to calculate, in each year studied, the contribution of each of these dimensions in the MPI final value.

The analyzes of multidimensional poverty are divided in incidence (H), intensity (A), multidimensional poverty index (MPI), with an interpretation of the association significance of these two variables in the trends perceived by the MPI's behavior from 2016 to 2019. Then, households are classified by the degree of vulnerability and the percentage of contributions of each dimension in the composition of the index (CT). Take into account the methodological restrictions, in the adequacy of the dimensions and indicators processed in this paper, due to the availability of data in the recent Continuous PNAD, a comparison of the current data with previous results from past years in other

studies is still possible. Likewise, this research uses results from OPHI/UNDP to refer to recent trends in multidimensional poverty in the country.

Finally, the MPI and its components for nine Brazilian Metropolitan Areas (MA) are shown, in order to demonstrate the analytical capacity and to test a different level of resolution, offered by the Continuous PNAD, and to enhance the analysis of trends and behavior of the multidimensional poverty in Brazil in recent years, as shown in Graph 1.

Graph 1 – Percentage of multidimensionally poor in the Brazilian population *(H)*



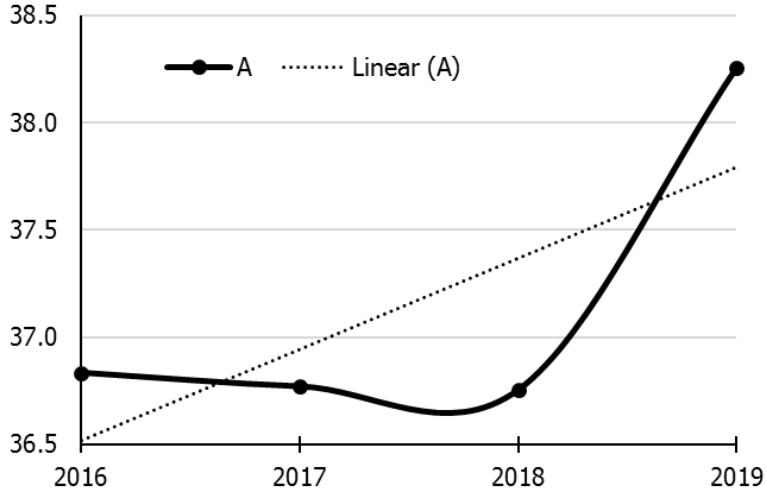
Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.
Note: Values of vertical axis start at 12.6%

The proportion of the poor population *(H)* or incidence in the multidimensional perspective, has shown to be high in the last four years and with a growing trend. Levels above 12% indicate that more than 25 million people in the country are considered multidimensionally poor, that is, they do not have the minimum conditions of education, labour, and living conditions, suppressing these individuals from access to the minimum in terms of well-being. This growth in multidimensional poverty amplifies the deprivations of a significant number of people and, in contrast to previous years, the evidence is even more explicit. A longitudinal analysis of multidimensional poverty in Brazil from 2002 to 2013 demonstrated a significant drop of 11 p.p.[12] considering the country from a level of 16% in 2002, to 5% in 2013 (FHAEL, THELLES, CAMINHAS, 2016).

[12] p.p.: Percentage points

When analyzing the multidimensional poverty intensity in Brazil, the mean percentage of the deprivation scores that affect multidimensionally poor individuals is shown in Graph 2. It can be seen that in 2016 individuals in poverty experienced, on average, 36.83% of the total deprivations according to the MPI indicators. This intensity increased by 1.43 p.p. in 2019 reaching 38.26%. This indicates that, in addition to the increase in the proportion of poor people in this period, among the multidimensionally poor individuals there has been an increase in the intensity of poverty. In other words, the worsening situation is noted by an increase in the number of poor individuals ***(H)*** at the same time that the poverty intensity experienced by these individuals has increased ***(A)***. These data, therefore, point to a consistent process of deterioration in the well-being conditions of the Brazilian population in the analyzed period.

Graph 2 – Deprivation's intensity in Brazil *(A)*



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.
Note: Values of vertical axis start at 36.5%

When comparing these data with previous research, keeping the methodological limitations[13], the variation in the multidimensional poverty intensity in Brazil follows the direction of the MPI variation but having as the main factor, the variation of the proportion of poor individuals. In a detailed study from 2001 to 2015, using data from the

[13] Although this analysis used the same methodology for multidimensional poverty, other dimensions and indicators were used, imposing limitations for a more accurate comparison of the results.

conventional PNAD, Dario Silva (2018) observed that, at the same time as the intense drop in the proportion of poor individuals ***(H)***, from 8.63% in 2001 to 0.87% in 2015, there was a slight improvement in the intensity of poverty from 44.23% to 39.27%[14]. Those data indicated that, as a result of a wide range of public policies, there was a significant reduction in the number of poor individuals, the living standards of those who, despite remaining in poverty, had small changes.

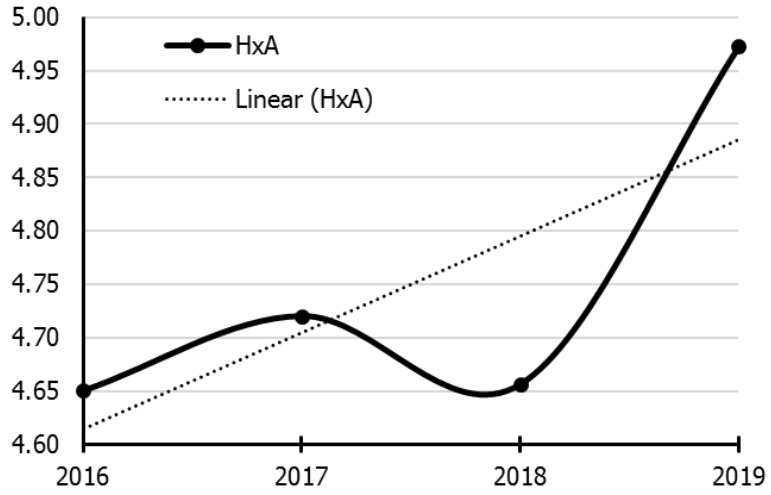
The growth in the number of poor people was enough to increase, even discreetly, the intensity of poverty experienced by the most vulnerable strata of the Brazilian population. This mechanism, of low sensitivity in reducing the intensity of poverty when the number of poor people decreases, and high sensitivity for the increase in the intensity of poverty, even with a less intense increase in the number of poor individuals, is a warning sign for the importance of monitoring the conditions of multidimensional poverty in Brazil and the urgency to confront its growth.

The results indicate the worsening of the MPI in Brazil, as shown in Graph 3. The MPI started from 4.65% in 2016 and reached 4.97% in 2019. Despite the fluctuations in 2017, with 4.72%, and 2018, with 4.6%, the MPI remained high as a result of the growth of multidimensional poverty in recent years. This corroborates with traditional studies (IBGE, 2020a) that are based on income analysis and also show the precarious living conditions of the poorest populations. According to IBGE, extreme poverty[15] reached 24.7 million people, or 11.8% of the population in 2019 (IBGE, 2020a, p. 64). Another study (NERI, 2018), showed that they lived below the poverty line, with income below R$ 232 per month, about 23.3 million people, or 11.2% of the population.

[14] The values found by Dario Silva (2018) were calculated using data from another research. They are not compatible for direct comparison with the present investigation. All comparisons made are between the conclusions obtained through both sets of data.

[15] IBGE considers per capita monthly income less than R$ 145 (Brazilian Reais) or 1.9 dollars per day as extreme poverty according to criteria adopted by the World Bank.

Graph 3 - PNADC Multidimensional Poverty Index Brazil (HxA)



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.
Note: Values of vertical axis start at 4.6%

In summary, there has been a process of impoverishment of vulnerable population strata in recent years, forming a scenario of expansion of the deprivations of the poorest populations and indicating the consolidation of the multidimensional poverty intensification trend in Brazil.

The significant increase in the MPI between 2016 and 2019 is also due to changes in the distribution of households by the counting of deprivations criteria. These changes are presented in Table 7. In 2016, non-poor households, those with deprivation score ***(C)***[16] less than 1/5 were 75.3% of the total and in 2019 they reached 67.5%, a reduction of 7.8 p.p. during that period, indicating that there has been a movement for families to return to poverty conditions. Vulnerable to poverty households, those whose deprivation score was equal to or greater than ⅕and less than 1/3, were, in 2016, 8.5% and in 2019 reached 16.2%, an important increase of 7.7 p.p. Poor households, with deprivation scores equal to or greater than ⅓ and less than 1/2, represented 15.2% of households in 2016, and 2019 were 15.1% of households, a decrease of 0.1 p. p. Finally, households

[16] See section Counting deprivations at the household *(C)*, on page 11.

classified as severely poor, with a deprivation score greater than 1/2, in 2016 represented 1% of households and in 2019 about 1.1%, a reduction of 0.1 p.p.

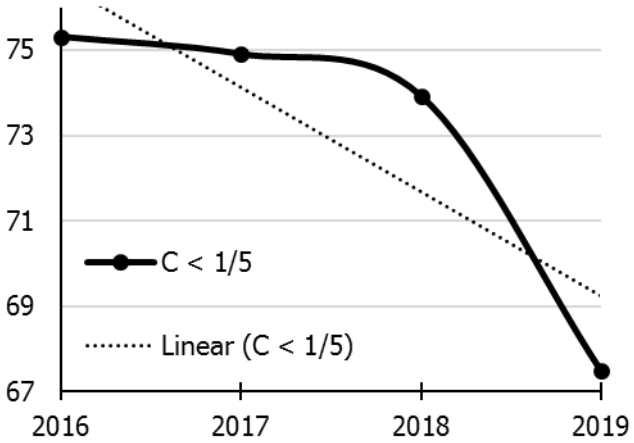
Table 7 - Distribution of households by the counting of deprivations

Classification	Deprivations' score (C)	% of households			
		2016	2017	2018	2019
Non-poor households	C < 1/5	75.3	74.9	73.9	67.5
Vulnerable to poverty households	1/3 < C ≥ 1/5	8.5	9.1	10.1	16.2
Poor households	1/2 < C ≥ 1/3	15.2	15.1	15.1	15.1
Severely poor households	C ≥ 1/2	1.0	0.9	0.9	1.1

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

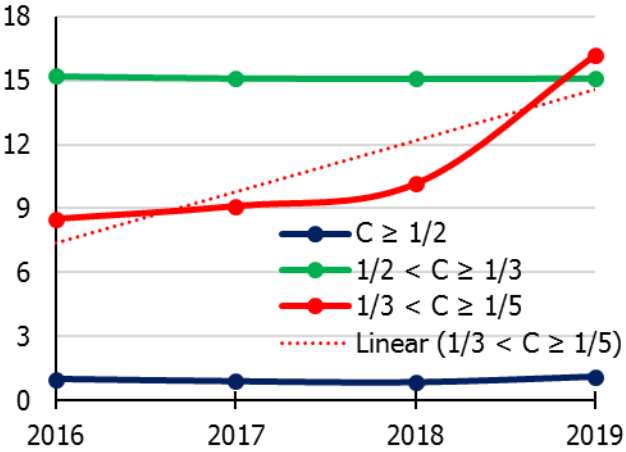
There was an increasing precariousness in the living standards of Brazilian people, expressed by the reduction in the number of non-poor households and by the increase in households vulnerable to poverty. The data show the contingent expansion of individuals susceptible to poverty due to socioeconomic worsening conditions. Graph 4 and Graph 5 show the deterioration in the classification, by the PNADC MPI:

Graph 4 – Non-poor households by deprivations' score *(C)*



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.
Note: Values of vertical axis start at 67%

Graph 5 – Vulnerable and Severely poor households by deprivations' score *(C)*



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

The MPI calculation method also allows observing the relative contribution of each of the deprivation dimensions[17] analyzed in the final index (Table 8). Observing the values, the dimension with the greatest contribution in the composition of the index, in all analyzed years, is the Labour dimension, responsible for more than half of the deprivations, despite the certain stability during the four years surveyed. Other researches attest the tendency for the labor market to deteriorate in Brazil, starting in 2014, after a long period of growth and conditions of full employment. The great participation of this dimension in the formation of the MPI reflects how the heterogeneous structure of the Brazilian labour market, marked by precariousness and informality, is expressed in the data obtained in the deprivation indicators of formal labour (ICC) and the long-term unemployment indicator (ICD).

The deprivations in the Education dimension are responsible for almost a third of the MPI from 2016 to 2018 and, showing a small decrease in their participation in the MPI of 2019. Both the indicators of deprivation of education *(CA)* and deprivation of school enrollment (CB) has an important weight in the multidimensional poverty condition of these individuals, with a slow and irregular trajectory of the overcoming of these deprivations by the multidimensionally poor individuals.

Finally, the living standards dimension, which also had a stable contribution between 2016 and 2018, expanded its participation in the composition of the MPI in 2019, indicating the precariousness of its indicators, directly related to the worsening of the standard of living of the poorest.

Table 8 - Contribution (%) of each dimension to the MPI result

Dimension	2016	2017	2018	2019
Education	29.6	27.2	27.0	24.3
Labour	58.2	60.4	60.4	57.3
Living conditions	12.2	12.4	12.6	18.4

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

[17]The measurement of the contribution refers to the dimension as a whole, and it is not possible in this type of analysis to separate the contribution of each indicator that composes it.

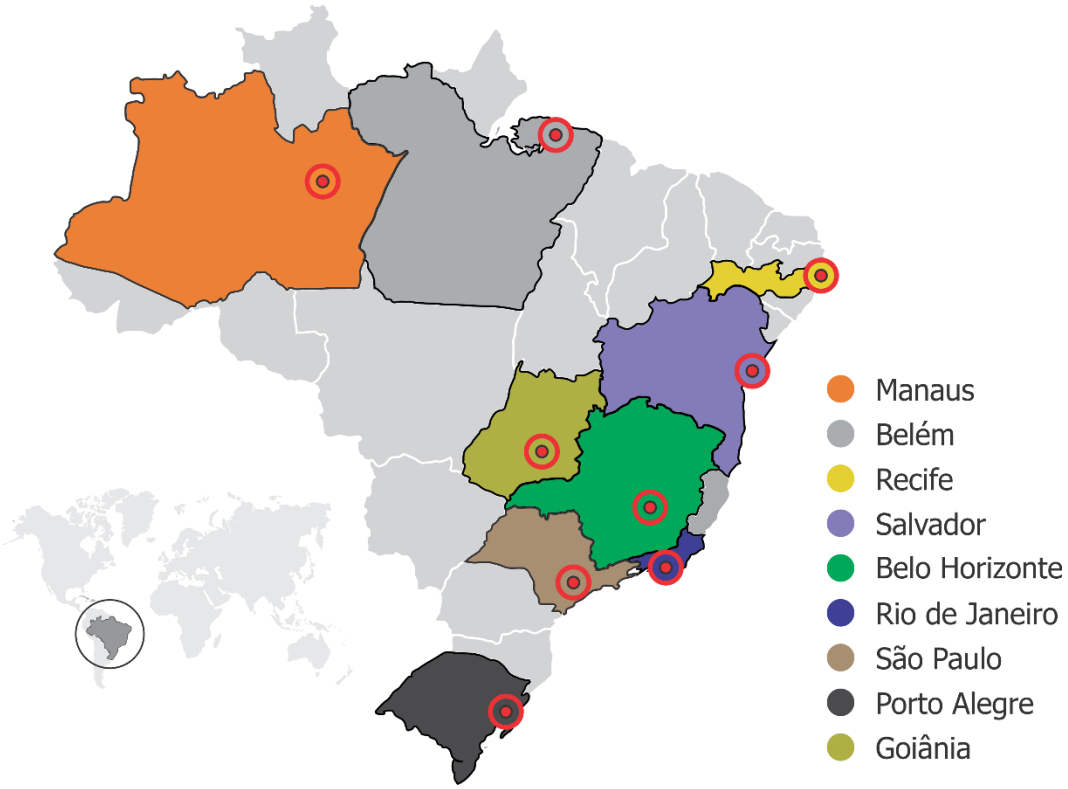
The fragmentation of each dimension's contributions in the composition of the MPI is strategic for the social policies development focused on efforts to overcome these privations sustainably, guiding both the design of public policies and the direction of investments, with the expansion of its effectiveness.

6. MPI FOR METROPOLITAN AREAS

In order to offer a complete analysis of the MPI behavior in Brasil from 2016 to 2019, and present possibilities for greater resolution of the results, which are offered by the Continuous PNAD database, the MPI, and its components were calculated, for 9 of the 74 Brazilian MA[18]. The selected MA are distributed across the country. From Northern Brazil: Manaus and Belém, from the Northeast: Recife and Salvador, from the Southeast: Belo Horizonte, Rio de Janeiro and São Paulo, from the South: Porto Alegre, and finally, from the central region: Goiânia. An overview of the spatial distribution of these MAs is shown in Figure 2. All methodological procedures, from dimensions and indicators, to the algorithms for calculating all results, are strictly the same used for MPI Brazil. Therefore, for these groups, there are no technical or methodological limitations when comparing their results.

[18] The Metropolitan Areas and Urban Agglomerations are sections established by complementary state law, according to the determination of the Federal Constitution of 1988 aiming to integrate the organization, planning, and execution of public functions of common interest. It is the competence of the States to define the Metropolitan Regions and Urban Agglomerations, under the terms of Article 25, Paragraph 3 of the Federal Constitution (IBGE, 2020b).

Figure 2 – Geographical distribution of Metropolitan Areas in Brazil



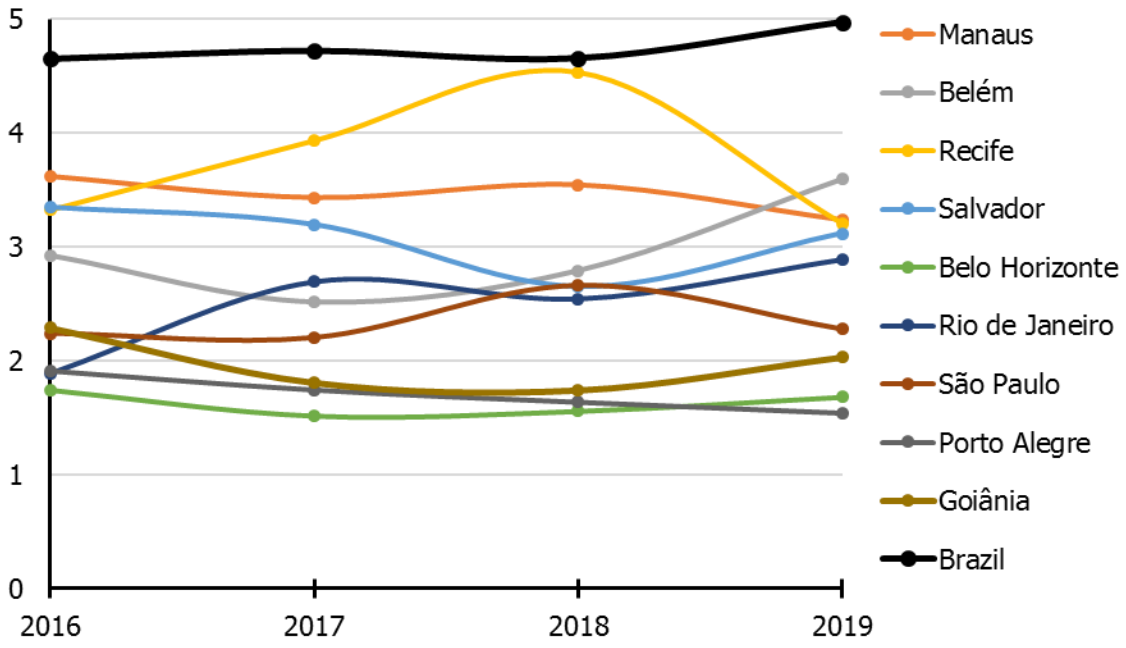
Source: Own elaboration.

6.1. Results for Metropolitan Areas (MA)

The results of the MPI calculation, by the various MAs, allow to interpret some aspects that would not be possible just by analyzing the result for the whole country. The first aspect refers to the influence of urban vs. rural distinction, as territorial categories (CHATEL, SPOSITO, 2019).The MA, as an administrative arrangement formed by municipalities of the same unit of the federation, is defined by the territorial continuity of urban areas(PERES, ADRIANO, SERAPHIM, OLALQUIAGA 2018). Rural activities are not excluded in this area, but MAs have predominant characteristics of urban areas.

This is one of the elements that justify the effort to reproduce the MPI calculation for these territorial sub-units. It is characterized as an approximation for the interpretation of urban multidimensional poverty and, consequently, for the contrast between urban and rural conditions. Graph 6 shows the behavior of MPI in Brazil, in comparison with the 9 MAs:

Graph 6 – Multidimensional Poverty Index PNADC – Brazil and its MAs



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

Therefore, a contrast of the regional indexes with the general index and the position of the indexes on the scale is perceived. All regional indices, except Recife MA's MPI, in 2018, distance themselves from the national index, with lower values. Another similar aspect among the indices is that, like the national MPI, most of the regional MPI increased between 2018 and 2019, except for Recife, which came from a strong increase in the previous three years, Manaus and São Paulo. The lowest values, with some stability over the entire studied period, are observed in the Belo Horizonte and Porto Alegre indices, followed by Goiânia, which had a reduction in its MPI between 2016 and 2018, but returned to growth in 2019. The highest indices in 2019 were those of Belém, which experienced a strong increase in 2018, and again, in 2019, accompanied by Manaus, Recife, and Salvador. Just below these MAs, there is Rio de Janeiro, which experienced a strong increase in its MPI, accumulating an increase of 153% between 2016 and 2019. Table 9 shows Brazil's MPI's values and the value of each MA.

Table 9 – PNADC MPI Brazil and its Metropolitan Areas

MA	2016	2017	2018	2019
Manaus	3.62	3.43	3.55	3.24
Belém	2.92	2.51	2.79	3.60
Recife	3.32	3.93	4.53	3.21
Salvador	3.35	3.19	2.65	3.12
Belo Horizonte	1.74	1.52	1.56	1.68
Rio de Janeiro	1.89	2.69	2.54	2.89
São Paulo	2.24	2.20	2.67	2.28
Porto Alegre	1.91	1.75	1.64	1.55
Goiânia	2.29	1.81	1.74	2.03
Brazil	4.65	4.72	4.66	4.97

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

It is possible to infer that the urban multidimensional poverty around the capitals is lower than expected to find in an exclusively rural MPI. The difference between the MPI of Brazil as a whole and the MPI of the MA studied points to the possibility of greater or more intense multidimensional poverty, in the countryside and rural areas.

Table 10 - Percentage of multidimensionally poor population in Brazil and its MAs

MA	2016	2017	2018	2019
Manaus	10.15	9.83	10.20	9.05
Belém	7.99	6.71	7.26	9.47
Recife	9.32	11.38	13.11	9.05
Salvador	9.82	9.45	7.81	9.05
Belo Horizonte	5.18	4.47	4.44	4.95
Rio de Janeiro	5.62	7.93	7.56	8.55
São Paulo	6.65	6.53	7.86	6.64
Porto Alegre	5.53	5.07	4.71	4.49
Goiânia	6.23	5.09	5.08	5.79
Brazil	12.62	12.84	12.67	13.00

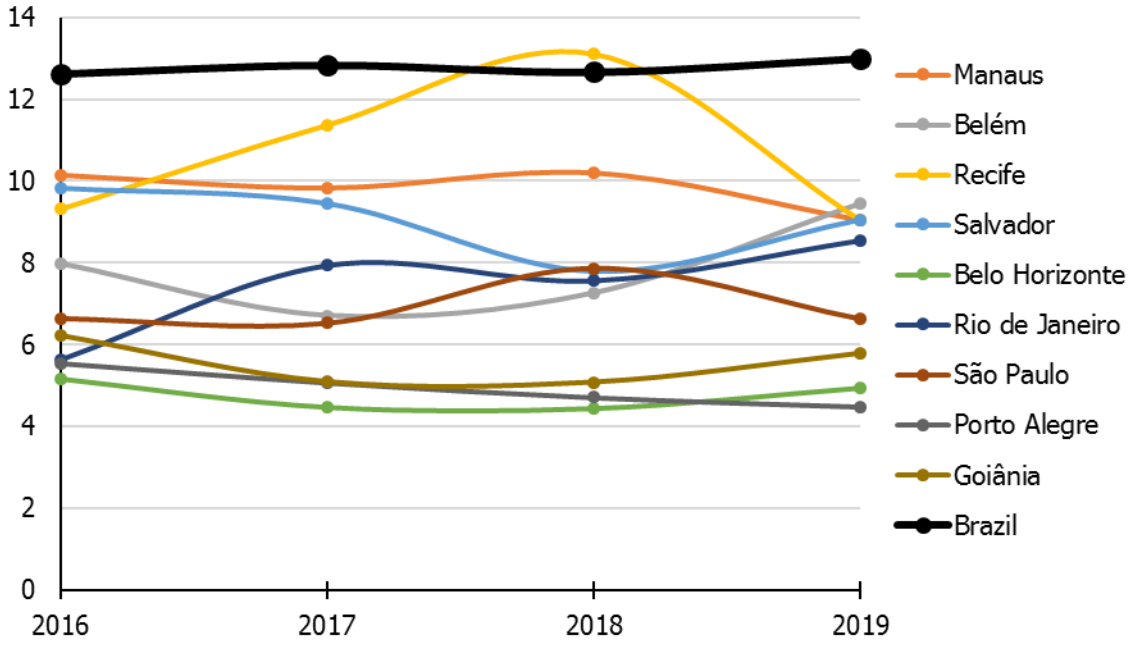
Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

Decomposing the indexes, the Table 10 shows the proportion of multidimensional poor individuals[19] (H). The diversity of the values found shows, in the first place, the regional inequality, according to the range of proportions of the poor among the different regions. Second, the values present the difference between the proportion of poor people

[19] This variable, both in the regional indexes and in the national index, includes individuals from the households classified as poor and severely poor (C> 1/3), see section Counting deprivations at the household *(C)* at page 11.

in the different MA, from the value found in the country as a whole. Only Recife, in 2018, showed a higher proportion of poor people compared to the country, as seen in Graph 7. The other regions have absolute figures for this proportion on a much smaller scale than the national scale. The metropolitan areas of Recife, mentioned above, Manaus, Belém (most recently), Salvador and Rio de Janeiro, with the largest proportions of the poor (over 8% of the population), while São Paulo, Goiânia, Belo Horizonte, and Porto Alegre having a lower proportion of poor, all below 7% and, Belo Horizonte and Porto Alegre, having been below 5% of poor population.

Graph 7 – Percentage of multidimensionally poor population in Brazil and its MAs



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

Regarding the poverty intensity (A), the results are more homogeneous. The total amplitude of the difference between the rates of poverty intensity is 4.8 p.p., or 12.5%. This indicates that the experience of deprivation, both in the various MAs, and that expressed by the national mean, are very similar in general, as seen in Table 11.

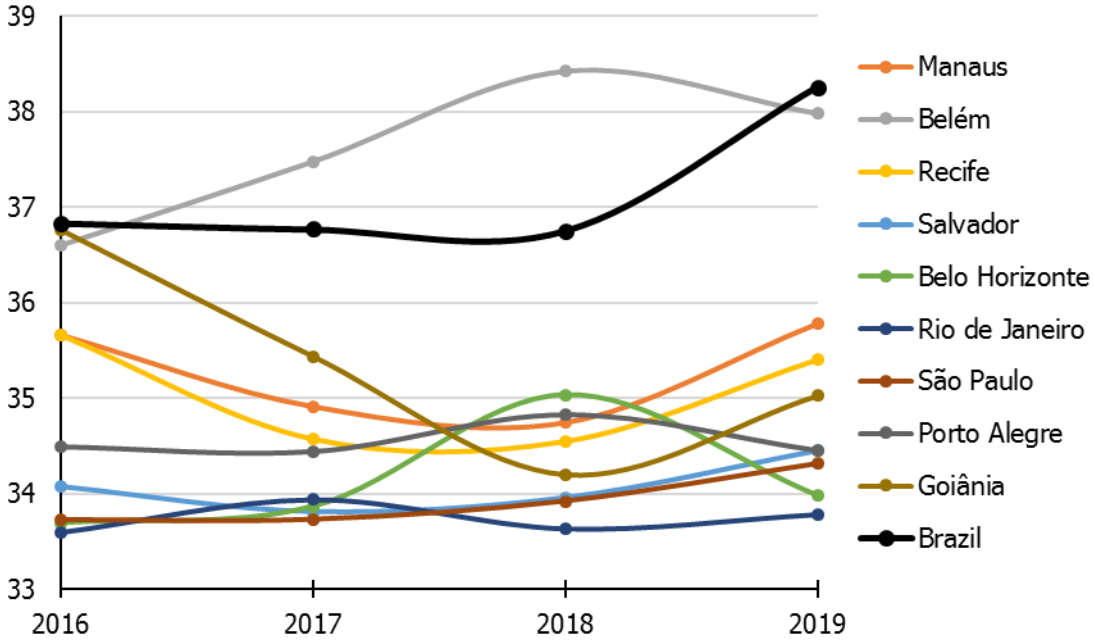
Table 11 - Poverty intensity, Brazil and its Metropolitan Areas

MA	2016	2017	2018	2019
Manaus	35.66	34.91	34.75	35.78
Belém	36.60	37.48	38.42	37.98
Recife	35.66	34.57	34.55	35.41
Salvador	34.08	33.81	33.96	34.46
Belo Horizonte	33.70	33.87	35.03	33.98
Rio de Janeiro	33.60	33.94	33.64	33.79
São Paulo	33.73	33.73	33.92	34.32
Porto Alegre	34.50	34.45	34.83	34.46
Goiânia	36.77	35.44	34.20	35.03
Brazil	36.83	36.77	36.75	38.26

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration

Although more uniform, the results of the poverty intensity (A) show, in general, a national mean above the MAs, except for the years 2017 and 2018, in which Belém had the highest poverty intensity in the country, and results very close to the general mean in 2016 and 2019. In addition to Belém, in 2019, the MAs of Manaus, Recife, Goiânia, Porto Alegre, Salvador, São Paulo, Belo Horizonte, and finally the MAs in Rio de Janeiro are below in the scale, as seen in Graph 8.

Graph 8 – Poverty intensity, Brazil and its Metropolitan Areas



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.
Note: The values of vertical axis starts in 33%

According to the classification by total deprivation score (C), only Belém showed, in its percentage of non-poor households, lower values than the national mean, with a small magnitude except in 2018. The other regions showed a higher proportion of non-poor households, compared to the national result. This indicates that the urban profile presents more positive indicators when compared to their equivalent indicators expressed by national means. Table 12 shows all the values of the percentage of non-poor households, in Brazil and MAs.

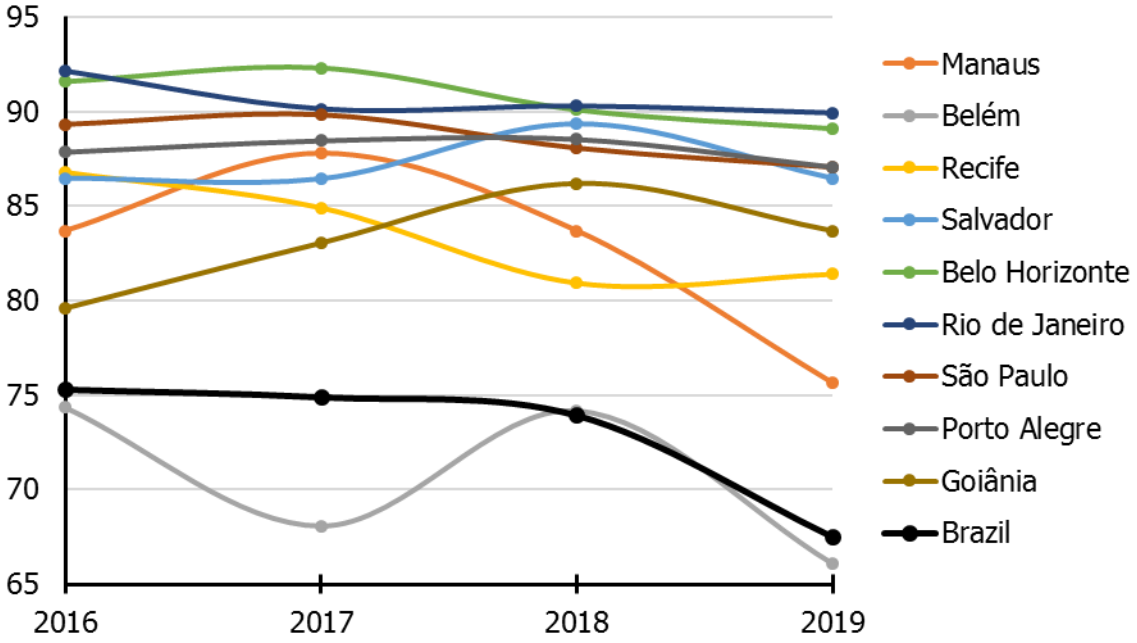
Table 12 - Percentage of non-poor households, Brazil and its Metropolitan Areas

MA	2016	2017	2018	2019
Manaus	83.68	87.77	83.69	75.65
Belém	74.34	68.07	74.16	66.08
Recife	86.80	84.91	80.92	81.39
Salvador	86.48	86.44	89.39	86.47
Belo Horizonte	91.59	92.31	90.11	89.12
Rio de Janeiro	92.16	90.14	90.29	89.92
São Paulo	89.31	89.81	88.05	87.04
Porto Alegre	87.85	88.46	88.55	87.03
Goiânia	79.56	83.03	86.19	83.68
Brazil	75.30	74.90	73.93	67.50

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

The largest proportion of non-poor households in 2019 was found in Rio de Janeiro's MA, followed by Belo Horizonte, Salvador, São Paulo, Recife, Goiânia, and Manaus. As aforementioned, with a result close to the national mean, the MA of Belém has the lowest proportion of non-poor households, as seen in Graph 9.

Graph 9 – Percentage of non-poor households, Brazil and its Metropolitan Areas



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.
Note: The values of vertical axis starts in 65%

When analyzing the households in vulnerability to poverty, whose values are shown in Table 13, there is a component in common to all the results and a MA that stands out. All results point to an increase in the proportion of households under this classification, even though in some MA this increase has undergone some fluctuations during the four years. The MA that stands out is Belém, which proportion of vulnerable households is higher than the national mean. Further investigation is needed in order to understand the reasons.

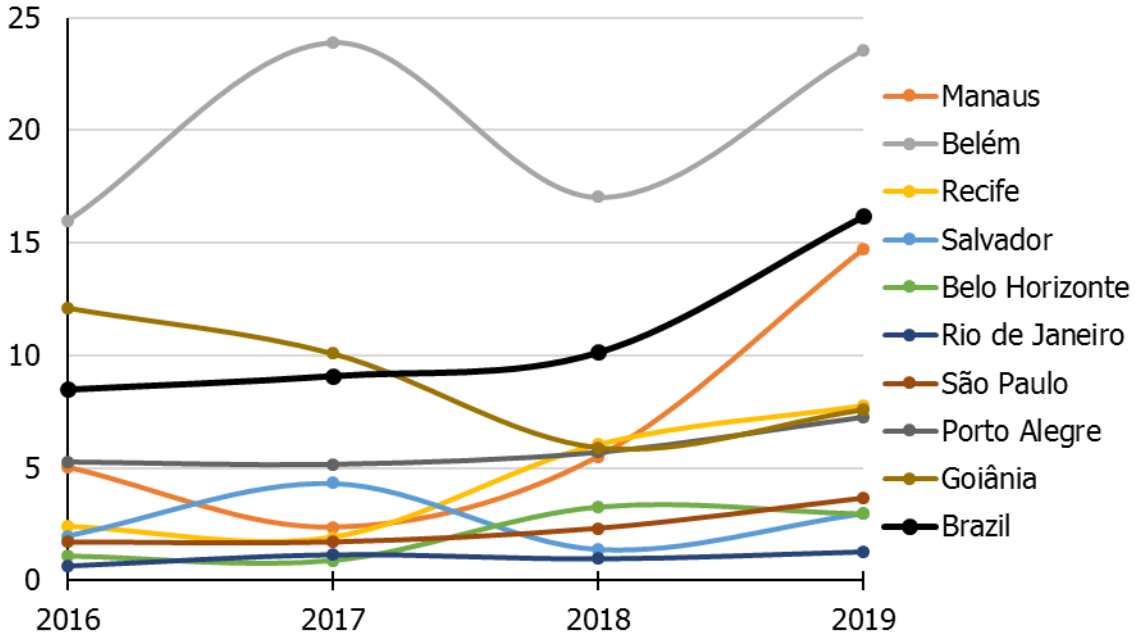
Table 13 - Percentage of vulnerable to poverty households, Brazil and its Metropolitan Areas

MA	2016	2017	2018	2019
Manaus	5.05	2.38	5.52	14.75
Belém	15.99	23.92	17.03	23.58
Recife	2.41	1.93	6.04	7.77
Salvador	1.98	4.33	1.38	2.99
Belo Horizonte	1.08	0.88	3.27	2.96
Rio de Janeiro	0.64	1.15	0.97	1.28
São Paulo	1.71	1.71	2.32	3.68
Porto Alegre	5.27	5.16	5.70	7.26
Goiânia	12.12	10.09	5.90	7.58
Brazil	8.50	9.10	10.14	16.20

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

Graph 10 shows the gap, in the vertical axis, between Belém and the other MAs across the country:

Graph 10 – Percentage of vulnerable to poverty households, Brazil and its Metropolitan Areas



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

In addition to the households classified as poor and extremely poor, there is also an increasing trend in the result of nearly all MA, as shown in Table 14. None of the MAs presented a percentage of the poor and extremely poor above the national mean.

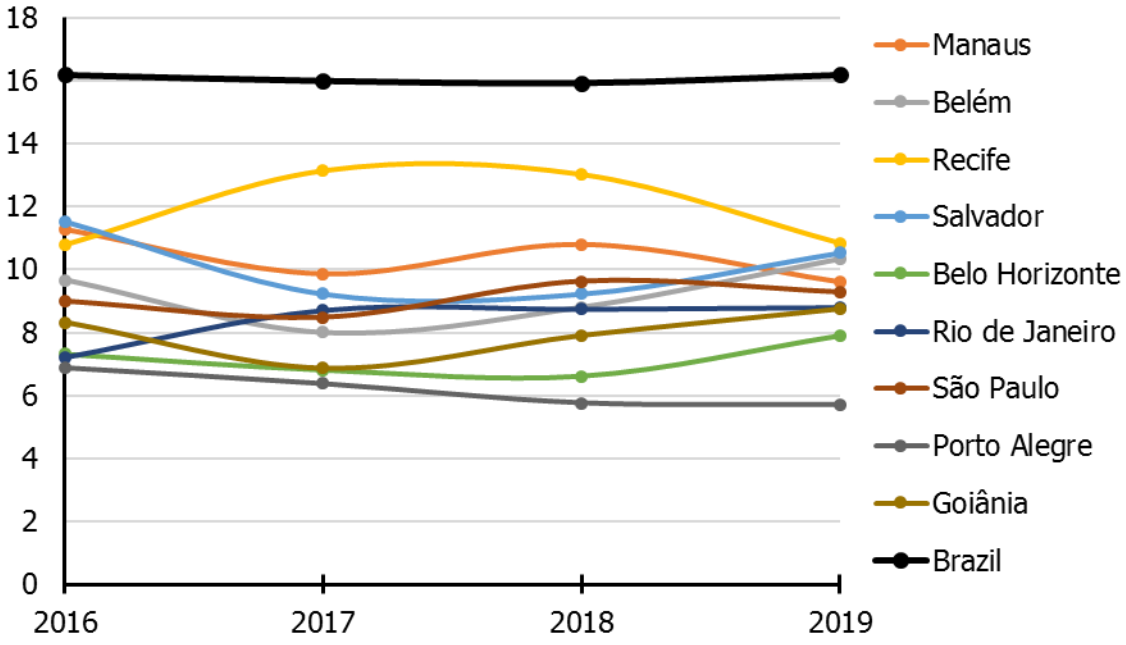
Table 14 – Percentage of poor and severely poor households, Brazil and its Metropolitan Areas

MA	2016	2017	2018	2019
Manaus	11.27	9.85	10.79	9.59
Belém	9.67	8.01	8.81	10.33
Recife	10.79	13.16	13.04	10.84
Salvador	11.54	9.23	9.23	10.54
Belo Horizonte	7.32	6.81	6.62	7.92
Rio de Janeiro	7.20	8.71	8.74	8.80
São Paulo	8.99	8.48	9.62	9.28
Porto Alegre	6.89	6.38	5.76	5.71
Goiânia	8.32	6.88	7.91	8.74
Brazil	16.20	16.00	15.93	16.20

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

Manaus and Porto Alegre are only the exceptions in the trend of increasing proportion of poor and extremely poor households. Recife also presents similar dynamics, all that can be seen in Graph 11:

Graph 11 – Percentage of poor and severely poor households, Brazil and its Metropolitan Areas



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

The regional results, with specific exceptions, reinforce the interpretation that the causal mechanism behind the increase in multidimensional poverty in Brazil in recent

years has a relationship with the increasing vulnerability to poverty. This can be seen by the relationship between the decrease in the proportion of non-poor households, the slight increase in poor and extremely poor people, and the evident increase in vulnerability to poverty. Future cross-sectional studies may contribute to this interpretation.

After evaluating the MPI for each MA, the next step is to evaluate the contributions of the dimensions that form the MPI. The dimension with the highest contribution to the MPI, both for national and each MA, was the Labour dimension.

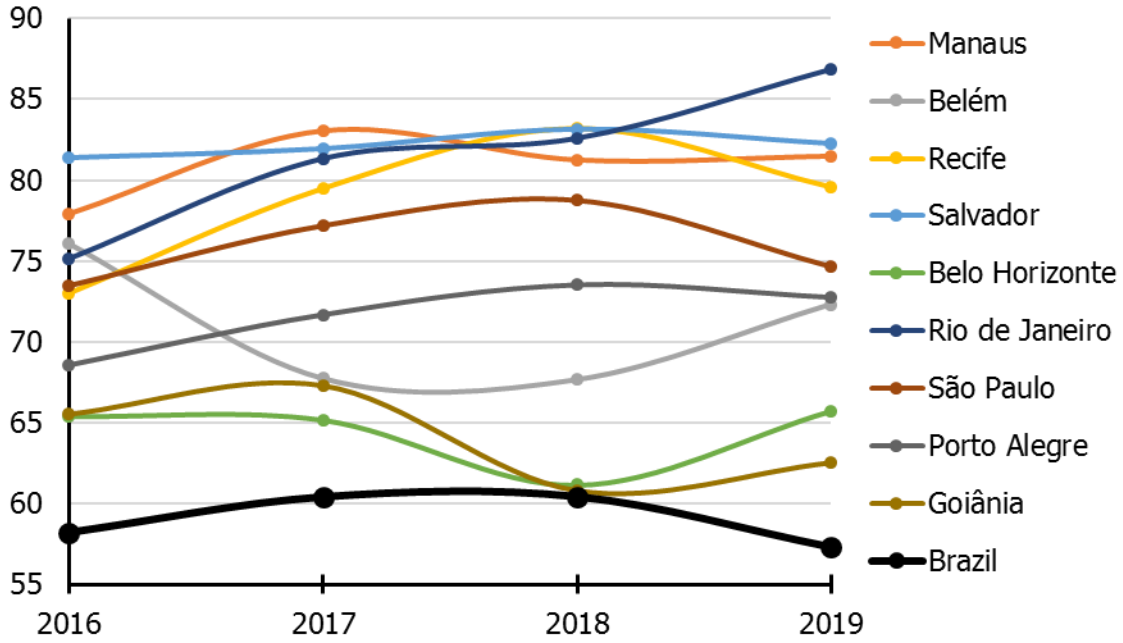
Table 15 – Contribution of the Labor Dimension to MPI, Brazil and its Metropolitan Areas

MA	2016	2017	2018	2019
Manaus	77.88	83.05	81.25	81.48
Belém	76.07	67.74	67.66	72.32
Recife	72.97	79.46	83.17	79.55
Salvador	81.39	81.95	83.15	82.27
Belo Horizonte	65.41	65.18	61.17	65.72
Rio de Janeiro	75.16	81.34	82.59	86.85
São Paulo	73.46	77.17	78.74	74.64
Porto Alegre	68.54	71.68	73.55	72.77
Goiânia	65.54	67.33	60.77	62.52
Brazil	58.20	60.39	60.41	57.30

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

Table 15 shows that the contribution of the Labour dimension was higher than the same contribution to national MPI. The major contributions of the Labour dimension were those in the MPI of Rio de Janeiro, Salvador, Manaus, Recife, São Paulo, and Porto Alegre. In all these MAs, the contribution of the Labour dimension showed an ascending behavior in the studied period. In Belém, Belo Horizonte, and Goiânia, presented, in addition to the small relative contributions, a decrease of this contribution during the studied period, as shown in Graph 12.

Graph 12 – Labour Dimension's contribution to MPI, Brazil and its Metropolitan Areas



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.
Note: The values of vertical axis starts in 55%

The next dimension, in terms of contribution, is the Education dimension. Belo Horizonte and Goiânia presented the highest contributions of this dimension, even higher than the national mean. This is because they showed the smallest contributions from the Labour dimension, as seen in Table 16:

Table 16 – Contribution of the Education Dimension to MPI, Brazil and its Metropolitan Areas

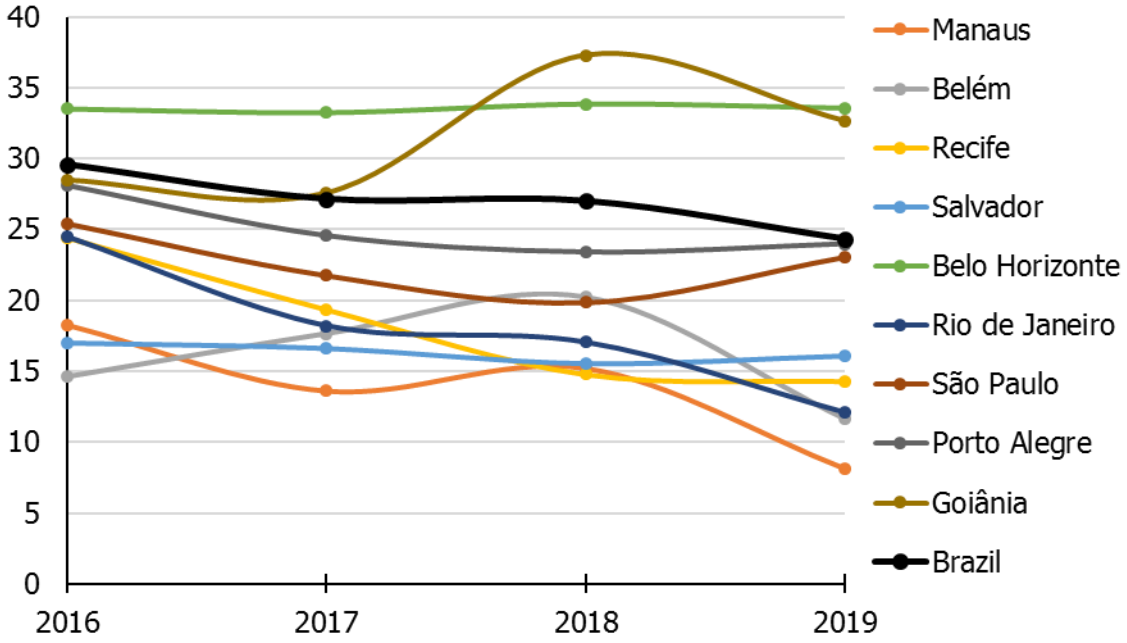
MA	2016	2017	2018	2019
Manaus	18.27	13.63	15.23	8.16
Belém	14.62	17.67	20.25	11.64
Recife	24.41	19.34	14.77	14.28
Salvador	17.03	16.64	15.54	16.09
Belo Horizonte	33.52	33.25	33.86	33.57
Rio de Janeiro	24.47	18.20	17.04	12.09
São Paulo	25.41	21.76	19.85	23.05
Porto Alegre	28.09	24.55	23.39	23.97
Goiânia	28.47	27.56	37.28	32.64
Brazil	29.60	27.16	27.01	24.33

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

Although deprivations of the Labour dimension weighed less in Belo Horizonte and Goiânia, deprivations in the Education dimension stood out, as can be seen in Graph 13.

Graph 13 – Education Dimension's contribution to MPI, Brazil and its Metropolitan Areas

Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.



Porto Alegre, São Paulo, Salvador, Recife, Rio de Janeiro, Belém, and Manaus showed lower contributions than the national mean, in deprivations of the Education dimension. Data from Recife, Rio de Janeiro, Belém, and Manaus show that the decrease in the contribution of the Education dimension has been a descending trend, at least during the studied period.

The Brazilian regional inequalities are well noticed, which cannot be attributed only to differences in income or GNP in these areas, but in a broader context, which public policies are developed to overcome deprivations in Education.

Finally, the last dimension, in terms of the weight of its contribution to the MPI, is that which measures the deprivations related to the population's Living conditions. Data, in Table 17, show the difference of this contribution in the national and MAs' MPI. Only Belém showed similar values to the national MPI. This difference at the national level and the MAs, except for Belém, points, once again, to the contrast of the conditions of urban and rural life in Brazil. This finding shows the relevance of future investigations to assess these hypotheses through a social index such as the MPI, and its indicators.

Table 17– Contribution of the Living Condition Dimension to MPI, Brazil and its MAs

MA	2016	2017	2018	2019
Manaus	3.84	3.32	3.53	10.35
Belém	9.31	14.60	12.09	16.05
Recife	2.62	1.20	2.05	6.17
Salvador	1.58	1.41	1.31	1.64
Belo Horizonte	1.07	1.58	4.97	0.71
Rio de Janeiro	0.38	0.46	0.37	1.06
São Paulo	1.13	1.08	1.41	2.30
Porto Alegre	3.37	3.77	3.06	3.26
Goiânia	5.99	5.11	1.95	4.84
Brazil	12.21	12.45	12.58	18.37

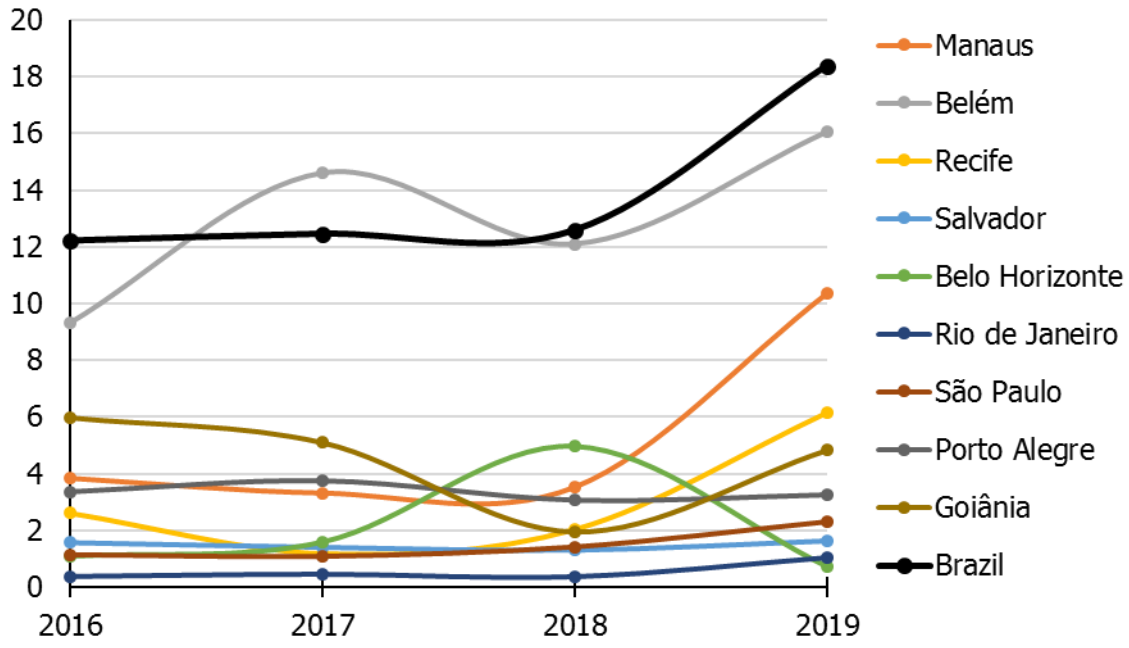
Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

Second, all others MAs are concentrated in the lower levels of the deprivations contribution of this dimension. Rio de Janeiro shows the lowest contribution of these deprivations. The contribution of Living condition dimension increases, progressively, in São Paulo and Salvador, whose results are very close in their contribution, followed by Belo Horizonte, Recife, Porto Alegre, Goiânia, and Manaus.[20]

The gap between Belém and the national mean compared to others MAs is shown in Graph 14:

[20] Manaus showed a sharp increase, at the last year studied, of the Living condition dimension's contribution to its MPI, from 3.53% in 2018 to 10.35% in 2019, an almost 3 times increase in just one year. This fact demands a further investigation to understand it causes.

Graph 14 – Contribution of the Living condition Dimension to MPI, Brazil and its MAs



Source: Calculated from IBGE's PNADC 2016, 2017, 2018 and 2019 data – own elaboration.

7. FINAL REMARKS

The results obtained with the calculation of the MPI consider the properties of the index, its ability to approximate the measure and the event, the empirical observation objectified by the statistical data, and the theoretical concept that justifies the effort to construct the index. The results show the social index capacity and its potential applications in supporting the formulation, implementation, and forwarding of several public policies that are related to its object.

Despite some limitations regarding the methodology adaptation, there is the possibility of replacing the less adapted indicators with other measures obtained more consistently by the PNADC and thus enabling the production of this indicator, at least once a year, which would offer a great advantage concerning the indexes produced from the Decennial Censuses. As long as the PNADC's statistical limitations are observed, it investigates about 211,000 households in approximately 16,000 census sectors across the country (IBGE, 2019c) and, therefore, allows regional cut-outs of the phenomena, given its characteristic of the research sample. The production of MPI through PNADC's data on an annual basis would contribute to the study of the phenomenon of poverty in Brazil and support, with the

systematic and continuous analytical instrument, the development of policies aiming its mitigation and, in the future, its eradication.

The central elements of the MPI, which are the proportion of the poor and the intensity of poverty, offer a substantial analytical capacity to this index. The proportion of poor people from a multidimensional perspective in Brazil, with changes in range and inclination in the period studied and in the MPI itself, was influenced by the deprivation score of individuals in households. Significant changes in the number of individuals affected by deprivation in the various indicators were reflected with higher intensity in the MPI variations. The intensity of poverty showed a different behavior from the MPI and the proportion of the poor. There is only a slight increase in the intensity of deprivation in which the poor and extremely poor, but with an intense transition from the condition of non-poor, expanding the number of vulnerability to poverty between 2016 and 2019. While the MPI had its value increased by about 0.32%, starting from a high initial level of 4.27% (2016) and the increase in the intensity of poverty was only 1.43%. Without evaluating the determinants of this behavior, but only the result itself, the incidence (H) shows a significant increase in the number of poor people in Brazil, while the living conditions of those who remained poor obtained a much smaller increase, with a slight reduction in deprivations for the poor population and a slight increase for the extremely poor. These components of the index allow the increase in the MPI to be qualified in the analyzed period and, thus, demonstrate a robust analytical index capacity, by demonstrating that there was a significant increase in the number of people subjected to the deprivations that characterize the condition of poverty, but with the maintenance of the reality of poverty itself, since those in poverty also had a slight increase in their average deprivation, to which they are already subjected.

Furthermore, when analyzing the classification of households in terms of deprivation score as non-poor, vulnerable to poverty, poor, and severely poor, it is observed a parallel with the demographic evolution of the households number, which deprivation ranges were more significant for the evolution of the MPI in that period; thus, the severely poor[21] and poor were the categories that had a slight increase, followed by a significant increase in vulnerability to poverty. When analyzing these results with traditional measures of inequality,

[21] Except between 2016 and 2017.

such as the Gini index, for example, it has the potential to contribute to the interpretation of the transformations in the Brazilian social structure during this period.

The aim of the analysis is to highlight the capacity of the MPI calculated from PNADC's data and raise new and relevant questions about the poverty in Brazil, offering a potential contribution to a more qualified approach, which will be added to conventional measures, to evaluate the implementation of actions associated with Human Development in Brazil. Thus, it is expected that this MPI contributes to approximating the theoretical approach of functioning and capabilities, as an effective reference that shows people's living conditions, the main discussions and decision making in the economy development policy; as well as collaborating to enrich the information base to support the formulation, implementation, and monitoring of policies to combat poverty and misery, in the search for greater focus and assertiveness to maximize its results.

The detailed analyzes on multidimensional poverty provides a miscellaneous diagnosis regarding the living conditions in its multiple social dimensions with the potential to adjust social policy strategies to improve the vulnerable population's wellbeing. Moreover, there is an aggravation of the economic crisis with endemic contours and, aggravated, recently, by the health and economic impact of the COVID-19 pandemic that pushes millions of Brazilians back to poverty and misery. The nuances of the multidimensional poverty spectrum that identifies its incidence, intensity, and index and, even more, its severity with possible disaggregations by dimensions and indicators creates precise and reliable parameters for the implementation of social policy targets, as well as for a more effective solution to the chronic welfare problems of an important part of the Brazilian population subject to unacceptable social deprivation in the modern globalized world.

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