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The effects of multidimensional well-being growth on poverty and inequality in Brazil over the periods of 2004-2008 and 2016-2019*

Efeitos do crescimento do bem-estar multidimensional na pobreza e desigualdade do Brasil no período de 2004-2008 e 2016-2019

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RESUMO: Por meio deste trabalho objetiva-se analisar os efeitos do crescimento do bem-estar multidimensional na pobreza e desigualdade do Brasil nos períodos de 2004-2008 e 2016-2019. Empiricamente, são utilizadas as metodologias de Kakwani e Pernia (2000), Kakwani, Khandker e Son (2004) e a decomposição de Shapley. Os resultados mostraram que houve diminuição da pobreza multidimensional entre 2004 e 2008 e um aumento entre 2016 e 2019. O crescimento do bem-estar multidimensional no segundo período foi antipobre. Com a decomposição constatou-se que, enquanto o crescimento do bem-estar multidimensional contribuiu para a redução da pobreza entre 2004 e 2008, entre 2016 e 2019 a concentração contribuiu para a elevação da pobreza.
PALAVRAS-CHAVE: Bem-estar; pobreza multidimensional; desigualdade.

ABSTRACT: This study aims to analyze the effects of multidimensional well-being growth on poverty and inequality in Brazil over the periods of 2004-2008 and 2016-2019. Empirically, the methodologies of Kakwani and Pernia (2000), Kakwani, Khandker, and Son (2004), and Shapley's decomposition are used. The results have demonstrated that a decrease in multidimensional poverty happened between 2004 and 2008, and an increase happened between 2016 and -2019. The growth in multidimensional well-being in the second period has been anti-poor. With the decomposition, it was found that while multidimensional well-being growth contributed to poverty reduction between 2004 and2008, between 2016 and 2019 the concentration contributed to an increase in poverty.
KEYWORDS: Well-being; multidimensional poverty; inequality.
JEL Classification: I31; I32; O11; P46.

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1. INTRODUCTION

The study on poverty is often carried out from the income insufficiency perspective. However, with the developments in research, the subject started to be analyzed based on the multidimensional perspective. According to Codes (2008), the multidimensional view enables the investigation of well-being in a broad sense, highlighting aspects related to work, health, housing, among other significant dimensions (Martini, 2010; Silva, Bruno, Silva, 2020).

The relevance of addressing poverty has been a key agenda for nations, including the Brazilian territory (Montali, Lessa, 2016). Therefore, reducing poverty along with improving the living conditions of the population is a justification to stimulate socio-economic development. In this context, the need to understand how income growth affects poverty and inequality emerges. This triangular relationship is referred to as pro-poor growth.

This theme rose to prominence with the studies of the World Bank researchers (Datt, Ravallion, 1992; Kakwani, Khander, Son, 2004; Kakwani, Pernia, 2000; Ravallion, Chen, 2003). In Brazil, several studies have focused on understanding the reciprocity among these indicators (Salvato, Araújo Júnior, Shikida, 2013; Godoy, Rodrigues, 2017; Morais, 2020). Despite this, the debate on the relationship between growth and poverty has been limited to income analysis.

Based on the confirmation of the persistence of poverty and inequality, even in the face of positive economic performance, other avenues of approaching this issue have emerged, such as the study of multidimensional poverty. For this reason, it is imperative to understand not only the effects of income growth but also the effects of multidimensional well-being growth on poverty and inequality indexes, which become key to this debate. Therefore, this study's main contribution is on understanding the effects of the triangular relationship among growth, poverty, and inequality through a multidimensional perspective, that is, providing additional analysis to the traditional pro-poor growth approach based on income growth.

Therefore, this paper aims to analyze the effects of multidimensional well-being growth on poverty and inequality in Brazil over the periods of 2004-2008 and 2016-2019. In the first period, the Brazilian economy experienced significant growth, while the second period has been characterized by an economic crisis. The analysis in two distinct periods from a socioeconomic perspective is relevant since they provide an understanding of the indicators'dynamics and the results can contribute to the development of public policies.

Therefore, the main question posed in this paper is: What are the effects of multidimensional well-being growth on poverty and inequality rates? What are the effects of multidimensional well-being growth on poverty and inequality indexes? The core hypothesis is that the increase in well-being can positively influence multidimensional poverty, as long as it is not concentrated.

To achieve this objective, the data from the National Household Sample Survey (PNAD) for the periods of 2004 and 2008, and the Continuous National Household Sample Survey (PNADC) of 2016 and 2019, both conducted by the Brazilian Institute

of Geography and Statistics (IBGE), are used. The choice for these databases is justified by the availability of information in the analyzed periods. In the analysis, the methodologies of Kakwani and Pernia (2000) and Kakwani, Khandker and Son (2004) are used, in addition to Shapley's decomposition.

This study is structured in five sections in addition to this introduction. The second section discusses pro-poor growth and the concepts of well-being and poverty from a multidimensional perspective. The third section briefly presents the socio-economic scenario in the study's analysis period. The fourth section discusses the analysis methodology, presenting the indicators used. The fifth section highlights the results and discussion. Finally, the final considerations of the study are presented.

2. PRO-POOR GROWTH, WELL-BEING, AND MULTIDIMENSIONAL POVERTY

There is no consensus on the definition of pro-poor growth. Simply put, pro-poor growth is regarded as a form of growth that is effective in reducing poverty, regardless of the levels of inequality in the economy (Ravallion, Chen, 2003). Thus, growth is pro-poor when it reduces poverty in the population, benefiting the poor population.

Analyses of pro-poor growth rely on income variation to check its effects on poverty and inequality outcomes. However, it is necessary to look beyond an increase in income and emphasize human development. The persistence of poverty even in the face of economic growth scenarios has led to the emergence of more complex approaches, aiming to incorporate other criteria besides income to characterize people's living conditions.

Although income is an essential indicator of well-being, according to Sen (2001), a person's well-being is related to a range of associated functionings, which enable the fulfillment of the statuses and actions that they need. In this approach, the functionings are the various activities that a human being can do or be, such as living for several years, having healthy nutrition, having an adequate social life, and several other valuable aspects involving their daily lives (Sen, 1997). The concept of capabilities, which represents the potential of individuals to perform such functionings, is key to this approach.

Based on this perspective, poverty should be understood as deprivation of basic capabilities, with the incorporation of distinct dimensions involving human well-being of which individuals may be deprived of. This analysis does not deny the idea that insufficient income is one of the causes of poverty (Sen, 2000). However, the understanding of well-being refers to well-being that is not only economic but also involves political, social, and spiritual aspects in the public and private spheres (Alkire, 2011).

In the capability approach, an individual's well-being can be viewed in terms of their achievements (Sen, 2000). Thus, from the capability perspective, human well-

being is multidimensional, related to individual freedom, and the fulfillment of human potential.

Analogous to the literature on pro-poor growth, a similar analysis can be performed by replacing the income-based measure of well-being with multidimensional well-being. This is equivalent to an analysis of the relationship between well-being growth and poverty considering the multidimensional concept, that is, based on multiple dimensions in addition to income.

3. THE BRAZILIAN SOCIO-ECONOMIC SCENARIO IN THE PERIODS OF 2004-2008 AND 2016-2019

Even with the relevance of studying multidimensional poverty, analyses based on income are still predominant. Despite this, there is progress in the multidimensional poverty theme in Brazil, with intensified research on the subject (Kageyama and Hoffmann, 2006; Lacerda, 2009; Silva, 2009, 2015; Serra, 2017; Silva, Bruno, and Silva, 2020).

In the 2010 Human Development Report of the United Nations Development Programme (UNDP), it was found that in 2010, 8.5% of the Brazilian population was living in multidimensional poverty. However, this percentage decreased to 3.8% in 2015.

For the study of poverty, regardless of whether it is based on income insufficiency or multidimensional, it is essential to understand the socio-economic scenario where individuals are inserted, which entails structural and situational aspects that justify the performance of these indicators. The starting point of this brief discussion will be the Lula government (2003-2010).

In this period, the State undertook an important role in the economy and in market regulation. The elements that led to economic growth with employment generation, poverty reduction, and income inequality were strengthened (Oliveira, 2015). The State started spending a portion of the Gross Domestic Product (GDP) on social policies, aiming to reduce poverty and inequality.

As a result, it was possible to expand the income and consumption spending levels of the Brazilian population (Lopes, 2018). Between 2003 and 2011, poverty due to income insufficiency decreased from 38.7% in 2003 to 21.0% in 2011 (ECLAC, 2020). These results are related to GDP growth – which reached 6.1% in 2007 – associated with income transfer policies, appreciation of the minimum wage, and expansion of formal employment (Dedecca, 2015; Kerstenetzky, 2016).

The increase in the minimum wage, along with income transfer programs, resulted in positive effects for the lower-income population. As a result, the Gini index, which measures income concentration, decreased from 0.576 in 2001 to 0.526 in 2011 (ECLAC, 2020). These factors contributed to the results of the country's income concentration indicators (Kerstenetzky, 2016).

During Dilma Rousseff's government, which started in 2011, economic performance has not been the same as in the previous period. Following the improvement

in the GDP growth rate in 2010, which reached 7.5%, economic activity decreased in the following years. According to Contri (2014), there was a decrease in consumption by Brazilian families, which had been fundamental to economic growth in previous periods.

Poverty and inequality indicators were also affected by this time of crisis in the Brazilian economy, breaking the downward trend starting in 2015 (Neri, 2019; Pedroso, 2020). The percentage of the population in poverty due to insufficient income increased from 16.5% in 2014 to 18.8% in 2015 (CEPAL, 2020).

The 2016-2018 period, which was represented by the Temer government, presented high unemployment rates – 12.3% in 2018, as reported by IBGE. A package of liberal measures was introduced in the economy, which advocated freezing public expenses for 20 years, privatizing, and labor reform, among other factors.

Due to the consequences of all the events experienced in the country, the years 2016 and 2019 represented moments of low GDP growth rates, especially in 2016 (-3.3%). A slow recovery occurred in 2019, but it was insufficient to alleviate the issues of poverty and inequality. At this moment, a new government led by Bolsonaro has taken office in Brazil, with the continuation of liberalizing policies and with a focus on reforms, especially the social security reform. Amid this, the measures imposed on Brazilian territory aimed to minimize state participation in the economy, with reduced attention to social policies.

Through the exposure of these scenarios, it can be noted that the periods of analysis proposed in this study correspond to a time of economic growth (2004-2008), and an economic crisis (2016- 2019). These two scenarios will be relevant, as it will be possible to verify and compare whether the growth of multidimensional well-being has reduced poverty and inequality, given the changes in the direction of economic and social policy from one period to the next. Most studies on this subject are based on income. In the literature, there is little evidence on the relationship between growth and poverty in the multidimensional sense.

4. METHODOLOGICAL PROCEDURE

This study analyzes the relationship among growth in multidimensional well-being, poverty, and inequality in Brazil in the periods of 2004-2008 and 2016-2019. In the analysis, the PNAD and PNADC databases, provided by IBGE, were used. PNAD used to be an annual survey, which was discontinued as of 2016 and replaced by PNADC. For this reason, the study for the period of 2004-2008 was conducted based on PNAD microdata. In turn, the PNADC was used for the 2016-2019 period. It is worth noting that the two surveys present some distinctions in their methodological processes, and these differences may limit the comparison between them.

To verify the growth from one year to the next, it was necessary to stack the PNAD and PNADC databases separately, since they are distinct databases. Therefore,

the data from 2004 were stacked with 2008 and the data from 2016 with 2019, in order to obtain two databases.

For the investigation of pro-poor growth rates through multidimensional well-being, it was necessary to estimate multidimensional well-being through the aggregation of a set of indicators. For this purpose, the methodology proposed by Alkire and Foster (2011) was used, which is frequently used in the literature for the estimation of multidimensional poverty. This is an intuitive methodology that is simple to replicate and is based on two steps.

The first stage identifies the deprivations faced by individuals based on two cut-off levels, one in each basic indicator to characterize deprivation situations (z); and another in a minimum number of dimensions in which individuals need to be deprived to be considered multidimensionally poor (k). After identifying the poor, an aggregate measure of multidimensional poverty can be devised (second stage).

The indicators that represented the deprivations were distributed according to the possibility of database compatibility in the following dimensions: Economic Vulnerability; Housing Conditions; Sanitary Conditions; Lack of Goods; Educational Characteristics, and Occupational Conditions. These dimensions are supported by the literature on the subject. Table 1 presents the variables'characterization according to the dimensions.

The cut-off levels (z) describe the conditions of deprivation in each indicator used, as presented in Table 1. The dimensions were selected to represent functionings that, if not satisfied, limit individuals from achieving the lifestyle they value. Thus, the number of dimensions considers the variables that, when combined, can identify the poor individuals multidimensionally.

Table 1: Selected dimensions, cut-off levels, and indicator weights*

Dimension	Indicators with the cut-off level (z)	Weight
Economic Vulnerability	Income below the poverty line	1/3
	More dependents than non-dependents	1/3
	Lack of a paid occupation	1/3
Housing Conditions	Not your own house	1/5
	More than three people living in one room	1/5
	Lack of electricity	1/5
	Walls made of substandard material	1/5
	Roofing made of substandard material	1/5
Sanitary Conditions	Lack of a toilet	1/4
	Lack of sewage system or septic tank	1/4
	Inadequate waste disposal	1/4
	Inadequate water supply	1/4

Lack of Goods	Lack of a landline or cell phone	1/5
	Lack of a TV set	1/5
	Lack of a refrigerator	1/5
	Lack of a washing machine	1/5
	Lack of a computer	1/5
Educational Characteristics	Presence of illiterate adults	1/3
	Presence of adults lacking complete elementary education	1/3
	Presence of children aged 6 to 15 out of school	1/3
Occupational Conditions	Lack of women's participation in employment	1/4
	Inadequate occupation	1/4
	Lack of someone employed with a signed contract	1/4
	Lack of someone employed earning an income higher than minimum wage	1/4

For the calculation of *Income below the poverty line* the World Bank poverty line of US$ 5.50 was used, converted into Brazilian Reais on the basis of purchasing power parity. It was considered as *Inadequate water supply* when water was not supplied from a general distribution network in urban areas, or not from a general distribution network, or from a well or spring in rural areas. As *Walls made from substandard material* materials other than brickwork were considered, and as *Roofing made of substandard material* different tile and concrete slab materials were considered. Since there is no direct waste collection in most rural areas, the possibility of waste being burned or buried on the property was also considered when individuals were located in rural locations, in the variable *Inadequate waste disposal*. By *Inadequate occupation,* underemployment was understood to be due to insufficient hours or insufficient wages.
Source: Authors'own compilation based on the PNAD and PNADC data covering the years 2004-2008, 2016-2019.

Based on these indicators (Table 1), a deprivation count matrix was developed, based on Alkire and Foster (2011). Where y_i are the achievements of individuals i in different dimensions j, for any y, $g^0 = [g^0_{ij}]$ indicates the deprivation matrix from 0-1, related to y. In this case, g^0_{ij} is given by $g^0_{ij} = 1$ when $y_{ij} < z_j$; and $y_{ij} > z_j$ when $g^0_{ij} = 0$. Therefore, g^0 is a matrix $n\ d$ – where n is the number of individuals and d is the number of dimensions – whose input $_{ij^{th}}$ is equivalent to 1 when the individual i is deprived in the dimension $_{j^{th}}$. When the value is 0, the individual is not deprived in the dimension $^{j^{th}}$. Through the matrix g^0, a column vector can be produced c of deprivation counting, where the $_{i^{th}}$ input, $c_i = \left|g^0_i\right|$, characterizes the extent of deprivation faced by the individual i (ALKIRE, FOSTER, 2011).

To characterize a multidimensional poverty situation, the deprivations were added up and a second cut-off level was determined k = 2[1]. Thus, when the sum of the deprivations, according to the weights presented in Table 1, totaled a value greater than or equal to 2, the individual was considered multidimensionally poor, that is, $c_i \geq k$.

To achieve a multidimensional well-being indicator that performed similarly to income, the reciprocal of this representation of deprivations was performed. Therefore, the well-being representation was equal to $1/c_i$. The cut-off level of the multidi-

[1] There is no predetermined level of *k* in the economic literature. Different levels of *k* can be consistent with the reality of each study object, thus, it is an arbitrary measure. Therefore, a value of 2 was considered more coherent, as it represents a satisfactory average in relation to the other values.

mensional well-being index applied to the two databases under analysis was represented by 1/k, that is, 1/2.

For the estimation of the pro-poor growth indexes, the ipropoor command of the DASP package – version 2.3 (Distributive Analysis Stata Package) of Stata was used. The ipropoor command generated the multidimensional well-being growth rate, referred to as g. This growth rate is key in the results analysis, as its value is the basis for the analysis of all pro-poor growth indexes. Moreover, it is worth noting that the pro-poor growth rates were calculated separately for each period. The indexes estimated in this study are described below.

4.1 Kakwani and Pernia's Index

Kakwani and Pernia's (2000) pro-poor growth index is derived from the ratio of the observed change in poverty to the observed change in distribution. Thus, it is assumed that a positive growth rate of g_{12}% exists between periods 1 and 2. Therefore, the poverty elasticity can be:

$$\eta = P_{12} / g_{12} \qquad (1)$$

This expression is understood as the proportional change in total poverty when a positive growth rate of 1% occurs. Similarly, it can be delimited:

$$\eta_g = G_{12} / g_{12} \qquad (2)$$

$$\eta_I = I_{12} / g_{12} \qquad (3)$$

Where: η_g is the proportional change in poverty when a positive growth rate of 1% occurs, as long as no changes in relative inequality occur; and η_I v is the proportional change in poverty when inequality changes and average well-being does not change. Thus:

$$\eta = \eta_g + \eta_I \qquad (4)$$

The expression above demonstrates the sum of the growth effect on poverty (η_g) and the effect of inequality on poverty (η_I), associated with a change in inequality. Therefore, the proportional change in poverty caused by a positive growth rate of 1% is given by the sum of these two factors. The η_g will always be negative, indicating that growth will decrease poverty when relative inequality does not change. However, η_g can be positive or negative. If η_I is negative, growth is pro-poor, that is, it entails a change in the distribution of well-being in favor of the poor population. If η_I is positive, the non-poor population benefits proportionally more than the poor. Therefore, the pro-poor growth rate can be described as follows:

$$\varnothing = \eta / \eta_g \qquad (5)$$

Thus, $\varnothing$ will be higher than 1, if $\eta_I < 0$, which indicates that the growth is strictly pro-poor. If $0 < \varnothing < 1$, it implies that $\eta_I > 0$, however, poverty is still being reduced

due to growth. If $\varnothing < 0$, the growth in well-being does not benefit the poor population and this scenario indicates an increase in poverty.

When the well-being growth rate is negative, it will lead to an increase in poverty, with η and η_g positive. If no redistribution of well-being occurs due to negative growth, poverty rises by η_g percent (this is due to the 1% decrease in the growth rate), while the real increase in poverty will be η percent. Thus, the well-being growth rate will be beneficial to the poor if $\eta < \eta_g$; and favorable to the non-poor if $\eta > \eta_g$. When the growth rate is negative, the index will be defined as follows:

$$\varnothing = \eta_g / \eta \qquad (6)$$

Given the equation (6), the negative well-being growth rate will be pro-poor when $\varnothing > 1$ and not pro-poor if $\varnothing < 1$. This pro-poor growth index is considered significant since according to Kakwani and Pernia (2000), it can be computed for any sector or region. Furthermore, the index can be used to develop public policies to benefit the poor.

4.2 Poverty Equivalent Growth Rate (PEGR)

Another index calculated was the Poverty Equivalent Growth Rate (PEGR). Kakwani, Khandker, and Son (2004) point out that a decrease in poverty is related to the magnitude of the growth rate, in the case of this study, of average well-being. Thus, the higher the growth rate, the greater the poverty reduction. Moreover, this reduction depends on the growth impact stemming from changes in inequality, that is, an increase in inequality reduces the effects of growth on poverty.

Starting from the proportion of people who are poor to consider the intensity of poverty, the level of absolute deprivation faced by a person with x well-being is defined by:

$$\begin{aligned} &\text{Dep}(x) = P(z, x) && \text{with } x < z \\ &\text{Dep}(x) = 0 && \text{with } x \geq z \end{aligned} \qquad (7)$$

Where P (z, x) is a homogeneous function of zero degree in z and x.

$$\frac{\partial P(z,x)}{\partial x} < 0$$

$$\frac{\partial^2 P(z,x)}{\partial x^2} > 0$$

This suggests that deprivation decreases monotonically with well-being over an increasing rate. Therefore, the level of poverty in society can be measured by the average deprivation faced by individuals, denoted as:

$$\theta = \int_0^z P(z, x)\, f(x)\, dx, \qquad (8)$$

where, f(x) is the probability density function of x.

To measure the two effects that contribute to the decrease in poverty, described at the threshold of this section, it is necessary to differentiate the equation (8). Thus, it follows:

$$\frac{d\theta}{\theta} = \frac{1}{\theta} \int_0^z \frac{\partial P}{\partial x} \, d(x) \, f(x) \, dx \quad , \qquad (9)$$

which stems from the assumption that P (z, z) = 0. This suggests that if a person's well-being is equivalent to the multidimensional poverty line, that person will not face any deprivation. It is assumed that x(p) is the well-being level of the population in the *percentile*th , therefore, the equation (9) can be expressed as follows:

$$dL_n(\theta) = \frac{1}{\theta} \int_0^H \frac{\partial P}{\partial x} \, x(p) g(p) dp \, , \qquad (10)$$

where, $g(p) = dL_n\,(x(p))$ represents the growth rate of individual well-being in the *percentile*th .

If L (p) is the Lorenz function that measures the total well-being share enjoyed by the top proportion p of the population, when the people in that population are sorted in an ascending order according to their well-being, then:

$$x(p) = \mu \, L'(p) \, , \qquad (11)$$

where μ is the average well-being level of society and e $L'(p)$ is the first derivative of the Lorenz function. Adding the logarithm in the equation (11) and differentiating it results in the following expression:

$$dLn(x(p)) = dLn(\mu) + dLn(L'(p)) \, ,$$

which can be transformed by the equation:

$$g(p) = \gamma + dLn(L'(p)) \, , \qquad (12)$$

where $\gamma = dLn(\mu)$ is the average well-being growth rate. Replacing the equation (12) in equation (10) results in:

$$dLn(\theta) = \gamma \, \eta + \frac{1}{\theta} \int_0^H \frac{\partial P}{\partial x} \, x(p) \, dLn\,(L'(p)) \, dp, \qquad (13)$$

where:

$$\eta = \frac{1}{\theta} \int_0^H \frac{\partial P}{\partial x} \, x(p) \, dp \qquad (14)$$

The equation (14) is the poverty growth elasticity, which represents the percentage change in poverty when there is a 1% growth in the average well-being of a given society, as long as the growth does not change inequality. This elasticity will

always be negative. In this step of the methodology, it is necessary to divide the equation (13) by γ, which results in:

$$\delta = \eta + \zeta , \qquad (15)$$

where, $\delta = \mathrm{dLn}(\theta)/\gamma$ is the total poverty elasticity, and $\zeta = \frac{1}{\theta\gamma}\int_0^H \frac{\partial p}{\partial x}\, x(p)\, \mathrm{dLn}(L'(p))\, dp$ measures the effect of poverty reduction according to inequality. This demonstrates how changes in poverty occur at the expense of variations in inequality that are followed by the process of well-being growth. In this sense, growth is pro-poor if the variation in inequality that follows growth mitigates total poverty, that is, growth will be pro-poor if the total poverty elasticity is greater than the growth elasticity of poverty.

Following these formulations, it is time to insert the PEGR developed by Kakwani, Khandker, and Son (2004). PEGR γ^* growth rate, which will generate the same level of poverty reduction as the γ growth rate, if growth is not followed by any changes in inequality. Therefore, the proportional rate of poverty reduction is determined by $\delta\gamma$, where δ corresponds to the total poverty elasticity. If growth is distributionally neutral, the γ^* growth rate will reach a proportional contraction of poverty equivalent to $\eta\gamma^*$, which must be equivalent to $\delta\gamma$. Thus, the PEGR, represented by γ^*, will be expressed as follows:

$$\gamma^* = (\delta / \eta)\gamma = \varnothing\, \gamma , \qquad (16)$$

where, $\varnothing = \delta/\eta$ is the pro-poor growth index developed by Kakwani and Pernia (2000), discussed in the previous section. The equation (16) suggests that growth is pro-poor if γ^* is higher than γ, and vice-versa. If γ^* varies between 0 and γ, growth is followed by increasing inequality, but a decrease in poverty will occur.

A positive well-being growth rate can lead to an increase in poverty levels, when γ^* is negative. This occurs when inequality increases, and the benefit of well-being growth is offset by the adverse effect of rising inequality. When the well-being growth rate is negative, poverty usually tends to increase. However, if $\gamma < \gamma^* < 0$, poor individuals are proportionally affected less than non-poor individuals. On the other hand, if $\gamma^* < \gamma < 0$, the poor are proportionally disadvantaged more than the non-poor.

In summary, Kakwani, Khandker, and Son (2004) sought to verify whether growth is pro-poor by calculating "equivalent growth rates for poverty" rather than using only the frequent growth rates of average well-being. Having presented the two indexes used, to complement the analysis, the next subsection presents the decomposition of poverty between growth and redistribution.

4.3 Shapley's Decomposition

The decomposition of poverty variation between growth and redistribution for the selected groups will be employed according to the methodology proposed by Shorrocks (2013). The methodological process is used based on Shapley's value (Araújo, 2007; Carneiro, Bagolin, and Tai, 2016), adapted in this study for multidimensional analysis.

Multidimensional poverty can be determined according to the following expression:

$$P(L, \mu, k) \tag{17}$$

where L is inequality, μ is average well-being, and k is the cut-off level determined in this study, mentioned in the beginning of section 4.

Considering a fixed cut-off level, the poverty level at the time t (t = 1, 2) can be defined by using the expression $P = (\mu_t, L_t)$. The growth component being denoted by $G = \frac{\mu_2}{\mu_1} - 1$ and the redistribution component by $R = L_2 - L_1$. The main point is to determine the contributions of growth and redistribution in the decomposition of poverty:

$$\Delta P = P(\mu_2, L_2) - P(\mu_1, L_1) = P(\mu_1 (1 + G), L_1 + R) - P(\mu_1, L_1 = F(G, R) \tag{18}$$

The average of variations in the growth and redistribution factors clarifies the variation in poverty by applying Shapley's decomposition. Through the equation (19) it is possible to notice the effects of the growth component, as it demonstrates the variation in average well-being. In this case, the distribution of well-being remains unchanged.

$$C_G^S = \frac{1}{2}[P(\mu_2, L_1) - P(\mu_1, L_1)] + \frac{1}{2}[P(\mu_2, L_2) - P(\mu_1, L_2)] \tag{19}$$

where, C_G^S represents the growth effect. In contrast, the equation (20) presents the effect of the redistribution component, denoted by C_R^S. Through this effect, the change in the level of well-being distribution is analyzed, considering the unchanged average well-being.

$$C_R^S = \frac{1}{2}\left[P(\mu_1, L_2) - P(\mu_1, L_1)\right] + \frac{1}{2}\left[P(\mu_2, L_2) - P(\mu_2, L_1)\right] \tag{20}$$

After demonstrating the expressions of the growth and redistribution effect, the total variation in poverty is composed of the sum of the two components, as demonstrated in the equation (21).

$$\Delta P = C_G^S + C_R^S \tag{21}$$

According to Shorrocks (2013), the advantage of using Shapley's decomposition is the feasibility of analyzing the factors'variation in the base year and the final year simultaneously. Furthermore, according to Araújo (2007), this decomposition is employed in any type of distributional analysis, regardless of the numbers and types of factors established in the research.

Despite the interpretation of these results of these factors, the minus sign for the growth component implies that the increase in average well-being promotes a decrease in poverty. In turn, the plus sign means that the reduction in well-being raises the poverty level. Similarly, the minus sign for the redistribution effect indicates that the decrease in well-being inequality will cause a reduction in poverty, and presenting the plus sign indicates that the increase in the concentration of well-being will imply an increase in the poverty measure. Regarding the total variation of pov-

erty (ΔP), the minus sign indicates a decrease in poverty, explained by both components.

The groups used[2] in this decomposition were the following: the geographic region (North, Northeast, Southeast, South, and Midwest), gender (male and female), ethnicity (Caucasian, African, Asian, Mixed, and Native), census tract (urban and rural), and economic activity sectors (Agriculture, Other industrial activities, Manufacturing, Construction, Trade and repair, Accommodation and food, Transportation, Public administration, Education and health, Domestic services, Other community services, Other activities, and Poorly defined activities). Shapley's decomposition will enable verification of the variation in poverty between growth and redistribution in the groups proposed for analysis. The next section will present this study's main results and discussions.

5. RESULTS AND DISCUSSIONS

To analyze the relationship between the growth of multidimensional well-being and poverty in Brazil, pro-poor growth indexes were generated according to the methodologies described in the previous section. Therefore, this section will present the results of the effects of multidimensional well-being growth on poverty for the periods of 2004-2008 and 2016-2019.

The results presented aim to contribute to the theme of pro-poor growth. This is due to the fact that this study is based on multidimensional well-being and no other studies were found in the literature that address the subject through this perspective, based on the proposed methodologies. Table 2 presents the results of the pro-poor growth indexes in Brazil in 2004-2008.

Table 2: Pro-poor growth indexes based on multidimensional well-being in Brazil in 2004-2008

Pro-poor growth indexes	Estimate	se*	lb*	ub*
Well-being growth rate (g)	0.1210	0.0016	0.1178	0.1242
Kakwani and Pernia's Index (2000)	0.8570	0.0117	0.8341	0.8799
PEGR	0.1037	0.0020	0.0997	0.1077
PEGR - g	-0.0173	0.0014	-0.0020	-0.014

*se = standard error; lb= lower-bounded (95%); ub = upper-bounded (95%).
Source: Authors'own compilation based on the PNAD and PNADC data covering the years 2004-2008.

[2] The justification for these groups involves the key characteristics that such groups present in the Brazilian territory. For instance, some groups are the most privileged in society, such as men, Caucasian individuals, individuals from the South and Southeast regions, and from urban areas, while women, people of African descent, and those from the Northeast region face structural challenges that are still present in Brazil. Therefore, the decomposition enables identifying these characteristics. Its results are relevant for policies aimed at addressing poverty and inequality among groups.

The growth rate of multidimensional well-being was positive (0.1210) between 2004 and 2008 in the Brazilian territory, according to the dimensions considered in this work. According to Kakwani and Pernia's index, Brazil presented a result ranging from 0 to 1, which implies that η_i is positive (Table 2). Thus, multidimensional poverty was reduced due to the growth in multidimensional well-being. However, the population with the lowest level of deprivation benefited proportionally more than the most deprived population.

On the other hand, Brazil's PEGR varied between 0 and g, which leads to the conclusion that this growth was followed by an increase in inequality, but a reduction in multidimensional poverty occurred. This conclusion points out that the multidimensionally poor individuals in Brazil received proportionally fewer benefits from the growth in well-being in comparison to the non-poor. Regarding the subtraction between the PEGR and g, the result was negative. Thus, the increase in multidimensional well-being among the poor was lower than the average increase in multidimensional well-being for the general population.

The two ways of operationalizing pro-poor growth demonstrated that although the fruits of well-being growth decreased multidimensional poverty, the poorest population failed to obtain satisfactory results from this growth. Otherwise, the non-multidimensionally poor benefited proportionally more than the poor, as verified based on the Kakwani and Pernia index and the PEGR. Table 3 presents the results of the same indexes for the period of 2016-2019.

Table 3: Pro-poor growth indexes based on multidimensional well-being in Brazil in 2016-2019

Pro-poor growth indexes	Estimate	se*	lb*	ub*
Well-being growth rate (g)	0.0117	0.002	-0.055	-0.047
Kakwani and Pernia's Index (2000)	-1.3092	0.069	1.079	1.348
PEGR	-0.0153	0.005	-0.072	-0.051
PEGR - g	-0.0270	0.004	-0.018	-0.003

*se = standard error; lb= lower-bounded (95%); ub = upper-bounded (95%).
Source: Authors'own compilation based on the PNAD and PNADC data covering the years 2016-2019.

The results presented in Table 3 demonstrate that the growth rate of multidimensional well-being (g) during the period between 2016 and 2019 was positive (0.0117), although it was much lower than the rate verified between 2004 and 2008 (0.1210). Regarding the Kakwani and Pernia index, a negative index is identified (-1.3092), indicating that the growth in multidimensional well-being failed to favor the poor population, that is, there was an increase in poverty in Brazil.

Regarding the PEGR, it is noted that its value pointed out that the distributional changes in the country were absolutely anti-poor, that is, the growth in multidimensional well-being failed to reduce poverty in the 2016-2019 two-way relationship. The result of the subtraction between the PEGR and g evidenced that the increase in well-being among the poor was lower than the increase in the average well-being of the general population. This indicates that the participation in multi-

dimensional terms of the poor population in the Brazilian territory was negatively affected by the distributional change.

The results of the two ways of operationalizing pro-poor growth in 2016-2019 pointed out that multidimensional well-being growth was not pro-poor in Brazil. The investigation of pro-poor growth through income is recurrent in the economic literature. This methodology is not widely used for measuring the fruits of growth in multidimensional poverty. Empirical evidence indicates that research on the topic focuses on average per capita income to verify the effects of growth. The study by Morais (2020) is the one that comes closest to the association between multidimensional poverty and economic growth, although it does not use the methodologies proposed in this study.

Morais (2020) measured a Multidimensional Poverty Index (MPI) for Brazilian cities with data from the 2000 and 2010 Censuses. The author analyzed how this index performed, on average, according to economic growth and income inequality. Through econometric tests, the growth-poverty and inequality-poverty elasticities were measured. Compiling the results found by the author, it was found a positive inequality-poverty elasticity and a negative growth-poverty elasticity. In addition, the poor were less favored by the increase in income, indicating that the increase in income in this period was not configured in a pro-poor growth. The results proved that income growth affected the one-dimensional and multidimensional poverty rates differently.

Although the focus of Morais (2020) is different from that proposed in this research, it is worth discussing the author's study to clarify that efforts are made in the literature to analyze pro-poor growth in multidimensional terms. The evolution of this theme provides a contribution to the economic literature, since as of yet there are few studies similar to this one.

The results from a multidimensional perspective, presented in this study, for the two-way analysis of 2004-2008 and 2016-2019, indicated that the growth in multidimensional well-being was not pro-poor. Although the period of 2004-2008 was characterized by increased employment and income, and consequent improvement in indicators measured by income, in multidimensional terms, the social cause would still need to make progress. This demonstrates the need to expand the analysis beyond income since well-being includes other relevant dimensions that cannot be underestimated. Despite this, it can be noticed that the scenario in the first period was not as serious when compared to the second period of the analysis, which points to the results of the socioeconomic dynamism of the period.

The 2016-2019 scenario represented a time of economic crisis and changes in the direction of the country's economic and social policy. Reforms were implemented that resulted in increased unemployment and reduced incomes. Unemployment reached 12.9 million individuals in 2019 (IBGE, 2020) and the population's income decreased (Neri, 2019). The deterioration in income and labor indicators had negative effects on multidimensional well-being indicators, a factor that contributes to

understanding the results of the indicators in favor of the non-poor population in the period in question.

Thus, it is necessary to consider the different dimensions of well-being such as housing, education, sanitation, and working conditions, among others, which are requirements for a person to achieve a full life in society. Hence, it is necessary to devise public policies that aim to reduce poverty and inequality through the multidimensional optimum. To understand the variation of poverty, data on the growth and redistribution of well-being in the periods analyzed in this research will be presented in the next section.

5.1 Decomposition of poverty variation between growth and redistribution

There is extensive national and international literature on decomposing poverty variation from an income perspective. In Brazil, the growth effect has been the main determinant of poverty performance, as demonstrated in research by Helfand, Rocha, and Vinhais (2009), Araújo (2007), Carneiro, Bagolin, and Tai (2016), and Santos and Vieira (2016). However, a share of authors clarify that inequality is the main macro-determinant of poverty (Annegues et. al., 2015; Souza et. al, 2017; Araújo, Marinho, and Campêlo, 2017).

The increase in poverty and inequality is a result of the capitalist process itself, and to mitigate these issues, strategies are needed to improve not only income redistribution, but also multidimensional well-being. With these considerations in mind, Table 4 presents the data for the decomposition of the variation in poverty between growth and redistribution in the period of 2004-2008 for the groups established in this work.

The decompositions by population groups for the period of 2004-2008 demonstrated that the increase in multidimensional well-being was predominantly driven by factors in the (C_G^S) growth component, which contributed to the decrease in multidimensional poverty in this period (ΔP). Of all the regions, the North region stands out, as the increase in well-being contributed 12.86% to the reduction of poverty. Although the total variation in poverty was negative, the (C_R^S) redistribution factor has led to an increase in multidimensional poverty (plus sign), especially in the Northeast region (3.2%) (Table 4).

Regarding sex, the increase in multidimensional well-being (C_G^S) between men and women contributed by 10.92% and 12.04% respectively to the reduction in multidimensional poverty. Regarding ethnicity, in contrast to the others, among the Asian population the redistribution component (C_R^S) was the main determinant for poverty reduction (2.39%). In addition, it is worth noting the Mixed ethnicity group's performance, whose contribution to the growth in multidimensional well-being (C_G^S) for poverty reduction was 13.97% (Table 4).

Table 4: Decomposition of the multidimensional poverty variation between well-being growth and redistribution in the period of 2004-2008

Groups	Shapley's decomposition		
	C_G^S	C_R^S	ΔP
Region			
North	-0.1286	0.0122	-0.1164
Northeast	-0.1204	0.0320	-0.0884
Southeast	-0.1124	0.0063	-0.1061
South	-0.1144	0.0100	-0.1044
Midwest	-0.1250	0.0053	-0.1197
Gender			
Male	-0.1092	0.0082	-0.101
Female	-0.1204	0.0206	-0.0998
Ethnicity			
Caucasian	-0.1130	0.0154	-0.0976
African	-0.1386	0.0177	-0.1209
Asian	-0.0150	-0.0239	-0.0389
Mixed	-0.1397	0.0278	-0.1119
Native	-0.0842	0.0026	-0.0816
Census tract			
Urban	-0.1165	0.0091	-0.1074
Rural	-0.1049	0.0370	-0.0679
Economic activity sectors			
Agriculture	-0.1494	0.0564	-0.093
Other industrial activities	-0.0462	-0.0016	-0.0478
Manufacturing	-0.0600	0.0029	-0.0571
Construction	-0.1254	0.0223	-0.1031
Trade and repair	-0.0766	-0.0070	-0.0836
Accommodation and food	-0.1011	0.0166	-0.0845
Transportation	-0.0614	-0.0047	-0.0661
Public administration	-0.0383	-0.0106	-0.0489
Education and health	-0.0287	-0.0115	-0.0402
Domestic services	-0.1257	0.0369	-0.0888
Other community services	-0.0807	-0.0109	-0.0916
Other activities	-0.0312	-0.0011	-0.0323
Poorly defined activities	-0.0738	-0.0388	-0.1126

Source: Authors'own compilation based on the PNAD and PNADC data covering the years 2004-2008.

The growth of well-being (C_G^S) was more prevalent in the results of poverty in urban (11.65%) and rural (10.49%) areas, although there has been an increase in multidimensional inequality in these locations. Regarding the sectors of economic activity, in some sectors – Other Industrial Activities, Trade and Repair, Transportation, Education and Health, Other Activities, Other Collective Services, and Poorly Defined Activities – both components were determinants for the reduction of multidimensional poverty, as they presented negative results. In other sectors only the growth component (C_G^S) has contributed to the reduction of multidimensional poverty.

As previously mentioned, the period of 2016-2019 presented changes in the directions of economic and social policy. The effects of these changes have affected the poorest individuals. In order to analyze the variation in poverty between growth and redistribution in these groups, Table 5 will present the main results for the mentioned period.

Table 5: Decomposition of the change in multidimensional poverty between well-being growth and redistribution over the period of 2016-2019

Groups	Shapley's decomposition		
	C_G^S	C_R^S	Δ P
Region			
North	0.0499	0.0350	0.0849
Northeast	0.0308	0.0332	0.0640
Southeast	-0.0348	0.0531	0.0183
South	-0.0122	0.0391	0.0269
Midwest	-0.0083	0.0472	0.0389
Gender			
Male	0.0000	0.0427	0.0427
Female	-0.0229	0.0583	0.0354
Ethnicity			
Caucasian	-0.0507	0.0756	0.0249
African	0.0249	0.0207	0.0456
Asian	-0.0748	0.1251	0.0503
Mixed	0.0267	0.0204	0.0471
Native	0.0337	0.0289	0.0626
Census tract			
Urban	-0.0154	0.0530	0.0376
Rural	0.0450	0.0052	0.0502
Economic activity sectors			
Agriculture	0.0624	-0.0133	0.0491
Other industrial activities	0.0000	0.0267	0.0267
Manufacturing	0.0450	0.0060	0.0510

Construction	0.0136	0.0156	0.0292
Trade and repair	0.0281	-0.0034	0.0247
Accommodation and food	0.0466	0.0065	0.0531
Transportation	-0.0225	0.0355	0.0130
Public administration	-0.0359	0.0433	0.0074
Education and health	-0.0395	0.0432	0.0037
Domestic services	-0.0045	0.0532	0.0487
Other community services	0.0735	-0.0163	0.0572
Other activities	0.0009	0.0844	0.0853

Source: Authors'own compilation based on the PNAD and PNADC data covering the years 2016-2019.

Unlike what occurred in the 2004-2008 period, growth in multidimensional poverty occurred between 2016 and 2019, as evidenced by the decomposition presented in Table 4. In some groups, the growth component had an effect on poverty reduction, while the redistribution component mostly had an effect in the opposite direction, pointing to a concentration of multidimensional well-being.

In other groups the components were mutually strengthened, increasing poverty as a whole. This performance was identified across the different regions, and in the North and Northeast regions, both components were mutually strengthened with positive results, so that total poverty (ΔP) increased, respectively, by 8.49% and 6.40%.

Between men and women, the growth in multidimensional poverty was driven by the redistribution component (C_R^S), with their respective contributions of 4.87% and 5.83% to poverty. Regarding ethnicity, the growth component of multidimensional well-being contributed to a reduction in poverty among Caucasian people (5.07%) and Asian people (7.48%). Still, an increase in total poverty occurred across all categories (Table 5).

The results of poverty variation by census tract status indicated that the redistribution component (C_R^S) was more significant in explaining the performance of total poverty. It is noted that despite the growth in poverty in both census tracts, the rural areas suffered the most, with poverty increasing by 5.02%.

Among the economic activity sectors, the largest increase in total poverty occurred in the Poorly defined activities (8.53%) and Domestic services (5.72%) sectors. Furthermore, the decrease in multidimensional well-being (C_G^S) of people in Domestic services contributed 7.35% to total poverty.

Contrary to the 2004-2008 analysis, the multidimensional inequality represented by the redistribution component was a determining factor for the performance of poverty between 2016 and 2019. The decompositions of the poverty variation in the 2004-2008 and 2016-2019 periods allowed concluding that in different socioeconomic scenarios, differences existed in the performance of multidimensional poverty.

6. CONCLUDING REMARKS

This study aimed to analyze the effects of multidimensional well-being growth on poverty and inequality in Brazil in the periods of 2004-2008 and 2016-2019. For this purpose, microdata from PNAD and PNADC of the aforementioned years were used where information was extracted to compute the effects of growth based on the methodologies proposed by Kakwani and Pernia (2000), Kakwani, Khandker, and Son (2004), and Shapley's decomposition.

Based on the results found it was possible to conclude that in the periods analyzed no pro-poor growth occurred in Brazil in the multidimensional sense. The scenario for the period of 2016-2019 was even worse, as the growth in well-being, measured according to the indicators highlighted in this study, was anti-poor. Between 2004 and 2008, growth occurred in multidimensional well-being, followed by a decrease in multidimensional poverty. In contrast, between 2006 and 2019 multidimensional poverty increased.

In the years 2004-2008, the Brazilian economy enjoyed high rates of economic growth, favoring the performance of poverty. During this period, a share of the GDP was allocated to social programs, with the objective of reducing poverty. Thus, income and consumption levels increased. The decomposition results demonstrate that the growth in well-being was the main factor responsible for the decrease in poverty during the period.

In contrast, during years of low economic dynamism, such as in 2016-2019, an increase in unemployment and crisis occurred. In this scenario, poverty and inequality tend to increase. As the Shapley's decomposition results analysis demonstrated, in virtually all verified groups, growth in multidimensional poverty as a whole occurred. The data clarified that the multidimensional well-being of the poor decreased, and that the concentration of multidimensional well-being followed an upward trajectory.

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