AGRICULTURAL LABOR MARKET AND INCOME DIFFERENTIALS BETWEEN OCCUPIED IN MATOPIBA AND IN OTHER AREAS OF NORTHEAST AGRICULTURAL RANGE.

MERCADO DE TRABAJO AGRÍCOLA Y DIFERENCIALES DE INGRESO ENTRE OCUPADOS EN MATOPIBA Y EN OTRAS ÁREAS DEL NORESTE DE LA SERIE AGRÍCOLA.

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Abstract:

 Income differences in the Brazilian labor market are high and affect all sectors of economic activity and all regions of the country. Therefore, this study aims to analyze the differences in income from agricultural work between the formally employed in the MATOPIBA region, the last

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agricultural frontier in the country, and in other municipalities in the Northeast region, considering the socioeconomic and demographic characteristics of the workforce. Microdata from the Annual List of Social Information of the secretary of social security and employment of the Ministry of Economy of Brazil (RAIS-MEB) were used in the time frame that comprises the years 2000, 2005, 2010 and 2015. Among the main results found by the Ordinary Least Squares - OLS estimates, from a Mincerian equation of income, it is observed that although in both regions the effects of socioeconomic and demographic characteristics impact on salary differences, the data show that those who are employed in MATOPIBA earn income higher in relation to an individual employed in agriculture in other northeastern states.

Keywords: Agriculture; Income differentials; MATOPIBA

Resumen:

Las diferencias de ingresos en el mercado laboral brasileño son elevadas y afectan a todos los sectores de actividad económica y a todas las regiones del país. Por lo tanto, este estudio tiene como objetivo analizar las diferencias en los ingresos del trabajo agrícola entre los ocupados formales en la región de MATOPIBA, última frontera agrícola del país, y en otros municipios de la región Nordeste, considerando las características socioeconómicas y demográficas de la mano de obra. Se utilizaron microdatos de la Lista Anual de Información Social de la Secretaría de Seguridad Social y Empleo del Ministerio de Economía de Brasil (RAIS-MEB) en el marco temporal que comprende los años 2000, 2005, 2010 y 2015.

Entre los principales resultados encontrado por las estimaciones de Mínimos Cuadrados Ordinarios - OLS, a partir de una ecuación minceriana de ingresos, se observa que si bien en ambas regiones los efectos de las características socioeconómicas y demográficas impactan en las diferencias salariales, los datos muestran que quienes están empleados en MATOPIBA obtienen ingresos superiores en relación con una persona empleada en la agricultura en otros estados del noreste.

1. Initial Considerations

The huge disparities in income in Brazil is a fact that promotes many discussions, given that it is a topic that involves several dimensions of analysis and of expressive interest in economic science (NEY & HOFFMANN, 2003). Thus, in addition to the individual characteristics of the workforce, other aspects explain the immense heterogeneity in work performance, such as, for example, the type and position that the individual occupies; the sector of activity employed; the size of the establishment and the region of occupation and exercise of work activities (LEONE & BALTAR, 2006).

There are several empirical studies focused on the analysis of income differentials (MATOS & MACHADO, 2006; CAMBOTA & PONTES, 2007; VILELA et al., 2012; SILVA FILHO et al., 2017; LACERDA & ALMEIDA, 2019). In many, it is revealed that female and non-white individuals are the groups that most suffer discrimination in the labor market. These have the lowest incomes and opportunities when compared to men and whites (COSTA et al., 2016). Regarding Brazilian agriculture, although there are few studies, investigations indicate that the agricultural sector has a high concentration of income and, therefore, income differentials between the various geographic regions, recording high levels of poverty and strengthening regional inequalities (CORRÊA et al., 2003).

According to Costa et al. (2016), there have been several socioeconomic transformations in Brazil in recent years, among them, a sharp and continuous drop in income differentials, even though there is still an intense concentration of income. That is, although the reduction of income disparities has been observed, it is still one of the main economic problems facing the country.

In the Northeast, a region that concentrates a large part of the workforce that lives and works in the countryside, income differentials have reduced in recent years. However, there is still a very high disparity, as seen in studies carried out across the country (ARAÚJO et al., 2008, SOUZA et al., 2015). Therefore, although the region is marked by intense regional inequalities in terms of geographic, political, and socioeconomic characteristics, the

northeastern agricultural activity is important to explain the regional economic performance, as stated by Gomes et al. (2013).

These inequalities are also seen in areas that form the region of MATOPIBA, the last agricultural frontier in the country, which encompasses municipalities in the North and Northeast regions, and which, after the intense transformations that occurred in the countryside, presented a very centralized income among regional producers. (BUAINAIN et al., 2017). MATOPIBA, in addition to using the technological factor intensively in its production processes, stands out in the production of commodities, especially in the cultivation of grains. However, the expansion of agribusiness in the areas of this agricultural frontier has had significant social impacts and has promoted intense debate at the national academic level (PORCIONATO et al., 2018; ALMEIDA et al., 2019).

In this way, the conception is that the region is considered quite relevant, economically, for the States that compose it, and, for this reason, it becomes an area of interest for several investigations. Thus, the objective of this study is to analyze the disparities in the income of those employed in the last agricultural frontier of Brazil, the MATOPIBA. Thus, it starts from the hypothesis that income inequalities of agricultural workers located in the municipalities of the States of Maranhão, Tocantins, Piauí and Bahia (MATOPIBA), in relation to other traditional areas of the Northeast, are, in part, the result of the impacts the socioeconomic and demographic characteristics of the workforce formally employed in agriculture.

It is in this context that the present article is inserted, seeking to verify the dynamics of the formal agricultural labor market in the MATOPIBA region, compared to the other areas of the states that make up this geoeconomic region, especially regarding the differentials of labor income. The purpose of the article to address only formal employment is because this is a type of employment with all the legal guarantees of the CLT and is the one that ensures all the institutional guarantees of rights to the occupied.

Therefore, in addition to these initial considerations, this study was divided into six other sections. The second section refers to the methodological procedures adopted to reach the proposed objectives; in the third, an approach is presented about income differentials in Brazilian and Northeastern agricultural work; the fourth section addresses the socioeconomic and demographic characterization of those employed in agriculture in the Northeast and in MATOPIBA; then, in the fifth and sixth sections, the results found are analyzed and discussed; and, finally, there are final considerations and perspectives for new approaches.

2. Differentials of labor income in Brazilian and Northeastern agricultura

Agriculture is one of the economic sectors that has shown constant income differentials among those employed over the years. In addition, there was a drop in the number of employed workers (COSTA et al., 2016). In the period from 2004 to 2014, as stated in the study by Balsadi & Del Grossi (2016), the Economically Active Population (EAP) employed in agriculture fell by 2.8%

per year, which means that the reduction was 3.6 million people. individuals, according to the results found by the authors.

The determinants of income disparities in the agricultural sector are still poorly addressed in scientific works (COSTA et al., 2016). In the 1980s, position in occupation was the main factor that explained income differentials in agriculture. Furthermore, the region and the hours worked also had a great influence on the determination and on the income differentials in the agricultural sector, although to a lesser extent (HOFFMAN & KAGEYAMA, 1986).

The income disparities registered in agriculture can also be determined by the race/color of the individuals. According to Jesus (2015), in 1995 the relative income of black people performing some agricultural activity was 57.9%, and in 2013 it shifted to 59.4% of the geometric average of white income. Thus, presenting a growth of only 1.5 percentage points.

In addition to the race/color of the agricultural workforce, the modernization of this sector in the Brazilian economy is considered an explanatory factor for the intensification of income differentials. This is attributed to the fact that several workers have their activities replaced by machines, which consequently generated impacts on wages earned and increased income concentration (HOFFMANN & KAGEYAMA, 1985).

The innovations introduced in rural areas resulted in the emergence of industrial and service occupations in the countryside, in addition to agricultural activities. Thus, the emergence of non-agricultural occupations

in rural areas can also be cited as responsible for contributing to income differentials in agriculture. The emergence of such activities is due to the changes that have occurred in the Brazilian countryside, mainly with the intensification of the relationship with urban areas. Thus, despite the importance of non-agricultural activities for the income of rural individuals, mainly because they have better remuneration, agricultural activities are essential for the income of the EAP in the agricultural sector (KAGEYAMA & HOFFMANN, 2000; STADUTO et al., 2002; SOUZA et al., 2015).

In terms of economic sectors, the average income of the agricultural sector is lower, compared to that of the service and industry sectors, disparities that are characterized by being high and resistant to downward fluctuations (NEY & HOFFMANN, 2003). According to Hoffmann (2011), between 1995 and 2009 all sectors showed a decrease in the inequality of income distribution, but this reduction had little significance in the agricultural sector due to the distinction of the level of education, since 2003 agriculture has registered an average level of education very low compared to other sectors.

In the Northeast, the level of education of those employed in rural areas is a very relevant variable as it has great significance in explaining and reducing income differentials in the region (ARAÚJO *et al.,* 2008). In this sense, Balsadi & Del Grossi (2016) mention that all regions of Brazil recorded growth in the level of education of the EAP employed in agriculture between 2004 and 2014. However, the North and Northeast stand out for having the lowest averages.

According to Souza *et al.* (2015), the rural areas of the Northeast concentrate the largest number of individuals who live and work in the countryside. However, most of those employed in agriculture do not have a formal contract (84.1% of employees). An alarming fact that the authors highlight is about the income differentials that the regions present, while 60.7% of employees in rural areas in the Northeast receive less than one minimum wage per month, the Southeast registers only 3.4% of those employed.

Therefore, according to Araújo *et al.* (2008) income differentials between regions did not change in the 1990s. The North and Northeast continued to register a pattern of inequality higher than the other regions. Despite this, internally, all northeastern states showed a reduction in income differentials. For these authors, it is suggested that this decline is also occurring in the rural areas of the region, albeit slowly.

3. Methodological Procedures

The study seeks to analyze the income differentials among those employed in agriculture in the municipalities of MATOPIBA, located in the North and Northeast regions, comparing the workforce formally employed in the same sector of economic activity as in the other traditional northeastern areas. Thus, this investigation is carried out by focusing on some variables that influence the wage returns of the employed workforce. In this section, the methodological procedures adopted in this article are presented.

3.1 Coverage area and data source

The sector of scope that the work encompasses is agriculture [‡], given the expansion of the Brazilian agricultural frontier and its economic importance for the country, especially after the transformations that have taken place in the countryside. The database used in this investigation comes from the Annual Report of Social Information (RAIS) of the Social Security and Employment Department of the Ministry of Economy (ME). they were excluded from the sample so as not to bias the results.

3.2 Spatial and temporal clipping

The spatial scope that the article encompasses is the entire geographic area of the Northeast region, highlighting the area of MATOPIBA, which includes 337 municipalities in the North and Northeast of the country, 135 in Maranhão, 139 in Tocantins, 33 in Piauí and 30 in from Bahia. To analyze the changes that have taken place in the agricultural sector [§], the years 2000, 2005, 2010 and 2015 were chosen as the time frame, as it was the last year that information was available from the database used in this work.

3.3 Empirical model

To analyze the income differentials between those employed in agriculture in MATOPIBA and in other areas of the Northeast, it was necessary to resort to


[‡]In this study, agricultural activities were not separated from livestock activities, thus being treated as an agricultural sector the activities developed in both sectors.

[§]Agriculture and livestock in this article include those employed in agriculture and livestock.

the use of the Mincerian equation of income. This equation, pioneered by Mincer (1974), makes it possible to verify the wage return to socioeconomic and demographic characteristics, using the natural logarithm of income/hour of work as a function of the socioeconomic and demographic characteristics of the population formally employed in agriculture at MATOPIBA and of the other areas of the Northeast, from estimations and constructions of counterfactuals.

Figure 1.

Municipalities, according to the Brazilian States, that make up the MATOPIBA region
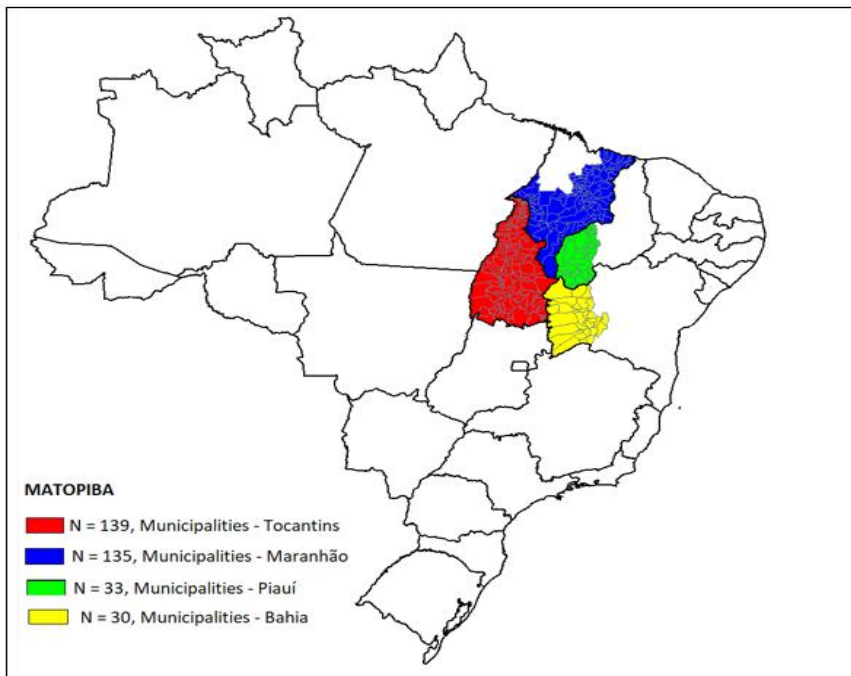
For the estimation of the effects of the socioeconomic and demographic characteristics of the employed in MATOPIBA and in other northeastern areas, multiple linear regression was used because it is widely disseminated in studies that deal with estimations of the effects of explanatory (independent) variables on a variable explained (dependent). The multiple linear regression model has spread substantially in studies that propose to estimate more robust methods, which, according to Maia (2017), its enthronement as an analytical method date from 1908, by Karl Pearson. In the case of estimations of this nature, the Ordinary Least Squares method – OLS is widely used in this type of estimation.

The theoretical denomination of the multiple regression model can be understood from the following description:

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_n X_{ni} + \epsilon_i \qquad (1)$$

Where the variable to be explained by a set of explanatory variables that Y_i is make up a data matrix defined in the format , in front of explanatory X_i $\beta_{1i} \ldots \beta_{ni}$ ϵ_i. coefficients expressed between added a stochastic component of the estimation

As in this study, it was about sample data, since all formal agricultural workers who failed to present any of the information contained in this research were excluded from the sample, the specification of the mathematical method occurs in an algebraic function as follows:

Where, represent functions of sample estimators for the coefficients of the $\hat{\alpha}$ and $\hat{\beta}$: multiple linear regression model, where o $\hat{\varepsilon}$

corresponds to the sample residual resulting from the estimations of the sample data.

Estimates by Ordinary Least Squares – OLS were carried out from a Mincerian equation of income (MINCER, 1974). Thus, it is possible to estimate the work income of employed persons in a region (Northeast [**]and MATOPIBA) at a given time X_t (2000, 2005, 2010 and 2015), having as explanatory variables a set of socioeconomic and demographic

$$Ln_w = 0 + 1X1 + 2X2 + \ldots + nXn + \varepsilon \qquad (3)$$

characteristics of employed individuals, grouped into a matrix . The equation proposed by Mincer (1974) is expressed algebraically as follows:

assumes the natural logarithm of labor income (explained variable) regressed as a function of a set of socioeconomic and demographic characteristics Ln_w (explanatory variables) of formally employed in Northeastern agriculture and in MATOPIBA.

To verify the average effects of the dependent variable as a function of the explanatory variables, the Ordinary Least Squares method - OLS was used in the definition expressed in equation 4. For this, the following variables were highlighted: MATOPIBA, occupied in a municipality in this geoeconomic region; gender (male), average age, exp² (experience proxy), size of

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establishment, length of stay in employment, education, and distribution of agricultural employment by state.

Thus, the econometric equation was represented as follows:

$$lnw_i = \beta_0 + \beta_1 matopiba + \beta_2 sex + \beta_3 exp + \beta_4 exp^2 + \beta_5 estab1 + \beta_6 estab2 + \beta_7 estab3 + \beta_8 temper1 + \beta_9 temper2$$
$$+ \beta_{10} temper3 + \beta_{11} temper4 + \beta_{12} temper5 + \beta_{13} esc1 + \beta_{14} esc2$$
$$+ \beta_{15} esc3 + \beta_{16} esc4 + \beta_{17} esc5 + \beta_{18} mun_{MA} + \beta_{19} mun_{PI} + \beta_{20} mun_{BA}$$
$$+ \varepsilon_{\theta i} \tag{4}$$

In view of the estimates to capture the effect of income inequalities in agricultural work in the Northeast, adding MATOPIBA only as a control variable, individual estimates of the two groups (matopiba and non-matopiba) were used to compare the coefficients that express the effects of socioeconomic and demographic characteristics on the differentials in earnings from work between the employed in both regions, as expressed in equation (5).

$$lnw_i = \beta_0 + \beta_1 sex + \beta_2 exp + \beta_3 exp^2 + \beta_4 estab1 + \beta_5 estab2 + \beta_6 estab3$$
$$\beta_0 \beta_7 temper1 + \beta_8 temper2 + \beta_9 temper3 + \beta_{10} temper4$$
$$+ \beta_{11} temper5 + \beta_{12} esc1 + \beta_{13} esc2 + \beta_{14} esc (\beta_2 exp) + \beta_{16} esc5$$
$$(\beta_1 sex)$$
$$+ \beta_{17} mun (\beta_3 exp2) PI + \beta_{19} mun_{BA}$$
$$(temper) + \varepsilon_{\theta i} \tag{5}$$

Here, it is considered that lnw_i corresponds to the natural logarithm of the individual's labor income and o is the intercept term of the regression. In addition, there are vectors related to the sex of the worker , the age of the workforce and the age squared   – used as an experience proxy –. For length of stay , the reference variable (omitted) was the category less than one year employed. The other ranges are more than one year and less than two years;

more than two years and less than three years; more than three years and less than five years; more than five years and less than ten years and more than ten years.

As for education, the level with no education or incomplete elementary education was chosen as the omitted category (reference) – the individuals' $(exp1)$, lowest level of formal education. The other levels of $(exp2)$ education are $(exp3)$ complete $(exp4)$ elementary $(exp5)$ school and (mun) incomplete high school ; (mun_{MA}) complete high school and (mun_{BA}) incomplete higher $\varepsilon_{\theta i}$ education; Completed higher education ; master's and doctorate . Regarding the municipalities of the states that comprise MATOPIBA in which the worker is employed , the analysis considers the states of Maranhão , Piauí (mun_{PI}) and Bahia , leaving the employed in the municipalities of Tocantins as a reference category, therefore , omitted. Finally, it represents the stochastic error of the model.

It is important to highlight that in the empirical model adopted in this study, the sample microdata from RAIS are used through information from the years 2000, 2005, 2010 and 2015. In addition, a sample of approximately 90% was selected in the first three years and of 50% on the last of the *Cross Section.* All people who failed to provide all their complete information by the employing agency, based on the RAIS annual questionnaire, were excluded.

Regarding the decomposition of Oaxaca (1973) and Blinder (1973), the equations of wages estimated for the two groups through the counterfactuals can present coefficients for the decomposition, as follows:

$$
\begin{aligned}
\log \log \underline{W}_{matopiba} &- \log \log \underline{W}_{n\tilde{a}o\_matopiba} \\
&= \left(\underline{X}_{matopiba} - \underline{X}_{n\tilde{a}o\_matopiba} \right) \hat{\beta}_{n\tilde{a}o\_matopiba} \\
&+ \underline{X}_{matopiba} \left(\hat{\beta}_{matopiba} \right. \\
&\left. - \hat{\beta}_{n\tilde{a}o\_matopiba} \right) \qquad\qquad (6)
\end{aligned}
$$

Equation 6 shows the way in which the salary differentials between employed persons in MATOPIBA and Non-MATOPIBA are decomposed, considering the observable and unobservable characteristics.

4. Socioeconomic and demographic characterization of those employed in agriculture in the Northeast and in MATOPIBA

The analysis of the agricultural labor market and the income differentials that the sector presents involve structural changes manifested by the economy and the transformations that have occurred in agriculture (CARDOZO & CUNHA, 2018). In this perspective, the modernization of this sector, based on the insertion of new techniques, resulted in the renewal of Brazilian agricultural production and the emergence of new configurations of the labor market, whether in rural or urban areas. Therefore, there were substantial impacts on the quality of employment (RODRIGUES & SANTOS, 2014).

The agricultural workforce was strongly affected by the negative effects of the innovation process, which, in turn, occurred in a marginalizing and excluding way (SILVA FILHO, 2013). Certainly, this process culminated in increased productivity and the expansion of agricultural markets. However, the insertion of modern machines in the field requires workers with better qualifications to occupy the new jobs created. Thus, technological unemployment intensifies, especially for the less educated workforce and susceptible to the negative externalities of innovation (BRITO *et al.* 2013), but jobs with intensive use of technology and the exercise of the labor activity of less and less painful way in field activities, in addition to being better paid.

In this context of mechanization of agriculture, the Economically Active Population (EAP) of the country was considerably affected. However, it is worth noting that the modernization of the sector resulted in different impacts among the different regions of the country (BRITO *et al.* 2013). In the Northeast, for example, a region with many individuals living or just working in rural areas, the reflexes of technical innovation were more pronounced regarding the reorganization of the forms of insertion of the workforce, given by the new pattern of job generation. in the field (SILVA FILHO & SILVA, 2011).

The innovation process of Northeastern agriculture began in 1970. From then on, changes were observed in the rural environment of the region, driven by the emergence of new relationships in the productive and work sphere. Amid the transformations that have taken place in rural areas of the Northeast, a new profile of the agricultural worker emerges (SILVA FILHO & SILVA,

2011). In addition, the region showed significant growth in the number of employees in the sector, which, according to Silva Filho *et al.* (2014), registered a variation of 39.2%, comparing the year 2000 to 2010.

However, in the Northeast, although the stock of employees in the primary sector has increased, it is important to analyze the type/quality of these new jobs, since the region is characterized by seasonality in agricultural activities; and, therefore, due to the high turnover in employment (SILVA FILHO *et al.,* 2014). In this sense, the conditions of new occupations generated in the region are characterized by a workforce that increasingly improves levels of schooling, but with a concentration of low wages, in addition to the high turnover that agricultural activities present (BRITO *et al.,* 2013), despite the increase in average remuneration over the years, indicating an improvement in the remuneration of formal jobs in this sector.

In Table (01) below, there is a description of the socioeconomic and demographic characteristics of those formally employed in the northeastern agriculture and in the MATOPIBA region, an area that has high technology in its production processes, especially to produce *commodities,* as observed by Porcionato *et al.,* (2018). Thus, the average age of the agricultural workforce employed in MATOPIBA is lower in relation to the population employed in the agricultural sector in the other Northeastern municipalities.

Furthermore, this last agricultural frontier concentrates, above all, the male workforce, registering very high percentages compared to female participation in both areas analyzed. However, it should be noted that, despite the discrepancy in values, the participation of men falls while that of women

increases. However, in the agricultural sector, women are still a minority. This can be explained, according to Silva Filho & Silva (2011), by the northeastern agricultural occupations that are characterized as work/intensive, thus requiring greater physical effort, making it impossible, in part, for greater female participation in the sector.

As can be seen, still in Table 01, the employed are distributed among the different sizes of establishments, apart from the large establishment in MATOPIBA in 2000. The micro-establishment has the highest percentage of employed workers in all selected years, both in relation to the other establishments, regarding the municipalities located outside the areas of MATOPIBA. This result converges with that of Cardozo & Cunha (2018), in their study, establishments with up to 19 employed workers (micro-enterprise) also recorded the highest percentage of jobs (52.01%) in the agricultural sector. Thus, the importance of public policies aimed at stimulating small businesses and family farming is highlighted.

Table 1.

Socioeconomic and demographic characterization of formally employed in agriculture in the Northeast and in the MATOPIBA region - 2000/2005/2010/2015

Variables	Not MATOPIBA	MATOPIBA	Not MATOPIBA	MATOPIBA	Not MATOPIBA	MATOPIBA	Not MATOPIBA	MATOPIBA
Mean age and age squared of formally employed								
Age	33,7	32	33,4	31,6	34,4	32,8	35,6	33,9
Age²	1265	1118,9	1228,7	1097,2	1291,5	1168,1	1389,1	1250,6
Sex of the formally employed								
Male	89,2	93,7	85,9	94,4	84	92,2	82,8	91,3
Female	10,8	6,3	14,1	5,6	16	7,8	17,1	8,7
Distribution of formally employed by establishment size								
Micro	30,9	52	29,3	47	30,8	41,2	33,6	49
Small	23,2	23,3	21,5	30,3	22,9	26,3	22,5	27,4
Medium	23	24,7	24,9	16,6	24,5	27	24,1	20,8
Great	22,9	0	24,2	6	21,8	5,5	19,8	2,8
Length of stay in formal employment								
Ap to 1 year	54,2	66	60,7	76,6	61	68,9	55,4	58,1
More than 1 to 2	13,1	13,8	13,2	11,9	12,1	13,9	14,6	17,4
More than 2 to 3	7,8	8,3	7,1	4,7	6,8	6,2	7,9	8
More than 3 to 5	8,3	6,7	7	3,7	7,5	5,3	8,6	8,2
More than 5 to 10	8	4,2	6,4	2,5	7,9	4,7	8,2	6
More than 10	8,6	1	5,5	0,6	4,7	1,1	5,3	2,4

Level of education of formally employed							
Seminstfundinc	89	82,2	83,9	79,8	71,8	65	59,8	45
Fundcompmedic	5	11,8	8,6	12,8	14,5	19,3	18,4	24
Medcompsupinc	4,7	5,4	6,5	6,7	12,4	14,2	20,3	28,5
Supcomp	1,4	0,6	1,1	0,7	1,2	1,4	1,5	2,5
Master's degree	0	0	0	0	0	0	0,1	0
Doctorate degree	0	0	0	0	0	0	0	0
Distribution of formally employed by geographic region							
TO	0	33,4	0	21,6	0	21,4	0	27,8
MA	0,6	40,6	1,5	31,2	1,2	33,2	1,5	28
PI	2,1	2,3	1	2,7	2	5	2	8,2
CE	5,4	0	7,4	0	9,2	0	11,4	0
RN	9,2	0	8,2	0	6,3	0	6,7	0
PB	6,7	0	6,8	0	6,5	0	6,1	0
PE	25,6	0	29,1	0	27	0	24,1	0
AL	11,1	0	4,3	0	4	0	4,4	0
SE	4	0	2,9	0	6,1	0	5,9	0
BA	35,3	23,7	38,8	44,5	37,7	40,4	37,9	36,1
Average income and hourly income in formal agricultural employment							
Average income from work	876,3	967,8	915,9	1.230,20	1.137,10	1.483,70	1.259,60	1.761,20
Income per hour of work	20,8	22,4	22,3	28,2	31,4	34	29,9	40,4

Source: elaboration of the authors based on data from RAIS-ME, 2019.

Note 1: values are in Reais as of December 2019.

Note 2: Seminstfundinc = No education and incomplete primary education; fundcompmedic = Completed elementary school and incomplete high school; Medcompsupinc = complete higher education and incomplete secondary education; supcomp = complete higher education.

Agriculture has high turnover, especially for the employed who spent less time on the job. This can be seen, mainly, in the municipalities of MATOPIBA that registered, in the year 2000, a percentage of 66% in the lowest analyzed range. This figure shows a reduction, in 2015, to 58%. It should also be noted that the other northeastern municipalities reveal very significant results for the workforce that was occupied for less time, the percentages exceed 50%. It should be noted that these results corroborate those already found by Silva Filho *et al.* (2014).

As for schooling, the participation of the uneducated workforce or those with incomplete primary education is substantially high, even though there have been reductions over the years in both regions. It is noted that this fall was more significant in the areas of MATOPIBA. Analyzing the highest levels of education, it is noticeable that agriculture only has people with a master's degree from 2010 onwards; and, in 2015, with a doctorate. However, the participation is extremely small in these bands, the values verified are 0.04 and 0.01, respectively. For Balsadi & Del Grossi (2016), across the country, there has been an increase in the educational level of the EAP employed in agriculture, in all educational levels. However, the lowest records are observed in the North and Northeast regions. Thus, the authors cite the importance of greater investments and public incentives for the educational area, because, after the innovations in the field, a new profile of workers is demanded, with greater qualification and flexibility.

Regarding the division of agricultural employment in the northeastern states and Tocantins, Bahia stands out for presenting a very high concentration of employed persons in all the years in the two regions in question, but it is mentioned that in the states that have the MATOPIBA the participation of the workforce is relatively higher, compared to the workforce located in states outside the agricultural frontier. The fact that the State centralizes a large part of the agricultural workforce can be explained according to Cruz *et al.* (2019) who observed, among the states that include MATOPIBA, Bahia is the one with the largest planted area and stands out in terms of production, despite being the state that encompasses the smallest number of municipalities in the new agricultural frontier in the world. country.

Additionally, the data reveal that the average income from agricultural work in the two regions has increased over the years, especially in MATOPIBA. This agricultural frontier shows an increase from R$ 967.8 in 2000 to R$ 1761.2 in 2015 in income from agricultural work. In other words, this means that being occupied in MATOPIBA implies higher income, on average, in relation to other northeastern areas. Similarly, in the hourly income, the values increase throughout the analyzed period. MATOPIBA continues to register the highest income with the amount of R$ 22.4, in 2000; and, in 2015, it increases to R$ 40.4. Despite this, for Cruz *et al.* (2019) the greatest difficulty found in MATOPIBA is to offer equality in income distribution, in addition, to offer fair and dignified work for workers. Therefore, the need to

intensify State intervention is reinforced, through public policies and greater control to reduce income differentials in the region.

5. Differentials of labor income in agriculture in MATOPIBA – Ordinary Least Squares estimations – OLS

Historically, the new agricultural frontier in Brazil - MATOPIBA -, like the entire country, is marked by concentration and inequalities. Thus, based on the intense transformations that have taken place in the countryside, it is understood that the primary manifestation that this area presents is the strong centralization of income in some municipalities and the growth of disparities within them. This high concentration of income in MATOPIBA areas is attributed to the fact that land, capital, and labor are in the possession of a few. In addition, the agriculture carried out in the region, based on monoculture, has agribusiness multinationals and large landowners as holders of power. (BUAINAIN *et al.,* 2017; PEREIRA *et al.*, 2018).

Thus, on the one hand, MATOPIBA draws attention for the large production of grains that has provided several gains for the region over the years, on the other hand, this area carries out a production of *commodities* that intensively uses the technological factor and reduces the participation of labor. which, consequently, reduces the income earned by workers. As a result, the region has a growing Gross Domestic Product (GDP), but income distribution does not increase proportionately. Thus, registering uneven and differential growth in the income of individuals (PEREIRA *et al.*, 2018).

The way in which the areas of this new frontier are economically exploited, particularly with the production of soy, has generated several socioeconomic impacts for the region. The perspective is that the soybean crop will grow a lot, however the gains obtained with the production point to great inequalities. In other words, MATOPIBA is characterized by wealth arising from agribusiness and, at the same time, by a local population that lives with the problem of poverty and misery because of the high concentration of income (PORCIONATO *et al.*, 2018).

In view of this dual scenario that MATOPIBA presents the income differential in agriculture can be portrayed, compared to other areas of the Northeast, according to the analysis of some variables related to the labor market. The following Table 02 shows the determination of the differentials in labor income estimated by the Ordinary Least Squares method – OLS, with significant variables at 1%. The results plotted in the Table show that an individual employed in MATOPIBA areas earned, on average, 27% more than an active worker outside MATOPIBA in the year 2000; while in 2015 there was an increase to 33%.

Despite the identification of income differentials occur between the employed who are inside and outside the MATOPIBA areas. It is noteworthy that these disparities also occur between individuals occupied in the same area of the border. Souza & Silva (2019) mention that when a country has its primary production focused on the international market, as is the case with the production of agricultural *commodities* carried out in the MATOPIBA region, it will be subject to the negative consequences generated by this process.

Becoming a vulnerable and fragmented territory, as it causes a great exploitation of natural resources and work, which results in cases of precarious work in a frequent way, directly implying in income.

Regarding age, it is possible to say that in the year 2000 one more year reflected positively on the income of agricultural workers, registering a percentage of 2%. In 2015, this percentage does not show significant variations. Differently, in age², there is an increase in income as age increases, but there is no progressive growth. That is, in each period the income grows in smaller proportions. It is also clear that there is a great difference in income between the different sizes of establishment. In 2000, being employed in the small establishment implied an income 9% more in relation to the micro establishment; in 2015, this figure increases to 13%. The large establishment, which registers the greatest differentials, presented a percentage of 29% in 2000 and, in 2015, 21% when compared to micro establishments.

The length of time in the job also revealed very expressive coefficients, especially for those who remain in the same job for longer. In the lowest analyzed range (More than 1 to 2) it is possible to verify that an employed agricultural worker earned an income of 2% more than a worker who stayed for less than a year, in 2000. In 2015, there was a slight change to 5%. When the range more than 10 is analyzed, the values increase significantly. In 2000, the percentage presented is 26%, changing to 21% in 2015, in relation to the reference category (less than 1 year). As this variable, for Silva Filho *et al.* (2017), considered relevant in determining the individual's gain in experience regarding their professional area.

Table 2.

Differences in earnings per hour of formal work according to the socioeconomic and demographic characteristics of those employed in the years 2000-2005-2010-2015.

Variables	Dependent Variable: ln_rendahoratrab			
	2000	2005	2010	2015
MATOPIBA	0.271 ***	0.342 ***	0.308 ***	0.332 ***
	-0.005	-0.002	-0.002	-0.003
Sex	0.150 ***	0.107 ***	0.127 ***	0.128 ***
	-0.003	-0.002	-0.002	-0.003
Age	0.024 ***	0.018 ***	0.013 ***	0.016 ***
	-0.0005	-0.0004	-0.0004	-0.001
Age2	-0.0003 ***	-0.0002 ***	-0.0001 ***	-0.0002 ***
	-0.00001	0	0	-0.00001
Small	0.087 ***	0.110 ***	0.100 ***	0.130 ***
	-0.003	-0.002	-0.002	-0.003
Medium	0.170 ***	0.144 ***	0.216 ***	0.151 ***
	-0.003	-0.002	-0.002	-0.003
Great	0.288 ***	0.240 ***	0.140 ***	0.211 ***
	-0.003	-0.002	-0.002	-0.003
More than 1 to 2	0.024 ***	0.035 ***	0.048 ***	0.050 ***
	-0.003	-0.002	-0.002	-0.003
More than 2 to 3	0.061 ***	0.059 ***	0.071 ***	0.093 ***
	-0.004	-0.003	-0.003	-0.004
More than 3 to 5	0.099 ***	0.091 ***	0.123 ***	0.124 ***
	-0.004	-0.003	-0.003	-0.004
More than 5 to 10	0.108 ***	0.139 ***	0.135 ***	0.181 ***
	-0.004	-0.003	-0.003	-0.004
More than 10	0.263 ***	0.229 ***	0.232 ***	0.210 ***
	-0.004	-0.003	-0.003	-0.005
Fundcompmedic	0.252 ***	0.107 ***	0.064 ***	0.052 ***
	-0.004	-0.002	-0.002	-0.003

Note 1: statistical significance at * $p<0.05$;** $p<0.01$;***$p<0.001$

Medcompsupinc	0.795 ***	0.450 ***	0.243 ***	0.159 ***
	-0.004	-0.003	-0.002	-0.002
Supcomp	1,812 ***	1,506 ***	1,131 ***	1,035 ***
	-0.008	-0.006	-0.006	-0.007
MA	-0.071 ***	0.105 ***	-0.016 ***	0.027 ***
	-0.007	-0.004	-0.003	-0.005
PI	-0.078 ***	0.147 ***	0.144 ***	0.194 ***
	-0.009	-0.006	-0.005	-0.006
CE	0.007	0.094 ***	0.141 ***	0.094 ***
	-0.008	-0.005	-0.004	-0.006
RN	0.076 ***	0.175 ***	0.146 ***	0.108 ***
	-0.008	-0.005	-0.005	-0.007
PB	0.056 ***	0.277 ***	0.211 ***	0.178 ***
	-0.008	-0.005	-0.005	-0.007
PE	0.041 ***	0.140 ***	0.162 ***	0.105 ***
	-0.008	-0.004	-0.004	-0.005
AL	-0.075 ***	0.156 ***	0.167 ***	0.095 ***
	-0.008	-0.005	-0.005	-0.007
SE	-0.047 ***	0.086 ***	0.177 ***	0.110 ***
	-0.009	-0.006	-0.005	-0.007
BA	-0.004	0.144 ***	0.185 ***	0.132 ***
	-0.007	-0.003	-0.003	-0.005
Constant	1,892 ***	2,087 ***	2,411 ***	2,496 ***
	-0.012	-0.008	-0.008	-0.012

Note 2: Fundcompmedic = Completed elementary school and incomplete high school; Medcompsupinc = complete higher education and incomplete secondary education; Supcomp = complete higher education; ln_rendahoratrab = Natural logarithm of income per hour of work.

The schooling variable proves to be quite relevant in explaining income disparities in the agricultural sector. In this sense, the fact that the worker has complete elementary and incomplete secondary education implies a salary of

25% and 5% more than an individual with no education or with incomplete elementary education (reference category), in 2000 and 2015, respectively. As the ranges of schooling increase, the differentials intensify. For workers who claim to have a college degree, the income was 1,812% in the first year analyzed, while in 2015 the income earned was 1,035%. In other sectors, according to Staduto *et al.* (2002), the lack of qualifications of agricultural workers prevents or hinders their allocation to non-agricultural activities, which have greater economic value when compared to agricultural occupations.

In an analysis of the northeastern states, it is possible to notice that the employed individual in Maranhão, Piauí, Alagoas, Sergipe and Bahia registered lower income in relation to the agricultural worker in the State of Tocantins in the year 2000. But in 2010 this situation was reversed and all states that make up the Northeast showed employed people with higher income than the state used as a reference, therefore, omitted (Tocantins). In their studies, Silva Fiho *et al.* (2020) analyzed the average income of agriculture in the MATOPIBA region and found that the municipalities that form this agricultural frontier have average wage income located in the best ranges.

6. Differential income from work in agriculture between the municipalities in the MATOPIBA region and other municipalities that are part of the States of this region.

The incorporation of scientific knowledge in the activities of the agricultural sector and the use of technical instruments such as planters, plows, irrigation

systems, harvesters, etc., provided the growth of productivity in the areas of crops destined for the international market, mainly in the 2000s. scenario in which MATOPIBA is inserted, a region that gained a new productive dynamic from the various transformations that occurred in agriculture, which made it possible to install large corporations in the sector in the region (SOUZA & SILVA, 2019).

From the 1990s onwards, MATOPIBA presented an increase in grain production, mainly soybean, corn, and cotton. Agricultural products intended for foreign trade and belonging to its main crops, which since 2000 have reached an even more expressive growth. With the significant increases in production, the State allocated financial resources to infrastructure to improve the region's logistics (SOUZA & SILVA, 2019).

Among the investments made, mention is made of the expansion of the North/South Railroad network, in the states of Tocantins and Maranhão, and the improvements in innovation in the Port of Itaqui, considered a primordial port to ship the *commodities* that are produced in the last agricultural frontier. country (SOUZA & SILVA, 2019). However, the MATOPIBA region still has a great deficiency in infrastructure, especially in storage, which does not keep up with the pace of production, and in flow, due to the precarious conditions of the modes of transport (BRANDÃO *et al.,* 2018).

The dynamization of spaces dedicated to agricultural practice is also the result of various government programs and fiscal and financial incentives for primary sector activities in the period of agricultural expansion. The areas of the northeastern cerrados, specifically those located in part of the territory of

the states of Maranhão, Piauí and Bahia are models of highly capable spaces in the productive and economic sphere (SANTOS, 2018).

Bahia, for example, is the state that stands out in terms of cocoa exports in the country (SANTOS *et al.,* 2013). Maranhão stands out in the production of soybeans. In 2013, the state exported 1.3 million tons of soybeans. Balsas, belonging to the MATOPIBA region and located in the south of Maranhão, is a pole municipality considered the major soybean producer, with significant growth not only in production, but also in productivity and planted area (CUNHA & ESPÍNDOLA, 2016).

In addition to the great importance of the region in the production of some grains, the agricultural occupation in MATOPIBA can boost the dynamism of other activities carried out in the sector. Thus, it becomes interesting to develop public policies to promote the attraction of agricultural activities, as well as their permanence in the region. As an example, the adoption of measures to increase the supply of credit and subsidies for agro-industrial activities (SILVA FILHO *et al.,* 2020).

The following tables (03 and 04) show data referring to the MATOPIBA area and the other areas of northeastern agriculture regarding income/hour disparities in formal work according to the socioeconomic and demographic characteristics of the workforce. In the analysis of the values for the years 2000 and 2005 (Table 03), in the first year, men earned more than women in both areas analyzed, especially in MATOPIBA (21%). Similarly, the age of the agricultural worker also corroborates income differences. An extra year

implies a higher income; however, in age squared, this increase occurs in smaller proportions.

The data obtained also reveal that a person employed in a small establishment earns a higher salary than someone who works in a micro-establishment (reference category), both in MATOPIBA and abroad, the percentages are 9% for both regions in the year of 2000. In the same year, the large establishment registered squatters only outside the MATOPIBA areas, with a value of 30% in relation to the reference category.

According to Silva Filho *et al.* (2020), in MATOPIBA, micro, small and medium-sized agricultural establishments are fundamental in regional economic development. However, despite these types of establishments having the largest number of occupations, they pay less compared to large establishments. The authors relate this disparity in income to the low technology used in the production process, which reduces productivity and, consequently, the income earned by the worker.

In relation to the length of stay in the same agricultural job, it is noted that in the year 2000 at MATOPIBA the income difference is 8% for those who stay more than a year or two in the same activity, while in areas outside this new border, the percentage is only 1%, when compared to an employed person who stays at work for less than a year. In the largest range (more than 10) the results grow substantially. In MATOPIBA, income differentials approach 50%, while in the other areas the percentage reaches 25%, in relation to the omitted variable (less than a year) for the year 2000. In the municipalities that make up the MATOPIBA, it was observed that the time of agricultural

employment was shorter. In 2000, 65% of the employed stayed less than a year in their jobs (SILVA FILHO *et al.,* 2020).

Table 3.

Income/hour disparities in formal work according to socioeconomic and demographic characteristics in MATOPIBA and in other municipalities in the states that make up the region - 2000/2005

Variables	Dependent Variable: ln_rendahoratrab			
	2000		2005	
	MATOPIBA	NOT MATOPIBA	MATOPIBA	NOT MATOPIBA
Sex	0.214 *** -0.013	0.142 *** -0.003	0.207 *** -0.007	0.104 *** -0.002
Age	0.032 *** -0.002	0.024 *** -0.001	0.023 *** -0.001	0.017 *** -0.0004
Age2	-0.0004 *** -0.00002	-0.0003 *** -0.00001	-0.0003 *** -0.00001	-0.0002 *** -0.00001
Small	0.089 *** -0.008	0.092 *** -0.003	0.105 *** -0.004	0.113 *** -0.002
Medium	0.221 *** -0.008	0.172 *** -0.003	0.089 *** -0.005	0.163 *** -0.002
Great	–	0.279 *** -0.003	0.266 *** -0.007	0.252 *** -0.002
More than 1 to 2	0.077 *** -0.009	0.014 *** -0.003	0.056 *** -0.005	0.032 *** -0.002
More than 2 to 3	0.081 *** -0.011	0.056 *** -0.004	0.080 *** -0.007	0.057 *** -0.003
More than 3 to 5	0.153 *** -0.012	0.087 *** -0.004	0.142 *** -0.008	0.085 *** -0.003
More than 5 to 10	0.218 *** -0.015	0.091 *** -0.004	0.198 *** -0.01	0.132 *** -0.003
More than 10	0.485 *** -0.031	0.252 *** -0.004	0.429 *** -0.02	0.212 *** -0.003
Fundcompmedic	0.157 *** -0.009	0.274 *** -0.004	0.090 *** -0.005	0.108 *** -0.003
Medcompsupinc	0.634 *** -0.014	0.813 *** -0.005	0.341 *** -0.006	0.476 *** -0.003
Supcomp	1.538 *** -0.041	1.832 *** -0.008	1.321 *** -0.019	1.538 *** -0.007
MA	-0.125 *** -0.008	0.159 *** -0.013	0.083 *** -0.005	0.112 *** -0.006
PI	0.088 *** -0.021	-0.118 *** -0.007	0.197 *** -0.01	-0.026 *** -0.007
BA	0.040 *** -0.008	-0.027 *** -0.002	0.175 *** -0.004	-0.014 *** -0.001
Constant	1,979 *** -0.034	1,925 *** -0.01	2,254 *** -0.018	2,251 *** -0.007

Note: statistical significance at * p<0.05;** p<0.01;***p<0.001

Note 2: Fundcompmedic = Completed elementary school and incomplete high school; Medcompsupinc = complete higher education and incomplete secondary education; Supcomp = complete higher education; ln_rendahoratrab = Natural logarithm of income per hour of work.

Regarding the level of education, it is possible to verify that for the individual who declares to have completed elementary school and incomplete secondary education, the salary was 16% in the new agricultural frontier and 27% for those employed outside the area that comprises MATOPIBA, indicating that, in 2000, in both regions, individuals with the schooling range had a higher income than those with only incomplete elementary education. For this same year, in the higher education category, the difference increases to 1,538% in MATOPIBA and 1,832% in the other areas, considering the reference category (incomplete elementary education).

In addition, it should be noted that the low qualification of agricultural labor is considered an obstacle to the adoption of technical innovations in the production process and makes it difficult for workers to access higher incomes (CIRO & ALBINO, 2021). However, it should be noted that, in MATOPIBA, there was an increase in the level of education of agricultural workers (SILVA FILHO *et al.,* 2020).

Carrying out an analysis of income differences in the states that include MATOPIBA, in 2000 only the municipalities of Maranhão that are part of the new frontier present employed persons with lower incomes than those of

Tocantins, the state chosen as a reference, therefore, omitted. While Piauí and Bahia registered positive percentages. The opposite occurred in States outside the MATOPIBA area for the same year.

Among the MATOPIBA states, it is mentioned that those located in northeastern areas have a strong soybean crop. In Maranhão, the municipality of Balsas was considered, in 2017, the main producer of the grain at the state level. It was also observed, in the savannas of Piauí, a lot of soybeans planted area in five municipalities of the state, representing more than 50 thousand hectares. The greatest emphasis is given to the state of Bahia, but precisely to the micro-region of Barreiras, which has five municipalities that planted more than 100 thousand hectares of soybeans. In Tocantins, however, there were no large soybean areas, compared to those in the Northeast (OLIVEIRA *et al.,* 2020).

Table (04), corresponding to the years 2010 and 2015, refers to the continuation of the previous Table. Their results demonstrate that the male individual continues to earn higher income than the female workforce, in the two regions in question. In MATOPIBA the difference remained higher (21%), while in the other areas the inequality was 1% in 2015. These results converge with those of Silva Filho *et al.* (2020), who attribute this difference to the fact that most agricultural activities are occupied by men, due to the characteristics of agricultural jobs that require a lot of physical effort, and because of the remuneration for productivity.

In relation to age, one more year continues to corroborate income differentials. Similarly, age squared shows that there is an increase in income

with increasing age, but after a certain period it begins to fall. Regarding the size of the establishment, a person employed in any of the establishments contained in the Table had a higher income than that of the reference category (micro-establishment) in the two areas analyzed.

In the large establishment, the workforce outside MATOPIBA registered a percentage of 21% in 2015. It is important to note that in this same year MATOPIBA presented an approximate value (20%). Although in the year 2000 there were no large establishments in MATOPIBA, in 2015 it was verified 2.88% of the workforce employed in this type of establishment (SILVA FILHO *et al.* 2020).

In the category length of stay at work, the range over 10 remains with the most expressive percentages. In 2015, MATOPIBA registered a value of 29%, while outside this new frontier the result was 19%. When compared with the initial year (2000), it is noted that there was a drop in values, indicating that the difference in income between those employed in these regions, for this size of establishment, has been reducing over the years in relation to the workforce. who stays up to a year in the same agricultural job.

As for the level of education, it appears that in all categories the income differential is positive in relation to those who have incomplete basic education, both in the municipalities of MATOPIBA and outside them. For those employed who have completed higher education, it is observed that the values have reduced over the years, but the income disparity remained stark in 2015, the last year analyzed. For this year, MATOPIBA recorded 1,022%

and the other areas 1,044%, compared to the category chosen as a reference (incomplete elementary school).

According to Ciro & Albino (2021), Brazilian rural occupations have workers with a low educational level. This being a historical fact in the country, which intensifies when referring to the agricultural sector. This low level of education has a negative influence on the income earned by the Brazilian workforce, especially in the Northeast, since the region has a significant portion of the population engaged in agricultural activities.

In an analysis of the states of Maranhão, Piauí and Bahia, the data allow us to verify that in 2015, no state had a percentage lower than the category chosen as a reference (Tocantins). Therefore, it is possible to observe that there was a differentiation regarding the initial years. It is worth mentioning here the State of Piauí, which corresponds to the highest percentage in 2015 in MATOPIBA (22%); while in the municipalities outside the border it was registered only 6%. It is important to emphasize that this result refers to the income differential compared to the State of Tocantins, an omitted category.

Table 4.

Income/hour disparities in formal work according to socioeconomic and demographic characteristics in MATOPIBA and in other municipalities in the states that make up the region - 2010/2015

| Variables | Dependent Variable: ln_rendahoratrab | | | |
| | 2010 | | 2015 | |
	MATOPIBA	NOT MATOPIBA	MATOPIBA	NOT MATOPIBA
Sex	0.231 ***	0.110 ***	0.207 ***	0.116 ***
	-0.004	-0.002	-0.008	-0.003
Age	0.024 ***	0.010 ***	0.027 ***	0.013 ***
	-0.001	-0.0004	-0.001	-0.001
Age2	-0.0003 ***	-0.0001 ***	-0.0003 ***	-0.0001 ***
	-0.00001	-0.00001	-0.00002	-0.00001
Small	0.124 ***	0.089 ***	0.176 ***	0.108 ***
	-0.003	-0.002	-0.005	-0.003
Medium	0.174 ***	0.233 ***	0.144 ***	0.149 ***
	-0.003	-0.002	-0.006	-0.003
Great	0.161 ***	0.143 ***	0.196 ***	0.206 ***
	-0.006	-0.002	-0.014	-0.003
More than 1 to 2	0.065 ***	0.043 ***	0.069 ***	0.046 ***
	-0.004	-0.002	-0.006	-0.003
More than 2 to 3	0.136 ***	0.055 ***	0.140 ***	0.076 ***
	-0.005	-0.003	-0.008	-0.004

Note: statistical significance at * $p<0.05$;** $p<0.01$;***$p<0.001$

More than 3 to 5	0.177 ***	0.110 ***	0.162 ***	0.111 ***
	-0.005	-0.003	-0.008	-0.004
0	0.204 ***	0.121 ***	0.270 ***	0.158 ***
	-0.006	-0.003	-0.009	-0.004
More than 10	0.325 ***	0.225 ***	0.291 ***	0.194 ***
	-0.012	-0.004	-0.015	-0.005
Fundcompmedic	0.087 ***	0.050 ***	0.061 ***	0.047 ***
	-0.003	-0.002	-0.006	-0.003
Medcompsupinc	0.260 ***	0.232 ***	0.179 ***	0.149 ***
	-0.004	-0.002	-0.005	-0.003
Supcomp	1,140 ***	1,133 ***	1,022 ***	1,044 ***
	-0.01	-0.007	-0.014	-0.009
MA	-0.022 ***	0.038 ***	0.013 **	0.044 ***
	-0.004	-0.007	-0.006	-0.009
PI	0.215 ***	-0.066 ***	0.216 ***	0.059 ***
	-0.006	-0.005	-0.009	-0.007
BA	0.215 ***	0.017 ***	0.141 ***	0.017 ***
	-0.003	-0.002	-0.006	-0.002
Constant	2,403 ***	2,653 ***	2,524 ***	2,689 ***
	-0.015	-0.008	-0.026	-0.012

Note 2: Fundcompmedic = Completed elementary school and incomplete high school; Medcompsupinc = complete higher education and incomplete secondary education; Supcomp = complete higher education; ln_rendahoratrab = Natural logarithm of income per hour of work.

Table 05 contains the data referring to the decomposition of the marginal effects of the observable and unobservable characteristics on the income differentials between those employed in agriculture in MATOPIBA and outside the areas of this new frontier. Thus, it is observed that the characteristics of the labor force employed in these regions confirm income differentials. When analyzing the unobservable characteristics (coefficient effect), it is emphasized that in the initial years this differential occurred in favor of those employed outside MATOPIBA, -1.91%, in 2000. However, in

2015, the coefficient effect came to explain 0 .07% in favor of employees in the new agricultural frontier.

Table 5.

Decomposition of the marginal effects of observable and unobservable characteristics on income differentials between those employed in agriculture in MATOPIBA and outside MATOPIBA - 2000/2005/2010/2015

Variables	2000		2005		2010		2015	
	Coefficients	Features	Coefficients	Features	Coefficients	Features	Coefficients	Features
Coefficient Effects and Characteristics	1,998	0	1.966	0	2,121	0	2,091	0
Sex	0.064	0.01	0.089	0.018	0.102	0.019	0.075	0.017
Age	0.27	-0.057	0.2	-0.04	0.481	-0.038	0.499	-0.047
age2	-0.127	0.058	-0.123	0.039	-0.258	0.037	-0.278	0.042
Small	-0.001	0	-0.002	0.009	0.008	0.004	0.015	0.009
Medium	0.011	0.004	-0.018	-0.007	-0.014	0.005	-0.001	-0.005
Great	-0.064	0	0.003	-0.048	0.004	-0.026	-0.002	-0.033
more than 1 to 2	0.008	0.001	0.003	-0.001	0.003	0.001	0.003	0.002
more than 2 to 3	0.002	0	0.002	-0.002	0.006	-0.001	0.005	0
More than 3 to 5	0.005	-0.002	0.004	-0.005	0.005	-0.004	0.004	-0.001
More than 5 to 10	0.01	-0.008	0.004	-0.008	0.007	-0.007	0.009	-0.006
more than 10	0.02	-0.037	0.012	-0.021	0.005	-0.012	0.005	-0.008
Fundcompmedic	-0.006	0.011	-0.002	0.004	0.005	0.004	0.003	0.003
Medcompsupinc	-0.008	0.005	-0.009	0.001	0.003	0.005	0.006	0.015
Supcomp	-4,124	-13.005	-2,423	-6,068	0.086	1,507	-0.32	10.246
Master's degree	0	0	0	0	0	0	0	0
Doctorate degree	0	0	0	0	0	0	0	0
BAD	-0.002	-0.05	0	0.025	-0.001	-0.007	0	0.003
IP	0.004	0	0.002	0.003	0.006	0.006	0.003	0.013
BA	0.024	-0.005	0.073	0.01	0.075	0.006	0.047	-0.003
Coefficient Effect	-1,913		-0.218		0.52		0.074	
Characteristic Effect	-13,075		-6,091		1,499		10,248	
Total Effect	-14,988		-6,309		2.02		10,322	

Source: Authors' elaboration based on RAIS-MEB data, 2020.

Note 1: Fundcompmedic = Completed elementary school and incomplete high school; Medcompsupinc = complete higher education and incomplete secondary education; supcomp = complete higher education.

The characteristic effect, referring to the observable characteristics, explained -13.08% to the detriment of those employed in municipalities outside the MATOPIBA areas, in 2000; and 10.25% in 2015 of income differentials from agricultural work for the benefit of individuals employed in the new frontier, called MATOPIBA. As for the total effect, the same trend occurs in the previous effects. In the initial years, the income difference was in favor of those employed outside the border (-14.99% in 2000), while in the last years under analysis the opposite occurred (10.32% in favor of those employed in MATOPIBA in 2015). It is important to emphasize that, although the data in the Table reveal that there are still differences in relation to the income of the employed workforce, over the years in question there is a reduction in income inequality.

7. Final considerations

In the present article, it was intended to analyze the income differentials among those formally employed in agriculture in the MATOPIBA region, comparing them to other areas of the Northeast. To carry out this analysis, the impacts that socioeconomic and demographic characteristics have on the performance of the workforce were considered. In addition, we worked with

RAIS microdata and with information on variables in the period 2000, 2005, 2010 and 2015.

According to the results found, it can be concluded that the MATOPIBA region is characterized, in relation to the other Northeastern municipalities, by a predominant male workforce, and small establishments concentrate a large part of the agricultural workforce. In addition, agricultural activities have high turnover, mainly affecting workers who spend less time on the job. In addition, the participation of people without education or with incomplete elementary education is large. However, it is noteworthy that those employed in the new agricultural frontier are more educated than in other areas of the Northeast. It is also important to highlight that MATOPIBA has the largest share of the agricultural workforce, which are also better paid.

By the OLS method, among the most relevant results, it was possible to verify that it is occupied in the areas of MATOPIBA, implying higher yields in relation to the other northeastern states. This can be explained by the production of *commodities* aimed at the external sector or even by the emergence of new jobs with better pay, after the mechanization of production processes. The data also indicate a persistent income inequality about the sex variable, in favor of men. As seen, they are the majority in this sector in the region. Furthermore, the indicators show that age has little impact on increasing income at work. The study also concluded that the greatest differences are observed in large establishments and for those who stayed longer in agricultural employment. In addition, it is mentioned that as the level of education increases, these differentials intensify.

Regarding the analysis of MATOPIBA, in comparison with other municipalities in the States that form this new frontier, very similar results were found. In both regions there are income inequalities between the sexes that favor men, especially in the MATOPIBA areas. Furthermore, age, one year older, corroborates income differentials in the analyzed regions, but with decreasing growth rates. The size of the establishment, length of stay and schooling are also responsible for explaining the intense inequalities in income in the agricultural sector of the municipalities. Additionally, income differentials by State favor employed persons in MATOPIBA.

Therefore, the results found in this article corroborate the various studies that point to socioeconomic and demographic characteristics as responsible for differentials in work income. In addition, it is reinforced that such characteristics also impact the income of agricultural labor in the country's new agricultural frontier, resulting in income inequalities of the employed population. It is also mentioned that as income differences were observed in the other northeastern areas, the idea of planning new strategies, on the part of Organs competent bodies, to reduce these disparities is intensified. Thus, it is recommended that further research be carried out focusing on other perspectives in the MATOPIBA region, an area still little addressed in scientific works, as well as contemplating other relevant variables. It is also suggested that new analyzes be carried out on measures to reduce these disparities, based on the use of other observation methods.

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