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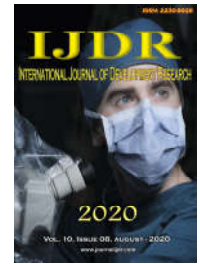
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RESEARCH ARTICLE

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INCOME AND ACCESS TO INFRASTRUCTURE IN RURAL HOUSEHOLDS IN NORTHEAST BRAZIL

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ABSTRACT

The increase of the contingent of rural residents engaged in non-agricultural activities is a reality throughout the Brazilian territory. In the Northeast region this increase has as its epicenter the natural-historical-structural issues that make life difficult in the region and make families look for non-agricultural activities in order to obtain higher incomes. However, analyzing the effect of these activities only from the income aspect can generate an incomplete understanding. In this sense, the objective of the study was to analyze to which extent the income from pluriactive and non-agricultural activities in the northeastern rural space materializes in improvements in household infrastructure. To conduct the research, we used the microdata from the National Household Sample Survey (PNAD), from 2002 to 2015. The results showed that pluriactive and non-agricultural activities, when compared to agricultural activities, presented higher incomes and greater capacity to amplify the effects of public infrastructure policies in rural areas. This configuration was observed even in the most problematic indicators, such as basic sanitation.

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INTRODUCTION

The Brazilian rural environment has been undergoing profound changes in recent decades (Silva *et al.*, 2002; Fernandes Filho *et al.*, 2004; Schneider, 2009; Escher *et al.*, 2014; Mattei, 2015). The changes have become more noticeable since the 1980s and 1990s with the occurrence of a series of events that drove such transformations, among them: the reduction of credit granted by the rural credit policy, the commercial opening and the exchange appreciation (Fernandes Filho *et al.*, 2004). The consequence of this conjuncture caused the fall of commodity prices and the crisis in the country's agriculture (Balsadi, 2001), which when combined with the industrial decentralization and the intensification of the technological innovations in the field, favored the advance of the occupations in non-agricultural activities by rural residents. The adversity faced by agricultural producers in the face of an unfavorable commercial environment, added to the disadvantage when compared to their more capitalized and

technified peers (who joined the modernization process) and the possibility of exploring other activities beyond the agricultural sphere, resulted in a decline in exclusively agricultural households, which, in part, later became non-agricultural families, or began to combine agricultural with non-agricultural activities, becoming pluriactive families. That is, the advancement of non-agricultural activities in rural areas configured a scenario of family heterogeneity in this space (Balsadi, 2001). In general, the inclusion of rural families in pluriactive and non-agricultural activities occurs mainly because of the search for higher and more stable incomes. Considering that, these practices present higher yields in relation to the exclusively agricultural activity (Silva and Neder 2006; Schneider, 2009; Sakamoto *et al.*, 2016). In addition, farming households focus on only one activity, which somewhat increases the economic risks due to seasonality of agricultural products. Thus, it is understood that pluriactivity and non-agricultural activities become viable strategies to reduce the economic vulnerability of rural families (Barret *et*

al., 2001; Barnes *et al.*, 2015; Salvioni *et al.*, 2020). These factors, while underlining the importance of pluriactive and non-agricultural activities, do not address a fundamental issue that could serve as an additional contribution, which is to introduce activities that are less dependent on climatic conditions in rural establishments. This aspect is not usually discussed with in the scientific literature, but it is extremely important for regions that suffer from climate adversities and where agricultural activities prevail in rural areas, such as Brazilian rural Northeast. In this way, we can have a glimpse at the pluriactive and non-agricultural activities not only from the economic point of view, but also see their potential as a way to improve the social conditions of the poorest of the areas vulnerable to climate change.

In the Brazilian rural Northeast, where climate is a limiting factor and there is a predominance of poor households with low schooling levels and restricted access to the modern technologies livelihood diversification emerges as a strategy for dealing with the hostile environment (Gautam and Andersen, 2016). According to Mattei (2008), engaging in pluriactive activities may help families adapt to socioeconomic transformations in the rural environment. In this sense, pluriactivity is related to the management power of individuals in responding to the context at their location (Schneider, 2009). However, strategizing requires a minimum level of knowledge (years of schooling) that most residents of rural northeastern Brazil do not have. The incipient level of education in the region makes it difficult for families to engage in high-quality non-agricultural activities, generating low-paying occupations. Therefore, it is understood that activity diversification strategies may not always result in higher income levels and, consequently, in social improvements for families.

The economic role that the diversification of activities (pluriactivity) can play on rural families is recognized (Benjamin, 1994; Haggblade *et al.*, 2010; Gautam and Andersen, 2016; Boiko, 2017). However, measuring the material conditions of rural households by monetary income may not be the most reliable measure, as income is not accurately computed due to self-consumption production (by family farmers) or informal employment in rural areas. Thus, it is not known to what extent the inclusion of northeastern rural families in non-agricultural activities guarantees social returns for them. In Humla (Nepal), Gautam and Andersen (2016) showed that the diversification of occupations only has a positive effect on the well-being of rural households if the activities performed are "high return". In the case of Northeastern Brazil, Nascimento (2009) showed that pluriactivity failed to raise rural families above the poverty line, precisely because it is a poor region with low dynamism of non-agricultural activities and low remuneration. Therefore, it is considered that in the Northeast these non-agricultural activities act more in the sense of complementing the family income than in real improvements of the social conditions of these families, considering the precariousness of employment and occupations of the non-agricultural labor market in the region (Nascimento and Cardozo, 2007). Currently, the microdata from the National Household Sample Survey (PNAD) show that the northeastern rural continues to become less and less agricultural, that is, rural families continue to seek non-agricultural activities to supplement their income. Given this, it is pertinent to inquire whether the significant increase in the share of non-farm incomes in the total incomes of

northeastern rural families - selected for the study - provides real improvements in their household infrastructure indicators. Based on the fact that pluriactivity and non-agricultural activities are a reality in rural areas and may or may not be momentary or complementary strategies to the income of rural families, this paper aims to analyze the influence of income originated by pluriactive activities and non-agricultural conditions in the household infrastructure conditions of selected northeastern rural families, from 2002 to 2015. The differential of this study in relation to others is to investigate the effect of non-agricultural activities on the social aspects of infrastructure, besides the economic aspect (income) and different forms of occupation that is commonly portrayed in most studies that talk about this theme (Lima, 2008; Balsadi, 2009; Nascimento and Aquino, 2010; Sakamoto *et al.*, 2016; Schneider *et al.*, 2013; Aquino and Nascimento, 2015; Escher *et al.*, 2014; Marino *et al.*, 2019). This gap was also noted by Gautam and Andersen (2016) in studies aimed at diversification in Nepal. Our results also contribute to a comparison between the rural households and agricultural, pluriactive and non-agricultural activities regarding the cited aspects.

METHODOLOGICAL NOTES

This study used nation-wide sample of rural holdings based on the National Household Sample Survey (PNAD), published annually by the Brazilian Institute of Geography and Statistics (IBGE). This tool for data collection is useful because it allows a temporal and spatial analysis of rural households according to their activities (agricultural, pluriactive and non-agricultural). The units of observation were rural households constituted of farming, pluriactive and non-farming families. The households studied were self-employed, which represent the families at least one member claimed to be self-employed and no other claimed to be an employer, regardless of whether the others were wage-earning employees or self-employed. Regarding the type of activity, families can be: (i) farming, when one member practices agriculture and the other do not perform non-agricultural activities; (ii) non-farming, when none of the members are engaged in agricultural activities and at least one of them is engaged in non-agricultural activities; (iii) pluriactives, when one of the members is engaged in agricultural activities and one of the other members is in non-agricultural activities, that is, when the household combines two or more activities, one of them being agriculture.

The variables selected from the PNAD were: number of rural families, income, education, home, household with predominant masonry material, electricity, piped water, sewage or septic tank and household waste collection network. These variables were selected because they assimilate to some extent how the evolution of activities practiced in rural areas may influence the infrastructure of households. The review period was from 2002 to 2015 (the latest available from PNAD), which allowed to visualize the evolution of activities in rural areas. It was not possible, however, to cover the beginning of the 2000s in some functions: first, in the Demographic Census year, there is no PNAD, causing the lack of data for the year 2000, it should be noted that this also applies for the year 2010; Second, in 2002, the PNAD incorporated in its methodology of classification of occupations of persons the procedures of the Brazilian Classification of Domestic Occupation (CBO) and National

Classification of Domestic Economic Activities (CNAE). The behavior of the variables from 2002 to 2015 was analyzed by growth rates estimated from regression analysis. The comparison between farming, non-farming and pluriactive families was performed using the Kruskal - Wallis test, only for the year 2015.

RESULTS AND DISCUSSION

Before specifically analyzing the infrastructure indicators of the selected rural households (families), it is important first to present some information about the evolution and relative participation of these households in the total number of households that structure the rural areas of Northeastern Brazil. As can be seen in Table 1, the northeastern rural is composed mostly of own-account families that practice agriculture (32, 0% in 2015)¹, which reveals that despite the harsh and unfavorable environment to these activities, it is still the most common livelihood practice for rural households. On the other hand, it is observed that self-employed families engaged in non-agricultural and pluriactive activities are growing at significant rates in rural areas, in a much higher proportion than agricultural activities². This increase could be due to family strategies against poverty in the region (Nascimento and Cardoso, 2007).

this article, that is, families of agricultural, pluriactive and non-agricultural own-accounts³. Regarding the average income of rural families (Table 2), it can be observed that pluriactive families had higher average income compared to farming and non-farming families. Therefore, from the perspective of income alone, combining activities in the Northeast is a more advantageous option than practicing isolated activities (whether farming or non-farming). By combining farming and non-farming activities, pluriactive households reduce their dependence on a single activity, decreasing not only economic vulnerability but also exposure to climate conditions (Schneider, 2009), making them less susceptible to events of risk, such the prolonged droughts that affect the northeastern semiarid (Marengo *et al.*, 2016), impact the harvested area, production and productivity, affecting the gross income of these farmers. It is also noteworthy as an explanatory element of a higher income in pluriactive families the fact that they are more numerous, have younger members and a higher level of education (Conterato, 2008; Cardoso, 2013), which increase the chances of developing strategies for diversification of activities among family members, possibly resulting in higher household incomes. Regarding the composition of farming families income (Table 2), the argument of the low level of adaptation to droughts is reinforced when the reduction of agricultural activities in the income composition of this family

Table 1. Distribution and evolution of the number of different types of rural families: Northeast, 2002 to 2009 and 2011 to 2015. (x 1,000 families)

Family Type	2002	2005	2009	2009	txgrowth (% aa.)	2011	2013	2015	2015	txgrowth (% aa.)		
	2009	2057	2072	52,2	0,4	2140	2189	2297	50,2	2,2		
				(%)	2002/2009 ^a				(%)	2011/2015 ^a		
Own-Accounts	2009	2057	2072	52,2	0,4	***	2140	2189	2297	50,2	2,2	**
Farming	1458	1421	1435	36,1	-0,3		1538	1495	1466	32,0	-0,3	
Pluriactive	378	425	372	9,4	0,3		350	371	417	9,1	4,5	*
Non-Farming	174	211	265	6,7	5,9	*	252	323	415	9,1	11,4	**
Employers	107	126	102	2,6	0,4		95	60	52	1,1	-13,5	*
Employees	1044	1183	1379	34,7	4,2	*	1277	1410	1399	30,5	2,4	
Unoccupied	256	284	417	10,5	6,8	*	499	649	833	18,2	10,3	***
Total	3417	3650	3969	100,0	2,2	*	4012	4308	4581	100,0	3,2	*

Source: PNAD / IBGE Microdata. Preparation of the authors. (a) estimate of the coefficient of a log linear regression against time. In this case, the t-test indicates whether or not a data trend exists. *, **, *** = p-value <0,01, 0,05 and 0,1 respectively.

Table 2. Composition of incomes (in percentages and in US) of own-account households by type of activity Northeast, 2002 and 2015.

Family Type	Average Income (US)		Farm (%)		Non-Farm (%)		Retirement / Pension (%)		Other Sources (%)	
	2002	2015	2002	2015	2002	2015	2002	2015	2002	2015
Farming	169,11	257,86	48,5	24,4	0	0	44,9	57,3	6,6	18,3
Pluriactive	270,17	455,64	30,7	21	44,3	45,9	19,8	21,2	5,2	11,9
Non-Farming	239,98	393,45	0	0	84,5	72,6	10,9	18,7	4,6	8,7

Source: PNAD / IBGE Microdata. Preparation of the authors. Note: The National Consumer Price Index (INPC) / IBGE was adopted to adjust monetary values for September 2015 (PNAD reference week).

Other reasons include the long periods of drought and the inability of farmers to adopt more modern techniques due to their low financial and educational capacity. Table 1 records the predominance, in the total northeastern rural family universe, of the group of families selected for the study carried out in

¹ The agricultural own-account families in Table 1 are composed, each year predominantly, of i) households with no paid farm members, but also ii) a small fraction of households that had as a characteristic the combination among their members, self-employed and activities salaried - in 2015, for example, this composition was respectively i) 96,5% and ii) 3,5%. The analyses presented from Table 2 will be restricted to the most significant family subgroup (96,5% in 2015), with no salaried member.

² These growth rates are annual averages that take into consideration each year of the time series, that is they are not calculated just between the two extremes of each period. It is also important to inform that, because of space, we do not present in the Table every year of each analyzed period.

group is noted, with a reduction of 50% between 2002 and 2015 - this may be related to the severity of the drought that occurred from 2011 to 2016 (Brito *et al.*, 2017). However, it is emphasized that an important part of the (non-monetary) income of family farmers is not captured by PNADs / IBGE, such as agricultural production for self-consumption. Taking the year 2015 as references it is noted that these farming families a strongly depend on pensions and other sources of income, with a total of 75,6%, which is not the case in

³ The other family groups that appear in Table 1, which will not be addressed in the present study, were classified as follows: i) employer families - those that have at least one member declared as an employer; ii) families of employees - those who have no members declared as an employers or self-employed, but only as an employees; iii) unoccupied families - those in which none of their members have declared any kind of economic occupation.

pluriactive and non-farming families (Table 2). One factor that favors the high participation of pensions in the income of farming families is the larger number of elderly people who make up these families⁴, who were favored by the expansion of the pension system in the first decade of the 2000s, ensured by the Federal Constitution of 1988 (Cardoso, 2013). It is generally agreed that education is preponderant for the economic and social development of any nation (Ozturk, 2001; Mercan and Sezer, 2014; Breton, 2013; Kotásková *et al.*, 2018; Sakmurzaeva, 2018). In this sense, the low educational level of the population is a factor that compromises income, and consequently, the living conditions of society. It is noted that 91,1% of people in farming families receive up to 1 minimum wage, which corresponds to US\$ 201,80 in 2015. Of this total, 71,4% had up to five years of study. At this level, the management of agricultural establishments is impaired as it hinders the processes of assimilation of agricultural practices that could improve agricultural productivity and consequently income. A clear example of this is the difficulty of the service provided by the Technical Assistance and Rural Extension (ATER) that provides non-formal education to the families in rural areas, however, the knowledge transferred is based on a more technological model (Esmeraldo *et al.*, 2017) and this becomes a problem due to the low education level of farmers.

Strategies such as the National Program for Access to Vocational, Technical and Technological Training and Employment (Pronatec) which offers vocational training courses (such as horticulture, dairy cattle breeding, artificial animal inseminator, fish breeding course, among others) for young rural workers requires that this group be in or have attended high school (which in Brazilian education equals 10 to 12 years of study), however, only 10,4% of all people practicing agricultural activities in the Northeast reach this level of education. That is, there is a concern of the State to train young farmers from a technical point of view, but almost 90% of the population has basic education (with up to 9 years of study). The concentration of people in the income stratum of up to 1 minimum wage and low education follows similar patterns for pluriactive and non-farming families. This is worrying because the labor market requires more skilled people, thus low education makes access to wage employment difficult (Gautam and Andersen, 2016). Moreover, the low levels of education of people engaged in non-agricultural activities suggest that these activities do not require high qualifications, which causes low pay and probably does not generate significant social returns for families. The individual's education has a direct relationship with income. The implication of this is a population with greater difficulty in developing skills, which negatively impacts their productivity gains. In addition, low purchasing power affects local consumption, which hinders economic dynamism in the region (Pereira *et al.*, 2009). The data analyzed so far indicate that, compared to the strictly agricultural families, the pluriactivity and non-agricultural activities of the northeastern rural self-employed families managed to promote significant increases in income (Table 2). However, it is questioned whether the activities practiced by these rural families go beyond the economic contribution, being able to promote significant housing changes in rural households, that is, if there is an association between income of the establishments according to the type of activity and some indicators of residential

infrastructure. The following discussion attempts to show this relationship. In general, home ownership is an indicator that expresses an important social security condition for families (IBGE, 2017). In rural Brazil, land concentration is a serious problem and difficult to solve (Alcântara Filho and Fontes, 2009). Many lands in the hands of the few are the subject of claims from social classes, such as family farmers. Although access to land is restricted, the vast majority of families have their own homes as can be seen in Table 3. Householding is an important criterion for the capture of families in rural areas, and some rural properties unlike urban ones, express a place that involves two functions in the same space: the home and the workplace (Silva, 2014) Thus, rural housing can be a tool for rural development, as it enables the generation of income on agricultural properties. In this sense, it is perceived a positive contribution in the group of pluriactive families, considering that among the analyzed activities was the one that presented the highest percentage of families with their own homes. However, it cannot be accurately stated whether the best result for pluriactive households derives exclusively from this activity, given that the group of farming families had the highest percentage (90,2%) in this variable at the end of the first period analyzed (2002-2009), although in 2015 it decreased (89,7%). This leads us to think that the largest percentage of pluriactive households with their own homes in 2015 may have been a transformation of agricultural households that had ownership of their homes into pluriactive establishments. Access to electricity is a basic necessity for the well-being of the population (Cardoso *et al.*, 2013), its deprivation directly impacts the individual's living conditions as it makes impossible the use of electronic devices and appliances, food preservation, access to information and communication, the possibility of studying and working at night, valuing property, reducing polluting gases (kerosene and diesel), generating jobs and income, among others (Cardoso *et al.*, 2013; Gusmão *et al.*, 2002). In this sense, it is not possible to effectively implement a rural activity without having access to such a resource. Table 4 shows the almost universal access to electricity in the northeastern rural area. This is due to an initiative that began in 2000 with the creation of the "Luz no Campo" Program launched by the Federal Government to bring electricity to the rural areas. This initiative was successful in indiscriminately covering all rural households, regardless of income or type of activity performed by households, as can be seen at the end of the period in 2015.

It is noteworthy the significant growth in the number of farming families over the period analyzed. This growth made it possible for these families to reach levels close to the other family groups in 2015. This result confirms the success of the "Luz no Campo" Program, but may also indicate that these families are more dependent on the public sector. Increased access to electricity by non-farming and pluriactive families may be pointing out that these activities may to some extent strengthen the effect of a public policy, possibly due to the higher incomes from these activities. Decent housing is a fundamental human right, as it can also be a vector for reducing rural poverty, and to some extent fostering rural development (Silva, 2014). Access to electricity, water and sewage may seem basic in a household, however, the common in rural Northeast is the lack of sanitation in rural households. The problem of piped water is one of the most deficient infrastructure aspects in northeastern rural households (Caldas and Sampaio, 2015). The cost of bringing water to more distant locations is one of the main factors contributing to this scenario.

⁴ Farming families are older compared to the two other family types (Conterato, 2008; Cardoso, 2013).

Table 3. Percentage of evolution of rural self-employed families, with their own domicile. Northeast, 2002 to 2009 and 2011 to 2015

Family Type	2002	2009	Txgrowth (% aa.)		2015	Txgrowth (% aa.)		Kruskal Wallis test (2015)
			2002/2009 ^a	2011		2011/2015 ^a	2015	
Farming	87,6	90,2	0,3	88,6	89,7	0,2	6,6**	
Pluriactive	86,8	88	0,4	89,2	91,1	0,8		
Non-Farming	81,1	81,6	-0,1	87	86,7	-0,1		

Source: PNAD / IBGE Microdata. Preparation of the authors. a) estimate of the coefficient of a log linear regression against time. In this case, the t-test indicates whether or not a data trend exists. ** = p-value <0,05

Table 4. Percentage of evolution of rural self-employed families, with electricity in the household Northeast, 2002 to 2009 and 2011 to 2015

Family Type	2002	2009	Txgrowth (% aa.)		2015	Txgrowth (% aa.)		Kruskal Wallis test (2015)
			2002/2009 ^a	2011		2011/2015 ^a	2015	
Farming	60,3	86,9	5,5*	93,8	98,2	1,0*	6,618**	
Pluriactive	76,5	94,8	3,3*	97,6	99,3	0,4***		
Non-Farming	89,4	98,2	1,4*	98,9	99,4	0,1		

Source: PNAD / IBGE Microdata. Preparation of the authors. a) estimate of the coefficient of a log linear regression against time. In this case, the t-test indicates whether or not a data trend exists. *, **, *** = p-value <0,01, 0,05 and 0,1 respectively.

Table 5. Percentage of evolution of rural self-employed families, with piped water in the household. Northeast, 2002 to 2009 and 2011 to 2015

Family Type	2002	2009	Txgrowth (% aa.)		2015	Txgrowth (% aa.)		Kruskal Wallis test (2015)
			2002/2009 ^a	2011		2011/2015 ^a	2015	
Farming	17,3	41,0	12,8**	49,1	58,3	4,2*	98,064*	
Pluriactive	24,7	52,8	9,5*	55,7	71,0	6,5*		
Non-Farming	48,6	65,4	4,3*	71,3	77,5	2,0*		

Source: PNAD / IBGE Microdata. Preparation of the authors. a) estimate of the coefficient of a log linear regression against time. In this case, the t-test indicates whether or not a data trend exists. *, **, *** = p-value <0,01, 0,05 and 0,1 respectively.

Table 6. Percentage of evolution of rural self-employed families, with sewage system or septic tank. Northeast, 2002 to 2009 and 2011 to 2015

Family Type	2002	2009	Txgrowth (% aa.)		2015	Txgrowth (% aa.)		Kruskal Wallis test (2015)
			2002/2009 ^a	2011		2011/2015 ^a	2015	
Farming		6,1	20,9	16,5*	22,5	31,5	6,4	11,4*
Pluriactive		11,1	21,4	10,4*	26,2	37,0	4,7	
Non-Farming		20,4	31,8	6,1*	37,0	40,8	0,7	

Source: PNAD / IBGE Microdata. Preparation of the authors. a) estimate of the coefficient of a log linear regression against time. In this case, the t-test indicates whether or not a data trend exists. *, **, *** = p-value <0,01, 0,05 and 0,1 respectively.

Table 7. Percentage of evolution of rural self-employed families, with garbage collection network. Northeast, 2002 to 2009 and 2011 to 2015

Family Type	2002	2009	Txgrowth (% aa.)		2015	Txgrowth (% aa.)		Kruskal Wallis test (2015)
			2002/2009 ^a	2011		2011/2015 ^a	2015	
Farming		2,5	6,9	15,0*	8,6	12,1	9,6**	304,9*
Pluriactive		6,6	15,2	11,9*	14,0	22,6	13,1*	
Non-Farming		29,0	46,3	5,6*	46,0	48,7	2,6	

Source: PNAD / IBGE Microdata. Preparation of the authors. a) estimate of the coefficient of a log linear regression against time. In this case, the t-test indicates whether or not a data trend exists. *, **, *** = p-value <0,01, 0,05 and 0,1 respectively.

This becomes more worrying due to water scarcity problems especially during drought periods. To meet the needs of the home with water shortages, rural families resort to public taps, wells or springs, rain collections, or travel long distances to fetch water from rivers or dams, causing great physical damage in the individuals in this population, which reduces welfare. The precarious access to piped water is verified in the three groups studied (Table 5). However, a comparison between the groups indicates that pluritative and non-agricultural households have better water access conditions. This may be due to the fact that such households have higher average income, which makes it possible to implement in their houses but also alternative, rudimentary, plumbing equipment in their homes, whose source of water comes from rain collections, wells or springs. It is important to highlight that, although the three groups increased access to piped water over the period. The activity performed by families is not enough to improve the housing conditions of the household.

In the Northeast, where there is a complex set of historical and structural factors, access to this indicator is more related to these factors than to household income. In other words, non-agricultural activities do not guarantee the complete access to some infrastructure indicators. The precariousness of sanitary sewage is a national problem, especially in rural areas (Saiani, 2007; Landau and Moura, 2016; Tonetti et al., 2018). In rural northeast the most common form of toilet drain is the rudimentary cesspool, ditch, straight to the river or sea (Microdados PNAD, 2015). One of the factors leading to the precariousness of this indicator is the dispersion of households, which hinders economic viability and the access to an integrated sewage system and (Tonetti et al., 2018). In addition, the low income level of rural residents makes it difficult to pay for sanitation services, which makes access impossible (Saiani, 2007). Although the Law n°11,445 of January 5, 2007 has as one of its fundamental principles the universalization of access to sanitation (Brasil, 2007), the data

in Table 6 indicate that the universalization of this indicator is still far from being achieved. The low percentages observed in the three groups analyzed indicate that the activity performed by families is not sufficient to improve the infrastructure conditions of households that depend on other factors, beyond family income. That is, this result is more related to the public sector sphere than the activity practiced by families. However, there was a noticeable growth of rural households analyzed with access to sewage or septic tanks over the period analyzed, especially from 2002 to 2009, when there was regulatory support and a greater amount of resources for basic sanitation (Borja, 2014). We highlight the agricultural households as those that had the highest growth rate of this variable, which indicates, once again, a greater dependence of these families in relation to the public power. Regarding solid waste management, the most common form of waste disposal in rural northeast is the means of burning or by burying on the property where the household is located (Microdados PNAD, 2015). The precariousness of basic sanitation in rural northeast is understood when observing the percentage of households with garbage collection network⁵ (Table 7). Although it is noticeable the growth (positive and significant) at access to this variable over the of time analyzed for farming and pluriactive households, in 2015, only 12,1% of agricultural and 22,6% of pluriactive households had access to this service. Non-farming families stand out in their access to the garbage collection network (48,7%), compared to other families, possibly due to their higher incomes (according to Table 2), considering that this variable also includes the service provided by a private company, which can be hired by those with the highest incomes. Table 7. Percentage of evolution of rural self-employed families, with garbage collection network. Northeast, 2002 to 2009 and 2011 to 2015. Therefore, although access to piped water, the general sewage system and the garbage collection network is related to State action, it was noted in Tables 5, 6 and 7 that pluriactive and non-farming households had the highest percentages of access to this variable. Thus, it is assumed that households with higher incomes tend to have better infrastructure conditions.

Conclusion

In order to evaluate the extent to which incomes from pluriactive and non-agricultural activities generate real infrastructure improvements in rural households in the Northeast, this work showed that these activities are important drivers of income generation and improvements of household infrastructure in the region. These findings deserve some consideration:

- At the beginning of the analyzed period (2002), when most of the public policies were still in their embryonic period or in the process of consolidation - compared to what occurred in the analyzed period - the pluriactive and non-farming families already presented a superior performance in relation to agricultural households in the same period, in all analyzed variables (except for the variable own domicile). However, over the years

and with the improvement and direction of certain public policies to the agricultural activity in the region, the infrastructure indicators of the farming families had a higher growth rate than the other families. Although this is commendable, because it enabled at the end of the period greater access to infrastructure conditions and closer ties between the three family groups studied, this indicates that farming families are more dependent on public policies compared to the other two types of families.

- Greater access to infrastructure conditions by pluriactive and non-farming families cannot be attributed solely to the income factor alone. An example of this is the variables electric power and brick houses that presented high access by all types studied families. However, this result is mainly due to the performance of public policies, such as the PNHR and the "Luz no Campo" Program. However, since the pluriactive and non-farming families reached the highest percentages of these variables, compared to the agricultural activities, probably due to the higher and more stable non-agricultural income, it is assumed that they may have potentialized the effect of the public policies in their favor.
- In contrast to the previous situation, the results are limited and those independent family income indicators that require the exclusive intervention of the government, such as sanitation, are still insignificant. Although non-farming families had the highest access to this variable, the performance of this indicator was not unsatisfactory for the three types of families studied. In this sense, it is understood that the guidelines arising from these activities cannot overcome the structural problems that persist in the region.
- Therefore, the study showed that the access to better conditions of home infrastructure may be positively related to the type of activity that the family engages in. However, the income from the activities performed does not replace the role of the government in providing services such as sanitation, which are still scarce in rural Brazilian Northeast.

The availability of data did not allow the study to address all household infrastructure indicators. However, it was observed that despite the low remuneration and low education level of the northeastern population, there is a potential social return of pluriactivity and non-agricultural activities, in a perspective that goes beyond income generation and also contributes to the creation of an environment favorable to social change, especially in a region where agricultural activities are impacted by recurrent droughts. In this sense, the study draws attention to the direction of public policies that stimulate such activities and place them as development vectors of rural areas of the Northeast.

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⁵ Household waste can be collected directly and indirectly. Direct collection refers to garbage collected directly by a public or private cleaning service or company that served the street where the household was located. Indirect collection occurs when garbage is disposed of in a bucket, tank or service depot or public or private cleaning company that later collected it.

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