Non-agricultural income, infrastructure and access to consumer goods in rural households in the northeast and south

Renda não agropecuária e condições de infraestrutura e acesso a bens de consumo em domicílios rurais (nordeste e sul)

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Abstract: The objective of this article is to analyze the impact of non-farm income on infrastructure conditions and access to durable consumer goods for rural families in the Northeast and South of Brazil. For this purpose, microdata from the Household Sample Survey (PNAD) from 2002 to 2015 were used. The methodology consisted of the construction of an index of household infrastructure and access to consumer durables and of the estimation of a quantile regression to verify the effect of labor income on this index. The results showed that families who practice pluriactive and nonfarm activities had higher average incomes, compared to agricultural families. However, the impact of income on the variables analyzed was greater in the group of poorer rural families, regardless of the activity practiced and the region. In other words, pluriactive and nonfarm activities can contribute, at first, to promote significant changes in a context of precariousness. However, they are unable to generate enough income to contribute to structural changes in better equipped households.

Keywords: income, nonagricultural activities, conditions of household infrastructure and durable consumer goods.

Resumo: O objetivo deste artigo é analisar o impacto da renda não agrícola nas condições de infraestrutura e acesso a bens de consumo duráveis para famílias rurais do Nordeste e Sul do Brasil. Para tanto, foram utilizados microdados da Pesquisa por Amostra de Domicílios (PNAD) de 2002 a 2015. A metodologia consistiu na construção de um índice de infraestrutura domiciliar e acesso a bens de consumo duráveis e na estimação de uma regressão quantílica para verificar o efeito da renda do trabalho sobre esse índice. Os resultados mostraram que as famílias que praticam atividades pluriativas e não agrícolas apresentaram rendimentos médios mais elevados, em comparação com as famílias agrícolas. No entanto, o impacto da renda nas variáveis analisadas foi maior no grupo de famílias rurais mais pobres, independentemente da atividade praticada e da região. Em outras palavras, atividades pluriativas e não agrícolas podem contribuir, em um primeiro momento, para promover mudanças significativas em um contexto de precariedade. No entanto, não conseguem gerar renda suficiente para contribuir com mudanças estruturais em famílias mais bem equipadas.

Palavras-chave: renda, atividades não agrícolas, condições de infraestrutura domiciliar e bens de consumo duráveis.

1. Introduction

It is known that, in a capitalist society, monetary income becomes essential to guarantee basic and indispensable rights to human beings. In the list of the basic human needs, good household infrastructure and access to durable consumer goods are included. However, a large number of people are still unable to take advantage of these conditions, as is the case with rural families. This inaccessibility or difficulty of access is due to several factors, such as the low income of this population, which, for the most part, does not find occupation in the rural environment, especially the northeastern agricultural families.

In an attempt to deal with economic and environmental shocks, many agricultural families are becoming pluriactive and nonfarm . The introduction of these activities in family income has proved more advantageous financially, compared to agricultural activity, as shown by Brazilian and international literature (Diep & Vien, 2017; Silva & Grossi, 2001; Kageyama & Hoffmann, 2000; Niemela & Hakkinen, 2015; Salmi, 2005; Schneider, 2009; Silva & Neder, 2006; Sakamoto et al., 2016; Subramanian, 2018). However, this does not necessarily mean that all rural families engaged in nonfarm and pluriactive activities experience high incomes and, consequently, present improvements in social conditions, given that there are rural families inserted in low-skilled and low-remunerated activities, such as domestic employment and civil construction (Nascimento, 2004). In this context, it is acceptable to question whether the presence of such activities can promote significant changes in basic infrastructure and access to durable goods in rural households.

In the international field, this assumption has also been noted. Silva & Kodithuwakku (2010) observed that, in a Sri Lankan community, not all rural families benefited socially and economically because they were pluriactive, and only families who practiced nonfarm activities that required more skills had a better socioeconomic response. In this same context, Gautam & Andersen (2016), using household data from Nepal, identified that well-being is related to the degree of economic return of nonfarm activities, and not only to diversification itself. In the Philippines, the study by Mendoza (2018) showed that there is no significant evidence of the positive impact of pluriactive income on the well-being of the poorest families, given that this group had a lower income level due to poor job quality (unstable, poorly paid and low productivity).

In the Brazilian context, most studies on this topic have not yet addressed the proportional effect that nonfarm income can have, at the micro level, in rural households. More specifically, the research analyzed the contribution of nonfarm income in average terms, which allows only a general perception of the contribution of these activities to family income. According to the microdata from the PNAD/IBGE (National Household Sample Survey/ Brazilian Institute of Geography and Statistics), the average nonfarm income of autonomous families (own accounts) in 2015 represented 1,536.34 reais (R$) in the Northeast and R$ 2,999.26 in the South. However, one must consider the existence of an enormous variation in the social conditions of these groups, which may make them less or more sensitive to the impacts caused by increases in household income stimulated by nonfarm activities.

In this regard, the question is: What is the impact of nonfarm income on the conditions of household infrastructure and consumer goods in rural households? Does this impact tend to be diluted as these conditions improve?

In order to answer these main questions, two methodological procedures were used: I) construction of an aggregate index that encompasses the variables of the dimensions of household infrastructure and consumer goods; and II) quantile regression estimation, to analyze the impact of income by ranges of household infrastructure and consumer goods conditions. It is emphasized that the analyses were performed for the three activities practiced by the families

(agriculture, pluriactivity, nonagriculture). This allows us to investigate the impact of different income levels on each activity, as well as to establish comparisons between them. In addition, we sought to analyze the results in two rural regions with distinct socioeconomic, technical and climatic realities: the Northeast and South regions of Brazil. In this regard, the study provides insights into the implications of changes in rural income sources on social transformations in rural households from two segmentation perspectives: infrastructure conditions and access to durable goods, and regional characteristics.

2. Theoretical Foundation

It is known that Brazil is a country of continental dimensions and presents great socioeconomic inequality between regions. The consequence of this problem has repercussions on several dimensions, among them the dynamics of the regional labor market, which in turn impacts on the quality of employment, with repercussions on family income and social conditions at home.

In this regard, the particularities of the rural labor market in the Northeast and South justify the configuration of rural families who practice the same activity, but have very different social characteristics, as is the case of pluriactive and nonfarm rural families in the two aforementioned regions.

With regard to the rural labor market in the Northeast, it is known that its low dynamism is due to the region's economy, which remained stagnant for decades. Among the various factors that contributed to this, the following are mentioned: the loss of importance of the main sectors of its economic activity—the sugar agribusiness and the textile industry—for the Southeast in the post-war period; and the late effort of the State to implement a regional policy with a multidimensional approach, instead of just the income dimension.

The slow-growth scenario of the Northeastern economy changed from the 1990s onwards, due to several factors, among which the strategies of the states to stimulate local dynamics, through tax exemptions to attract installation and growth, stand out. However, even with the greatest incentives for enterprises in less developed rural areas, a large part of the industries settled in the metropolitan areas, due to the better conditions of transport, communication and qualification of the workforce (Lima & Lima, 2010).

However, the growth of the Northeast region at the beginning of this century, above the national average, increased the supply of better-quality nonfarm occupations, which favored the growth of the number of nonfarm rural families to the detriment of pluriactivity (Cardoso, 2013). It is also added that the expansion of social transfers of income combined with public investments contributed considerably to the improvement of social indicators. However, this was not enough for the Northeast to change its position in the ranking of socioeconomic inequality in relation to other regions, especially in rural areas.

In addition to the low dynamism of the rural labor market in the Northeast, the region is also known for harboring pockets of illiteracy in the country. This situation is exacerbated in rural areas, as we will show later. Most members of rural families in the Northeast do not have enough schooling to perform the exercise that nonfarm activities require. The result of this configuration leads to at least three scenarios: idle jobs; informalization of the labor market; and/or families with low per capita income, who have no other option but to work in activities that pay less.

The combination of these two factors—a stagnant job market and the population's low level of education—makes it extremely difficult for rural families in the Northeast to be included in the limited nonfarm labor market. One cannot fail to note that, internally, the Northeast region

contains a noticeable differentiation between its federation units, which results in different dynamics in relation to the occupation of its populations and families (Silva & Veras, 2001).

The economic activity of the South region differs from the Northeast for at least two reasons: i) the vocation for agriculture, which favors the participation of the primary sector in the economy of the South region; and ii) the diversification and concentration of the main sectors of the economy (industry, commerce and services, and the civil construction subsector), behind only the Southeast (Pochmann & Silva, 2020). In view of this, it is clear that the economy of the South region is structured in the three sectors of the economy, which gives greater economic dynamics, with reverberation on the labor market.

The diversification of the economy of the South is favored by the region's logistics infrastructure (Pochmann & Silva, 2020) which, although it has some limitations, still has better conditions compared to other regions (behind only the Southeast). In addition, a road network in good condition favors commuting, which, in turn, benefits rural residents' nonfarm practices.

The dynamics of the South can also be explained by the more developed urban networks spread across the region, which favor the expansion and diversification of other sectors (other than agriculture), becoming an alternative income and nonfarm occupation for rural families. However, the common tendency in these richer and more economically dynamic regions is for agricultural families to become nonfarm families vis-à-vis pluriactive families (Nascimento, 2005, 2009; Nascimento & Cardozo, 2007).

It is noteworthy that the South region has the best social indices in the country, with emphasis on the educational level indicator. This condition allows the insertion of the population in occupations of better quality and greater profitability (Campolina et al., 2009). Therefore, it is for these reasons—potential and limitation of the nonfarm labor market and qualification of the population—that the Brazilian countryside is home to pluriactive and nonfarm poor families in the Northeast and prosperous in the South.

3. Methodology

3.1 Description of the sample and source of the data

The observation units were rural households, which can consist of agricultural, pluriactive and nonfarm families. To represent rural households, we used the term of "extended family," according to the methodology proposed by the Rurbano Project (IE/Unicamp), which understands this type of family as one that is formed not only by the "traditional" family (parents and children of blood ties), but also by individuals who may or may not have some degree of kinship and their families, living in the same household. In this denomination, individuals in the position of pensioners and domestic servants and their relatives are not counted.

Families working by own accounts as a branch of activity were compared, based on the typology of families proposed by the Rurbano Project (IE/NEA/UNICAMP). According to the classification of the Rurbano Project, families can be classified as: (i) agricultural— when one of the members practices agriculture and the others do not carry out nonfarm activities; (ii) nonfarm —when none of the members engage in agricultural activities and at least one of them carries out nonfarm activities; (iii) pluriactive—when one of the members engages in agricultural activities and another nonfarm activity.

The correction of monetary values (for information on the incomes of rural families) was through the National Index of Consumer Prices (INPC)/IBGE, referring to September 2015 (reference week of the PNAD).

The geographical delimitation of the study covered the Northeast and South regions. Therefore, they present significant socioeconomic differences, which justifies the choice of northeastern and southern rural families for comparison purposes, and, above all, to evaluate the impact of nonfarm activities on them.

The households surveyed were analyzed based on a set of indicators collected from the microdata of the National Household Sample Survey PNAD, published annually by the Brazilian Institute of Geography and Statistics (IBGE). This tool for data collection becomes useful because it allows a temporal and spatial analysis of rural households, according to their activities (agricultural, pluriactive and nonfarm).

3.2 Growth trend in the number of families and their average income

To verify whether or not there is a linear trend in the evolution of self-employed families (and their average incomes) of each type, a log-linear time function was fitted[1]:

$$lnY_t = ln\varphi + \theta_t + \varepsilon \qquad (1)$$

Y_t: income family for the year t;
φ: expected value of y when $t = 0$;
θ: annual growth rate.
ε: random error not explained by the model.

The average percentage annual growth rate is given by $(e^{\theta} - 1)$ x 100.

Due to the closing of the annual PNAD, the analysis of the evolution of family types and their average income is restricted to the period from 2002 to 2015 and, in the case of the quantile study, to the year 2015. We introduced a binary variable d in Equation 1, which assumes 0 between years 2002–2009 and 1 between 2011–2015. This variable controls structural breaks in the annual growth trend due to changes in rural areas' delimitation. The municipal government may modify the urban perimeters in their respective municipalities, which consequently changes the number of rural residents. IBGE updates the rural areas in the Demographic Censuses, which, in our case, occurred in 2010. The equation will then be given by (Equation 2):

$$lnY_t = ln\varphi + \theta_t + \alpha d_t + \varepsilon \qquad (2)$$

We do not use the continuous PNAD (which has information only from 2012), to go beyond 2015, because the methodology of this new PNAD is different from the PNAD we use, so it would become incompatible with the PNADs we use (2002 to 2015). Furthermore, for information on income, we used the INPC as a deflator.

3.3 Measurement of household infrastructure conditions and access to durable consumer goods in rural households

To make it possible to measure the concept of interest "basic infrastructure and access to durable goods," an aggregate index was used as a tool. This choice of indexes is suggested when one wants to analyze a theme that involves multiple aspects (Mainali et al., 2014). From this

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[1] This log-linear regression model is used to determine growth rates over time and not just between two extreme points of a time series—so that possible effects due to outliers at the extremes of a time series are avoided, which can lead to underestimation or overestimation of the growth rate, according to Neder (2000).

perspective, it is understood that the index is a useful instrument to capture the conditions of household infrastructure and access to durable consumer goods of rural households, considering that they are two dimensions (indicators) that involve several variables and, therefore, cannot be analyzed in a single aspect.

Considering that the conditions of household infrastructure and durable consumer goods were treated from different variables, we opted for the aggregation of these in the two indicators analyzed and, then, in an index called the Index of Household Infrastructure and Durable Consumer Goods (IIDBC).

Thus, it was initially necessary to assign scores to the variables that make up each indicator. The scores were distributed in an increasing scale of values, in which the lowest value corresponds to the worst situation and the highest value to a better situation of access to household infrastructure items and durable consumer goods (Chart 1).

The IIDBC was calculated in two steps. Initially, the indicators of Domestic Infrastructure (IHI) and Consumer Durable Goods (IDCG) were obtained. The calculation of these indicators followed the mathematical expression adopted by Sousa et al. (2017) (Equation 3):

$$Indicator_i = 1/n \ \Sigma_{(j=1\,a\,n)} \left\{ 1/m \ \Sigma_{(p=1\,a\,m)} \left[E_{pij} / E_{maxpi} \right] \right\} \tag{3}$$

$Indicator_i$ = average value of the i-th indicator;
Ep_{ij} = Score assigned to the p-th variable of the i-th indicator, corresponding to the j-th household;
E_{maxpi} = Maximum score of the p-th variable of the i-th indicator;
p = 1, ..., m (m = number of component variables of the i-th indicator),
i = 1, 2 (number of indicators: 1 = IHI, 2 = IDCG);
j = 1, ..., n (n = number of household).

The IIDBC was represented by the arithmetic mean of the two indicators with values between 0 and 1, and, the closer to 1, the better the condition of household infrastructure and access to durable consumer goods.

In the construction of aggregate indexes, one can or cannot choose to weight the indicators. The non adoption of weighting can be performed when the indicators are equally related to each other, that is, there are no more relevant indicators than others (Nardo et al., 2005). This last situation is more appropriate for the data set in question, as observed by estimating a factor analysis model.

It is believed that the IIDBC is reliable and capable of representing the socioeconomic conditions of agricultural, nonfarm and pluriactive households, since it holds the main desirable criteria at a good aggregate index, according to Januzzi (2012): simplicity; transparency in calculation; ease of interpretation; and intelligibility.

3.4 Impact of income on the different levels of household infrastructure and consumer goods of rural households through quantile regression

It is believed that the conditions of household infrastructure and durable consumer goods of rural households are linked to the process of income generation. However, it is feasible to assume that the magnitude of the impact of income on these conditions may vary according to the socioeconomic level of the household. In order to empirically verify this hypothesis, we opted for quantile regression estimation.

The quantile regression analysis allows the estimation of coefficients in the different quants of the distribution of the dependent variable (Koenker, 2005). In the specific case of this study,

Chart 1- Quantification of component variables of the Household Infrastructure Index (IHI) and Access to Durable Consumer Goods[2] (IDCG)

Indicator	Variables	Distribution of scores
Infrastructure Home	Condition of occupation of the household	Own = 3
		Own - still paying = 3
		Provided by employer = 2
		Provided otherwise =2
		Rented =1
		Another condition = 0
	Predominant material in the construction of the external walls of the building	Masonry= 4
		Equipped wood= 3
		Coated taipa = 1
		Tapped wood= 1
		Straw= 1
		Other material=0
	There is piped water in at least one room of the household	Yes= 1
		No= 0
	There is a bathroom or a toilet at home or in the property	Yes= 1
		No= 0
	Form of bathroom drain	Sewage or rain collection network= 5
		Septic tank connected to sewage or rain collection network = 4
		Septic tank not connected to sewage or rain collection network =3
		Rudimentary cesspit =2
		Ditch = 1
		Straight to the river, lake or sea =0
		Other form =0
	Destination of garbage	Collected directly =3
		Collected indirectly =3
		Burned or buried in property = 2
		Thrown on wasteland or patio =1
		Thrown into river, lake or sea =0
		Other destination = 0
Durable goods	Has mobile phone	Yes = 1
		No = 0
	Type of fuel used on the stove	Cylinder gas =2
		Piped gas =2
		Firewood =1
		Coal =1
		Electricity = 0
		Other fuel = 0
	Has radio	Yes = 1
		No = 0
	Has color TV	Yes = 1
		No = 0
	Has a refrigerator	Yes, with two openings =1
		Yes, with one opening =1
		No = 0

Source: the authors.

it will allow the verification of whether the impact of household income is differentiated at the different levels of IIDBC. The mathematical model consisted of (Equation 4):

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[2] The variables electric energy and washing machine were excluded from the index. In the case of electricity, the existence of this condition in the rural household is almost universal and considering it could contribute to masking (inflating) the value of the final index. As for the washing machine variable, it is not yet an essential good in a rural household.

$$InIIDBC_j\left(\tau\,|\,R_j\right)=\beta_0\left(\tau\right)\,+\,\beta_1\left(\tau\right)lnR_j\,+\,\varepsilon_j\left(\tau\right) \tag{4}$$

QlnIIDBC_j (τ|R_j *)* is the τ - th conditional quantile of the dependent variable (logarithm of the Household Infrastructure and Consumer Goods Index - IIDBC) corresponding to the j-th household;

τ = quantiles of the data distribution (25, 50, 75 and 90);

lnR_j is the logarithm of the household income corresponding to the jth household;

β_0 (τ) is the intercept of the regression line corresponding to τ - th conditional quantile of the IIDBC distribution.

$\beta_1(\tau)$ the impact of the explanatory variable Rj on the τ - th conditional quantile of the IIDBC distribution.

$\varepsilon_j(\tau)$ is the stochastic perturbation that represents the other factors that are not under the control of the statistical model in τ - th conditional quantile of the distribution, $\varepsilon_j(\tau)\sim N(0,\sigma_\varepsilon^2)$.

The option to estimate the model from the logarithm of the variables is due to the fact that this functional form allows the estimation of elasticity coefficients, the reduction of biases caused by the presence of outliers and favors the chances of homoscedastic errors (Khandker, 2005).

The regressions were estimated for the households of agricultural, pluriactive and nonagricultural own accounts. Three models were estimated for the Northeast region and three models for the South region, totaling six models.

4. Results and discussion

In general, studies on pluriactivity focus on the income aspect or on the main variables that lead families to diversify their incomes (Anaman & Adjei, 2021; Demissie & Legesse, 2013; Khan et al., 2020; Mendoza, 2018; Rehan et al., 2019; Subramanian, 2018). However, there are almost no studies that investigate the relationship between pluriactivity and nonfarm activities with the social aspect. The following results attempt to fill this gap.

4.1 Descriptive statistics

Before dealing directly with the central question of this article—the impact of nonfarm income on infrastructure conditions and on access to durable consumer goods of the types of rural self-employed families in the Northeast and South—let us, first, present the evolution of the contingents and the average income of these groups of families (agricultural, pluriactive and nonfarm).

It can be seen in Table 1 that among these types of families, the only 'family group' that showed a growth trend - that is, with a statistically significant rate, in both regions (Northeast and South) - was the group of nonfarm families (families without any direct link with agricultural activities). In the case of exclusively agricultural self-employed families, these registered negative growth rates with a downward trend in the South region. And with regard to pluriactive families, in both regions analyzed, the contingent of this family group remained stabilized, with no tendency towards (de)growth (in the statistical sense).

Following the analysis from the perspective of the evolution of labor incomes (agricultural, nonfarm and pluriactive)[3] for each of the types of families, it can be seen in Table 2 that, firstly, both in the Northeast and in the South, the average income from nonfarm work is always higher than the average income from agricultural work. It is also observed that the average income from nonfarm and pluriactive work, in both regions, registered a growth trend (statistical sense), unlike the average agricultural income, which only showed a growth trend in the South region. Another

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[3] Income from pluriactive work corresponds to the sum of income from agricultural and nonagricultural work.

Non-agricultural income, infrastructure and access to consumer goods in rural households in the northeast and south

Table 1 - Evolution of the contingents of the types of rural households self-employed: Northeast and South Regions, 2002 to 2015. (x 1,000 families)

Types of family	2002	2003	2004	2005	2006	2007	2008	2009	2011	2012	2013	2014	2015	growth rate. 2002 a 2015[a]	
Northeast															
Agricultural	1,334	1,409	1,379	1,299	1,367	1,330	1,383	1,327	1,452	1,364	1,434	1,488	1,414	-0.1	
Pluriactive	378	360	369	425	389	405	371	372	350	357	371	390	417	1.1	
Non-Agriculture	174	205	190	211	224	257	243	265	252	309	323	335	415	6.9	***
South															
Agricultural	635	622	597	594	603	568	592	549	527	514	502	534	501	-1.5	***
Pluriactive	133	125	133	132	141	147	129	133	141	129	147	137	119	0.0	
Non-Agriculture	59	79	75	66	71	76	95	72	77	87	97	93	101	3.6	*

(a) estimation of the coefficient of the log-linear regression. ***Express significance at 1%. **Express significance at 5%. *Express significance at 10%. Source: PNADs/IBGE microdata. Authors' elaboration.

Table 2 - Evolution of average income from work (agricultural, non-agricultural and pluriactive) of types of self-employed rural families: Northeast and South Regions, 2002 to 2015.

Types of family	2002	2003	2004	2005	2006	2007	2008	2009	2011	2012	2013	2014	2015	growth rate. (%) 2002 a 2015[a]	
Northeast															
Agricultural	218.0	208.6	207.8	186.7	184.2	206.1	201.6	200.3	251.5	230.3	243.3	259.1	245.5	-0.6	
Pluriactive	546.6	544.4	522.3	540.7	594.5	637.1	662.4	717.6	1,026.9	1,191.3	1,165.3	1,262.4	1,190.3	4.2	***
Non-Agriculture	537.4	518.7	506.4	491.6	615.2	639.4	618.2	691.0	1,139.8	1,044.3	1,259.8	1,239.3	1,115.1	3.7	**
South															
Agricultural	706.3	757.0	807.2	727.1	748.1	998.9	834.3	959.6	1450.5	1615.7	1675.2	1569.7	1564.0	3.5	**
Pluriactive	1,312.6	1,470.5	1,557.2	1,291.4	1,641.0	1,728.9	1,723.3	1,729.9	3,021.0	3,012.3	3,204.2	3,301.8	3,243.9	3.7	***
Non-Agriculture	1,223.6	1,247.3	1,098.2	1,125.7	1,332.3	1,372.9	1,463.0	1,573.3	2,541.8	2,572.7	2,790.0	2,593.8	2,556.5	3.4	**

(a) estimation of the coefficient of the log-linear regression. ***Express significance at 1%. **Express significance at 5%. Source: PNADs/IBGE microdata. Authors' elaboration.

relevant piece of information for the purpose of this article is that pluriactive families were the ones with the highest average incomes, followed closely by nonfarm families and, in the last position, exclusively agricultural families who were much further behind in the two regions analyzed (Table 1). As explanatory elements of the higher income on the part of pluriactives, the higher education of the members, the differentiation by age and the greater number of members that make up the families, compared to agricultural families (Cardoso, 2013), stand out. It is also important to add that, among the three activities studied, the smallest variation in income, in 2015, occurs within pluriactivity (pluriactive families), both in the Northeast and the South (Table 3). This confirms the importance of this activity in the rural northeast and southland, not only from the point of view of income variability (which is lower in relation to other activities), but also because it has higher average income compared to other activities. On the other hand, agricultural and non-agricultural activities in the Northeast and rural South produce a large breadth of income within them, with extreme values of maximum and minimum. The heterogeneity within these groups is validated by the high coefficients of variation (CVs) (Table 3).

The high variability of income within the three activities, regardless of the region, proves the coexistence of rural families that practice the same activity, but which have different incomes. This differentiation is related to some particularities that can potentiate a particular activity in a given region, such as: a) the local economy, such as religious (pilgrimages), cultural (rodeos), rural or coastal tourism, agro-industries, and processing of agricultural products; b) the skill or aptitude in the production of a commodity, such as clay crafts, ceramics, embroidery, labyrinths, lace, nets, carpets, etc.; c) specialization in a more profitable segment, such as the manufacture of artisanal food products (sweets, cheeses); (d) the vocation of local trade (fish, cereals); e) cooperatives or associations that stimulate or favor agricultural production.

Therefore, local dynamics provide, to a greater or lesser extent, the supply and diversification of non-agricultural employment. In addition, the insertion in occupations of higher profitability is conditioned to assets such as initial capital and education (Campolina et al., 2009). It is for these reasons - the potential of the non-agricultural labor market and the qualification of the population - that the Brazilian rural area is home to poor pluriactive, non-agricultural families in the Northeast, and prosperous ones in the South.

The comparison between the regions shows that, as expected, the South presented higher average incomes in the three activities studied, in relation to the Northeast (Table 3). It is noted that, although they maintain similarities in the order of activities that present higher economic returns (pluriactivity, non-agricultural and agricultural activities, respectively), the potential of activities in terms of income generation is better used among southern families, likely due to the region's better social indicators, such as education.

It is consensual that lower levels of education generate lower levels of income. Table 4 shows this relationship clearly, when observing a high percentage of people in stratum A and who have up to 5 years of schooling, as is the case in the Northeast, regardless of the activity practiced.

In addition to validating the direct relationship between education and income, Table 4 also confirms that pluriactive and nonfarm activities require people with a higher educational level compared to agricultural activities, regardless of the region. In other words, the level of education positively influences income diversification among rural families (Wondim, 2019) since educated people have more skills and knowledge to diversify livelihood strategies (Debele & Desta, 2016). More specifically, it is observed that the percentage of pluriactive and nonfarm people with more than 10 years of schooling is higher than the people who are part of agricultural families. In percentage terms this represents, in the Northeast, 28.2% of pluriactive, 30.2% of nonfarm and 8.5% of agricultural (Table 4). In the South, the percentages of people with more than 10 years of schooling are 40.2% pluriactive, 39.1% nonfarm and 17.3% agricultural (Table 4).

Table 3 - Descriptive Income Statistics of rural labor (Agricultural, Pluriactive and Non-agricultural). Rural, Northeast and South, 2015

Northeast						
Types of family	**Minimum**	**Maximum**	**Average**	**Median**	**Standard Deviation**	**coefficient of variation (%)**
Agricultural	0.00	5,000.00	245.53	100.00	426.54	173.72
Pluriactive	0.00	12,450.00	1,190.26	900.00	1,144.13	96.12
Non-Agriculture	0.00	14,200.00	1,115.09	800.00	1,135.19	101.80
South						
Agricultural	0.00	20,000.00	1,564.04	800.00	2,342.21	149.75
Pluriactive	0.00	13,350.00	3,243.92	2,940.00	2,189.34	67.49
Non-Agriculture	0.00	16,000.00	2,556.54	2,188.00	2,140.66	83.73

Source: Microdata PNAD/IBGE. Prepared by the authors.

Table 4 - Percentage distribution (%) of the number of people* rural residents of agricultural, pluriactive and non-agricultural families, according to income brackets and years of study: Northeast and South, 2015.

Types of family/ schooling	Northeast				South			
Agricultural	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Unschooled**	31	2.7	0.3	0.3	3.3	0.9	0.4	0.3
1 to 5 years	40.4	2.9	0.2	0.4	24.3	19	7,8	9.7
6 to 9 years	12	1	0.1	0.1	4	5.8	2.7	4.5
10 to 12 years	7.3	0.7	0.2	0	3.2	4.7	2.3	3.7
13 years or older	0.3	0	0	0	0.7	1.2	0.4	1.1
Pluriactive	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Unschooled**	14.5	1.9	0.3	0	2.2	0.9	0.2	0.1
1 to 5 years	31.2	3.4	0.3	0.2	13.1	13.7	3.9	3.4
6 to 9 years	16.6	2.8	0.2	0.4	4.7	9.5	4.2	4.1
10 to 12 years	15.7	5.2	1.1	0.6	7.3	16.3	4.4	1.5
13 years or older	1.9	2.3	1	0.4	1.3	3.8	3.5	2.1
Non-Agriculture	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Unschooled**	10.5	2.6	0.5	0.5	2	0.7	0	0
1 to 5 years	22.1	6.6	1.1	1.1	10.6	12.8	4.1	3.4
6 to 9 years	16.6	6.6	1.3	0.4	5.6	11.9	5.6	4
10 to 12 years	15.7	7.6	1.4	0.7	4.6	11.1	5.5	6.6
13 years or older	1.3	1.9	1.1	0.5	0.7	2.8	4	3.8

*Persons ten years of age or older. **Unschooled and less than one year of study. Legend: A: Above 0.0 reais up to 1 minimum wage; B: Above 1 to 2 minimum wages; C: Above 2 minimum wages up to 3 minimum wages; D: Above 3 minimum wages. 1 minimum wage corresponds to 788.00 reais in 2015. Source: Microdata PNAD/IBGE. Prepared by the authors.

Regarding the regional comparison, it is observed that the Southern rural region has a more homogeneous distribution of people (in percentage terms) in all income strata and educational levels, compared to the Northeast. That is, people from the Northeast region are concentrated in the lowest income strata and with less education. According to Salvato et al. (2010), income inequality between Brazilian regions is explained by the difference in the education of its residents.

In addition to the higher level of education of the residents, the Southern region has a road network in good condition, which in turn favors commuting. Also, it has a greater dynamism that distinguishes it from the Northeast region, either by its vocation for agriculture or by the diversification and concentration of the main sectors of the economy (industry, trade and services, and subsector of civil construction), behind only the Southeast (Pochmann & Silva,

2020). This set of factors may have contributed to the higher income levels of southern families compared to those of the northeast, as seen in Table 2.

Resuming the analysis so far, it was possible to detect that pluriactive families have the highest average incomes and are the ones that exhibit the lowest income variations within this activity. These two findings lead us to assume that pluriactive families have better conditions of household infrastructure and durable consumer goods' access. Given that/Taking into consideration that the greatest access to such indicators may be positively related to the type of activity that the family practices, the following analyses try to show whether there is a relationship between higher incomes and greater access to social conditions

According to Table 5, the highest average rates were achieved by nonfarm families, as well as the lowest variation in IIDBC (lower CV), in relation to agricultural and pluriactive activities, in the Northeast and South regions. This result shows that higher incomes (such as pluriactive families) do not always materialize in social improvements, such as access to household infrastructure and consumer goods. However, it should be noted that it is likely that part of the pluriactive income is used for costing/investments in agricultural production (such as the acquisition of agricultural machinery and implements, purchase of agricultural inputs, the implementation of a drainage and irrigation system, etc.). This hypothesis may have favored agricultural production to the detriment of household social improvements.

Regarding the better conditions of household infrastructure and access to consumer goods between the Northeast and South regions, it is observed that, in general, southern rural families have higher IIDBC (Table 5). This result can be justified by the more favorable social conditions of the South region, such as the provision of basic sanitation services, which enables improvements in home infrastructure. It is emphasized that the availability of basic services in households depends on public and private investments, but once offered, their access would be related to the consumption decisions of families (Kageyama & Hoffmann, 2006), i.e. with monetary income.

Table 5 shows a higher heterogeneity of access of rural families to the IIDBC in the Northeast than the South, with a medium and high dispersion in the distribution of data to the Northeast and CVs considered average in the South region, with the exception of nonfarm ones. This shows that there are rural families who practice the same activity, but have very different social characteristics between the two regions. Even in rural areas with favorable endowments or opportunities, some families are better off in terms of well-being, while others remain stuck in structural poverty (Losch et al., 2012). It is observed that the results of the diversity of rural activities are different in dynamic and marginalized or stagnant regions (Haggblade et al., 2007).

Therefore, it is verified that there is no similar effect of these activities in the rural environment, that is, the success or not of rural families in pluriactive and nonfarm practices is not strictly related to the activity itself, but is a reflection of the dynamism of each region, which has its own structural and conjunctural characteristics. This dynamism allows the constant recreation of these environments, which requires an adaptation of rural families to each new moment to survive and recreate themselves as such. Not all families enjoy the same opportunities to diversify livelihoods (Lay et al., 2008). This setting generates increasingly distinct family groups in geographic space and time (Barrett et al., 2001).

The analysis of descriptive statistics for the indexes showed that: a) in general, nonfarm families had the highest average indices in the two regions analyzed; b) southern families had greater access to IIDBC compared to the Northeast; c) there is a medium and high variation in the IIDBC within the northeastern rural families and an average heterogeneity of the IIDBC in southern rural families; and d) it was not possible to establish a clear and direct relationship of

Table 5 - Descriptive Statistics of the Household Infrastructure and Consumer Goods Index of Agricultural, Pluriactive and Non-Agricultural Families. Rural, Northeast and South, 2015

Northeast						
Activities	**Minimal**	**Maximum**	**Average**	**Median**	**Detour Pattern**	**CV (%)**
Agricultural	0.14	1.00	0.69	0.72	0.149	21.59
Pluriativa	0.26	1.00	0.76	0.78	0.121	15.92
Non-Agriculture	0.17	1.00	0.79	0.81	0.120	15.19
South						
Agricultural	0.38	1.00	0.85	0.87	0.091	10.71
Pluriativa	0.45	1.00	0.88	0.90	0.090	10.23
Non-Agriculture	0.63	1.00	0.90	0.92	0.075	8.37

Source: Microdata PNAD/IBGE. Prepared by the authors.

average income by type of activity with access to the average indexes constructed, given that it was the pluriactive families that had the highest average incomes, but it was the nonfarm families who achieved the highest access to the index of household infrastructure and durable consumer goods.

4.2 Impact of non-agricultural income on the household infrastructure and durable consumer goods index of rural families in the Northeast and South of Brazil

The analyses carried out so far have focused on average terms, both on income and in indexes. Although it is a relevant contribution, these results may present a greater generalization than is actually the case. Examples of this were the high-income CVs and the medium and high CVs of the IIDBC. In this sense, this subsection tries to ascertain whether there is any impact of income on the constructed index.

According to Table 6, the ordinary least squares (OLS) method shows that there is a positive contribution of the income of rural households to the IIDBC, regardless of the activity practiced and the region. However, the impact of income from agricultural and pluriactive activities is greater in the South region compared to Northeastern households. This may be due to the fact that the average income of the families surveyed in the South is higher than in the Northeast, creating better access conditions. With regard to nonfarm income, it contributes significantly to the conditions of infrastructure and access to goods of Northeastern households, which is not the case in the South. It is also observed in the Northeast region that the impact of agricultural income on the IIDBC was greater compared to income from other activities, probably because agriculture shelters the poorest rural families in the region; this greater vulnerability on the part of agricultural families means that small variations in income are used to a greater extent to improve household conditions.

Quantile regression shows that there is a similar effect of the impact of income on the different levels of IIDBC in the two regions studied (Table 6). More specifically, the impact of income (regardless of the activity practiced) is higher in the IIDBC in quantile 25 and quantile 50, that is, the impact of income is more expressive in the IIDBC for poorer rural families. This is because small income variations tend to cause more significant impacts among the most deprived rural families of the conditions represented by IIDBC indicators compared to those who already have better socioeconomic conditions. However, the observed impacts, despite being statistically significant, are small. Loison (2015) argues that due to asset constraints, increasing wealth based on diversification of livelihoods has little potential to significantly benefit most

rural producers. In addition, poorer households tend to specialize in low-return agricultural or nonfarm activities, remaining in structural poverty (Losch et al., 2012), since higher nonfarm income is needed for faster growth, income and consumption, especially among the poorest agricultural families (Bezu et al., 2012).

The results obtained draw attention to the fact that pluriactive and nonfarm activities can contribute, at first, to promote significant changes in a context of precariousness. However, they cannot generate enough income to contribute to structural changes in the more equipped households. They are, therefore, allies in reducing inequalities by favoring social gains for more deprived populations, but are not yet able to act as a catalyst of rural demands with regard to providing improvements that exceed the basic levels of access to home infrastructure and durable goods considered in the study. This finding may be pointing to the importance of public policies to, firstly, reduce regional inequalities and, secondly—the Light for All program (variable electricity)—to provide more and better infrastructure conditions, beyond the individual limits that family incomes can achieve, reducing inequalities between family types. However, the reduction of income inequality tends to occur when relatively poorer families are able to engage in nonfarm activities with higher returns (Van Den Berg & Kumbi, 2006). Otherwise, nonfarm activities may reinforce inequality in favor of relatively wealthier families (Canagarajah et al., 2001).

Table 6 - Effect of Income by type of activity and occupation in the Household Infrastructure and Consumer Goods Index (IIDBC) of rural families in the Northeast and South of Brazil, in 2015

Region	Activity	OLS Robust	Quantile Regression Coefficients			
		Coefficient	25%	50%	75%	90%
Northeast	Agricultural	0.091*	0.12*	0.06*	0.03**	0.02*
	Pluriactive	0.066*	0.07*	0.60*	0.04*	0.38*
	Non-Agriculture	0.074*	0.06*	0.06*	0.05*	0.04*
South	Agricultural	0.118*	0.12*	0.10*	0.05*	0.03
	Pluriactive	0.145*	0.14*	0.12*	0,12*	0.13*
	Non-Agriculture	0.013	0.13*	0.08**	0.02	0.00

*p<0.01, **p<0.05, Source: Microdata PNAD/IBGE. Prepared by the authors.

Finally, there is a positive effect of agricultural, pluriactive and nonfarm incomes on the indices studied in the Northeast and South regions in relation to the average (OLS). The response in each quantile showed that income in the three activities and in the two regions tends to impact differently the different strata of the IIDBC. This confirms the importance of these activities for the economically most vulnerable population, which still lives in precarious conditions or with the absence of essential items in a household, whether domestic infrastructure or consumer goods. As families prepare themselves in relation to the conditions analyzed, income from these activities ceases to have such an impact.

5. Conclusions

The first conclusion that the article provides is that pluriactive income in rural areas is a means, but it is not an end to ensure access to household infrastructure and durable consumer goods. Considering that, it was the pluriactive families that wanted higher incomes in the rural areas, but it was the group of non-farmers who presented greater access to the two dimensions studied.

Heterogeneity regarding access to household infrastructure and durable goods was high not only among regions, but also intra-region. Similarly, it was perceived that there are rural

families living in poverty within each activity, even practicing activities that generate higher average income, such as pluriactivity. This situation reinforces the idea that the income from the activity is not enough to improve the social conditions of rural families.

Based on the analysis of heterogeneity among rural households regarding income and conditions of household infrastructure and access to durable goods, the study found that the impact of income generated is not uniform. More clearly, income in economic activities tends to cause higher positive and significant impacts on the strata of households with lower levels of household infrastructure and access to durable goods. In these strata, it is believed that the income was sufficient to promote additional changes in the existing conditions. On the other hand, in less precarious households, the income generated by the activities is not able to generate a significant increase in those already verified.

It is believed that, in addition to the limits of income, it is necessary to articulate some actions. Therefore, the following are suggested: a) higher qualification of the population, considering that the low schooling of rural residents is one of the greatest obstacles to the insertion in the nonfarm labor market; b) public policies and actions aimed exclusively at stimulating nonfarm activities; c) increased support to families who run their own business (such as own-account families); d) greater collaboration between the private and governmental spheres, so that they can expand the supply of nonfarm jobs; e) public policies and actions aimed at expanding and improving the infrastructure conditions/offerings of rural households.

Finally, this article recognizes the contribution of nonfarm activities into income and access to household infrastructure and durable consumer goods. However, public policies still do not acknowledge the importance of these activities for the rural environment, given that resources and policies focus on supporting the productive aspect. We hope to have contributed to and advanced the discussion on this important topic for rural development. It is emphasized that the availability of data did not make it possible to explore other dimensions of the social aspect.

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