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Labor income differentials between formal workers in civil construction in the Northeast: Comparison by Race/Color and Gender

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Abstract. Even though female insertion in the labor market has increased in recent years, studies have found an abyss in terms of wage inequality, in which, even with more years of schooling, women receive lower wages than men. In this context, this study sought to evaluate the labor market and wage inequalities between men and women in civil construction in the Northeast, in the years 2009 and 2019. Microdata from the Annual List of Social Information (RAIS) for the years 2009 and 2019 were used. Mincerian earnings equations were estimated using Ordinary Least Squares (OLS) models and Quantile Regression to measure the impacts of socioeconomic and demographic characteristics of formally employed workers in civil construction on earnings between men and women. The results show that there is income inequality between men and women, with men earning higher wages in civil construction, as well as wage inequality persisting by race/color, age, education, among others.
Keywords. Labor market; Wage inequality; Construction; Northeast.
JEL. J0; J15; J61.

1. Introduction

Although women are managing to establish themselves in the labor market, conquering a space that they truly deserve, issues such as salary divergence are characterized as a counterweight in the evolution of this process. Thus, analyzing the reason for the existence of income disparities between men and women in the labor market, even though both are in equivalent positions and levels of education, becomes an object of study by the most diverse areas of science. From this perspective, we seek to answer: how does the civil construction sector, a predominantly male *ghetto* in the labor market, practice gender wage differences? How important is age, schooling, and race/color in this sector of economic activity in the Northeast to determine earnings from work?

Bearing in mind that there is wage disparity in the labor market, the study by Cacciamali & Freitas (1992), ensures that the neoclassical theory of human capital becomes the main means to explain wage differences in a labor market in equilibrium. Considered as an investment, human capital has different

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levels and, because of this, giving rise to the explanation of inequality in wages, the dissimilarity of investments results in different wage levels. However, in this context, the search for explanations of the fact that workers with the same functional capacity – same level of invested human capital – can be remunerated in different ways, draws attention by highlighting externalities that lead to the unequal distribution of earnings.

Thus, even though the Brazilian economy has been showing reductions, about this inequality in wages, external issues such as the gender of the worker have been the subject of studies in search of an explanation for this type of segmentation in the labor market. Barros *et al.* (2007), studying the evolution of the degree of segmentation of the Brazilian labor market, draw attention to the determinants of race/color and gender that contribute to the explanation of the degree of wage inequality, which, even with a slight reduction, continue to as an accentuated form in the formation of this disparity. The authors also question female participation in the labor market in a discriminatory manner, pointing out that man inserted in the same sector of economic activity as women, both having the same observable characteristics, got to receive 56% more than them in the year 2005.

The conditions in which the different population groups are inserted in the labor market characterize, in a certain way, the beginning of discrimination and, consequently, of inequality, considering mainly the gender of the worker. According to Pinheiro *et. al.* (2008), female participation in the Brazilian labor market has increased significantly in recent years, even with a difficulty of insertion that starts very early, since young females aged 16 to 17 years, in 2007, had only 69.4% of occupations, compared to 81.1% of males.

Observing the means that lead to the increase of women's participation in the labor market, Fontoura & Gonzalez (2009) pay attention to the explanation that this can happen due to the expansion of the market itself, as well as cultural issues and schooling of the female population. But, even evolving in their role in society, women still face structural barriers that, sometimes, involuntarily overlap with their capacity. The civil construction sector is a good example to address this issue, since its origin it has been considered a masculine *ghetto,* where women would have little prestige and opportunity (Silva Filho & Queiroz, 2013).

The civil construction sector is considered the sector that stands out for having tasks that are mostly attributed to men, and that, because of this; women find it difficult to enter this environment. In Brazil, the sector has gained momentum in recent years, with structural growth, boosted by government infrastructure programs, which increased the demand for labor and allowed women to have chances of inclusion. According to Romcy & Brites (2014), based on the 2011 RAIS records, women with a formal contract in all categories increased by about 5.93%, with civil construction responsible for a significant percentage of this growth between periods from 2010 to 2011.

Silva Filho & Queiroz (2013) show that between 2006 and 2007, only 6.9% of those formally employed in civil construction in Brazil were women, rising to 7.5% between 2009 and 2010. Furthermore, the study shows that the rate of net creation of jobs in the first clipping was lower for women and in the second clipping analyzed it becomes higher, compared to that registered for men.

In view of this, this research aims to analyze the labor market and wage inequalities between men and women in civil construction in the Northeast, in the years 2009 and 2019, between the international financial crisis and the

COVID-19 pandemic (an excerpt that seeks to eliminate the adverse effects of the cavities, thus justifying the choice of years). This work becomes a pioneer in the theme by bringing the Northeast region to the fore, given that it has seen significant growth in the sector in the generation of jobs in the years observed (RAIS-ME), as well as being considered a region with a predominantly male culture in this sector of economic activity, mainly because it has a construction infrastructure relatively developed by manual activities and that requires extremely high physical effort in the execution of its activities, being, in most cases, activities carried out by male labor. With this, the aim is to analyze this *ghetto* in a region where cultural factors still contribute to greater difficulty for women to enter the sector.

To achieve the proposed objective, the article is structured as follows: in addition to these initial considerations; the second section presents the methodological procedures; in the third section, a review of the literature on the wage gap between men and women in the labor market is presented; in the fourth section, the results found are presented; and, in the fifth section, the final considerations and perspectives for new approaches are presented.

2. Methodological procedures

This study aims to analyze the labor market and income inequalities between men and women for those formally employed in the civil construction sector in Northeast Brazil. It is based on a literature review, with emphasis on the wage gap between men and women, and then an empirical analysis is carried out based on the RAIS-MEB Microdata.

2.1. Coverage area and database

The study area comprises the entire Northeast region of Brazil, as shown in Figure 1. According to Oliveira *et al.* (2015), the Northeast region has become a great attraction for companies to set up their branches, increasing the number of firms with an employment relationship in the civil construction sector. Furthermore, according to Silva Filho & Queiroz (2013), this sector is considered the one that most employs the working class with low education, along with agriculture, and contributes to regional development by bringing a greater supply of formal jobs to the less educated workforce of the Brazilian Economically Active Population (EAP).

Bezerra (2018), points out that in 2017, the Northeast region had around 25.2 thousand companies in the construction sector, which is 16.6% of the national total, with about 20% of the stock of jobs in the sector, thus justifying a study of this nature in this region, given the significant capacity for formal occupation and its significant share in the national context.

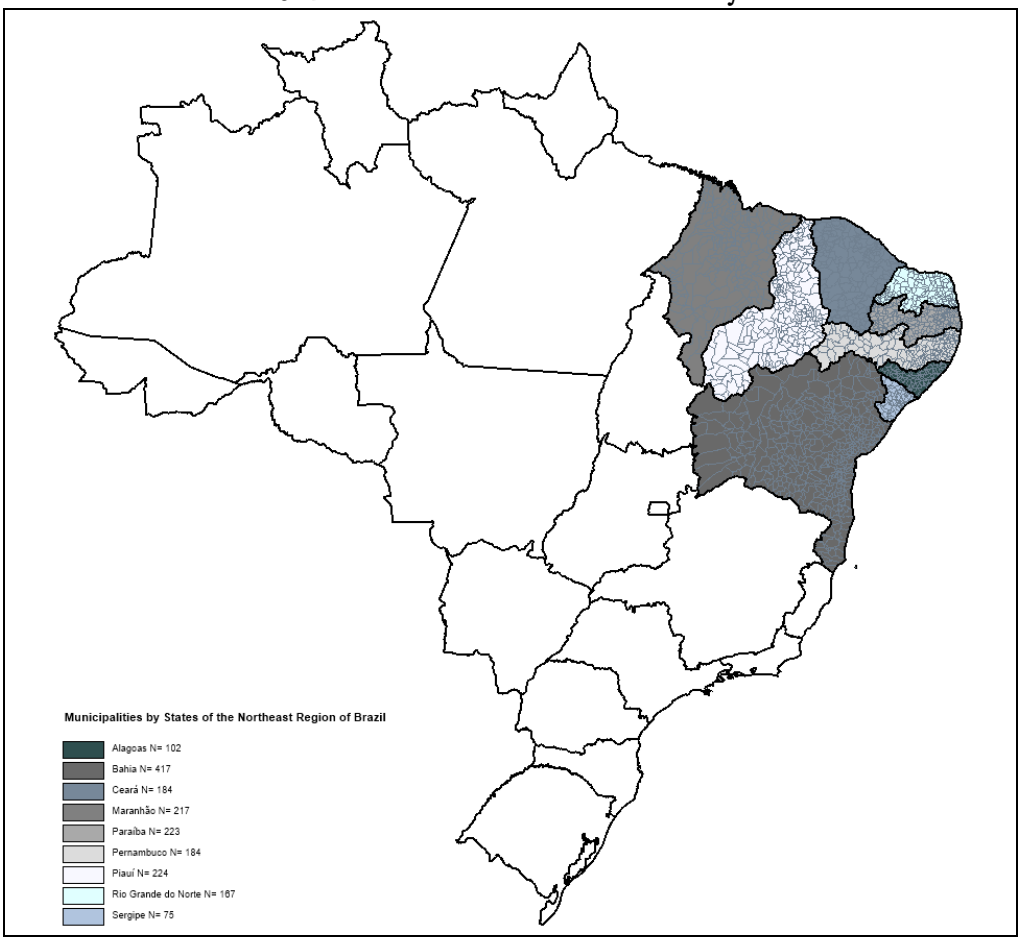

Figure 1. *Northeast Region of Brazil and its territorial division by states and municipalities – 2019.*
Source: elaboration of the authors, 2022.

Due to the significant participation of this sector in the generation of jobs, especially for the Economically Active Population with a lower level of education, this study is justified for the Northeast region, as it has the highest rate of illiteracy and people with lower levels of education, relatively.

Thus, to be able to estimate the labor income differentials through a mincerian income equation, we seek to analyze the wages/hours paid by employment in the formal sector of civil construction in the Northeast. The use of Microdata from RAIS, from the Secretariat of Social Security for Employment, from the Ministry of Economy of Brazil was used.

Formal jobs are those that have social protection through the current Brazilian Labor Legislation - Consolidation of Labor Laws - CLT and current regulations. They are formal; all those employed who are under the protection of the country's labor legislation.

2.2. Empirical models

It is assumed here that, given the existence of workers' formal ties, any type of bias is greatly reduced, given that these are, in theory, the positively selected in the Brazilian labor market. That is, they are those who actively seek a form of placement in the formal job market, among those seeking placement in the market. Being formally employed already gives them characteristics that differentiate them from other employed people in the labor market. With this,

the observable characteristics can be exclusive to differentiate the earnings of work among this group that are already selected when entering the job.

To estimate the effects of demographic and socioeconomic variables on the earnings of formal civil construction workers in the Northeast, in 2009 and 2019, two different points in the time, mincerian earnings equations will be estimated using Ordinary Least Squares (OLS), as well as Regression Quantile. According to Gujarati & Porter (2011), multiple linear regressions are given by equation (1).

$$Y_i = \beta_0 + \sum_{j=1}^{k} \beta_j X_{i,j} + u_i \quad (1)$$

According to Salvato & Silva (2008), the MQO method is traditionally applied to ascertain the return on education, as well as other factors, on wages. However, as demographic and socioeconomic characteristics may not influence workers' earnings in an identical way, the equations are estimated in different quantiles. This method, which is also robust to the presence of outliers, was proposed by Koenker & Bassett (1978). In equation (2), the quantile regression is presented.

$$Q_\tau(Y_i|X) = X\beta_\tau, \tau \in (0,1) \quad (2)$$

In this study, therefore, these two methods will be applied to estimate Mincer's (1974) equations for the logarithm of earnings per hour worked as a function of the demographic and socioeconomic characteristics of those employed in civil construction in the Northeast, according to regression (3). They were estimated in the first decile, median and ninetieth percentile (10; 50; 90).

$$ln\, Y_i = \beta_0 + \sum_{j=1}^{k} \beta_j X_{i,j} + u_i \quad (3)$$

Where Y_i is the individual's income i and $X_{i,k}$ captures the individual's k demographic and socioeconomic variables i. It should be noted that all of them come from the RAIS for the cross-sections of 2009 and 2019.

3. Income inequality between men and women: A review of the empirical literature

Brazilian women face opportunities for insertion and permanence in the labor market that are different from those experienced by men, and these differences are revealed through the opposite forms of access to jobs and levels of remuneration (Baptista, 2000).

Aiming to understand and demonstrate the existence of income differentials by gender, considering marital status and types of employment in the labor market, Baptista (2000) carried out the decomposition of income differentials according to the method of Oaxaca (1973). Based on the aforementioned model, the author highlights the disparate relationship with regard to salary, regardless of the worker's marital status, where the average income of men is higher than that of women, both among married workers (33.72%), as among employed singles (4.87%), although women have better productive attributes than men, such as experience and education.

According to Abramo (2006), women's earnings are systematically lower than men's, even when comparing similar levels of education. Per hour worked, in 2006, as reported by the author, women received about 79% of the average remuneration of men – that is, 21% less – and black workers of both genders received on average half (50%) of what all white workers of both genders received.

Carvalho *et. al* (2006) estimated the wage equation of Mincer (1974) with bias correction of the selection of wage information from Heckman (1979) to verify the disparity of wages when considering race/color, gender, the productive attributes of each worker and their place of residence, in relation to the white man. The results of the authors' study highlighted the pre-eminence of white men, because in addition to women earning less when compared to them, regardless of race/color, black or brown men also obtain a considerable wage disadvantage. Thus, although women have a higher level of education than men, regardless of race/color, their salary is still lower than that of white men (R$657 versus R$1,010) on average in that analyzed year. This strand of study is also similar when considering the worker's place of residence, as Carvalho *et.al.* (2006) show that for those who live in urban areas, the wage ratio is disproportionately compared to those living in rural areas, with these wage returns being comparatively lower than those living in urban areas.

Menezes (2013), in his work on income differentials among Brazilian workers by quantiles of occupational categories, sought to explain how issues related to wage discrepancy between men and women, whites and non-whites, and residents of more and less developed regions work. The author used mincerian equations in quantile regressions, which make it possible to verify the impact of the explanatory variables on each quantile of the earnings distribution, making it possible to identify and measure the difference between the earnings of the mentioned categories, resulting from distinctions between characteristics – experience and education –, and how much of this is the result of discrepancy in remuneration for these characteristics, which can be understood as a discriminatory action on the part of the labor market.

As a conclusion of his study, Menezes (2013) points out that wage differentials between men and women occur through remuneration, considering the characteristics of the individual, who, despite being similar or equally, are remunerated in different ways. Regarding white and non-white workers and residents of more and less developed regions, it is clear that income differentials are the result of different characteristics of workers, unlike what occurs in terms of gender, characteristics such as years study and experience mean that non-white workers or residents of less developed regions earn lower incomes.

In this sense, with the aim of demonstrating the negative relationship of wages between genders, Aguiar & Vaz (2016) used the Oaxaca-Blinder decomposition method, performing a descriptive analysis of personal and productive characteristics and access to occupations and line of work. Economic activity, and found that although women earn less, they are, on average, more educated than men. In the presented model, it was possible to observe that, controlling the variables that influence the determination of earnings; women receive, on average, earnings around 28% less than men.

In this way, education is seen as a decisive socioeconomic factor in wage determination, a variable capable of determining, in addition to the

individual's remuneration level, the margin of wage differentiation, through which the segregated behavior of the labor market can be observed, a since studies such as that by Aguiar & Vaz (2016) demonstrate that there is an intensification of discrimination between the genders by means of income, which manifests itself in the unequal predilection of observable characteristics between men and women,

4. Results and discussions

4.1. Employees in civil construction in the states of the Brazilian Northeast

With the growth of the Brazilian labor market, some regions become centers of great economic activities. Cavalcante *et al.* (2010) report, using data from the Institute of Research and Economic Statistics of Ceará - IPECE, that the Northeast in 2009 already occupied second place in the number of formal jobs, with a participation of 18.01% of total formal jobs of the country, registering one of the greatest relative advances of the period. The civil construction sector, in that year, held a share of 5.17% of the composition of total formal jobs in the Northeast region, according to the authors.

The increase in the level of formal employment and income in the country was mainly allowed by public policies of structural development, seeking to reduce the existing regional inequalities in the country, mainly in the Brazilian Northeast (Gumiero, 2017). As a result, the northeastern region becomes the target of the largest industrial centers and becomes attractive to a greater demand from companies.

From the map in Figure 2, a considerable concentration of formal work in civil construction can be seen during the years analyzed, because according to Gumiero (2017), regional development was driven by the formulation of the National Policy for Regional Development (PNDR) combined with income redistribution programs, social inclusion, and economic growth in the period between 2003 and 2014. The Northeast was the scene of major civil construction works, such as the transposition of the São Francisco River and the construction of the Transnordestina Railroad, in addition to related to housing programs.

In this perspective, the map in Figure 2 presents the distribution of formally employed in civil construction considering RAIS data for the states of the Brazilian Northeast in the periods of 2009 and 2019. Sector in the east of the state of Bahia, followed by the east region of the state of Pernambuco and north of Ceará. This dynamic of labor distribution in the civil construction sector corroborates the recent study carried out by Batista & Fernandes (2021), which points to Bahia, Pernambuco and Ceará as the three states that presented the highest volumes in terms of hiring personnel in the sector, in the period between 2003 and 2010.

Conversely, there are states that did not obtain a significant number when compared to those highlighted, such as the states of Sergipe, Alagoas, and Rio Grande do Norte, which were also pointed out by Batista & Fernandes (2021) as the states that had the lowest hiring balances in the region, with results well below the hiring leaders.

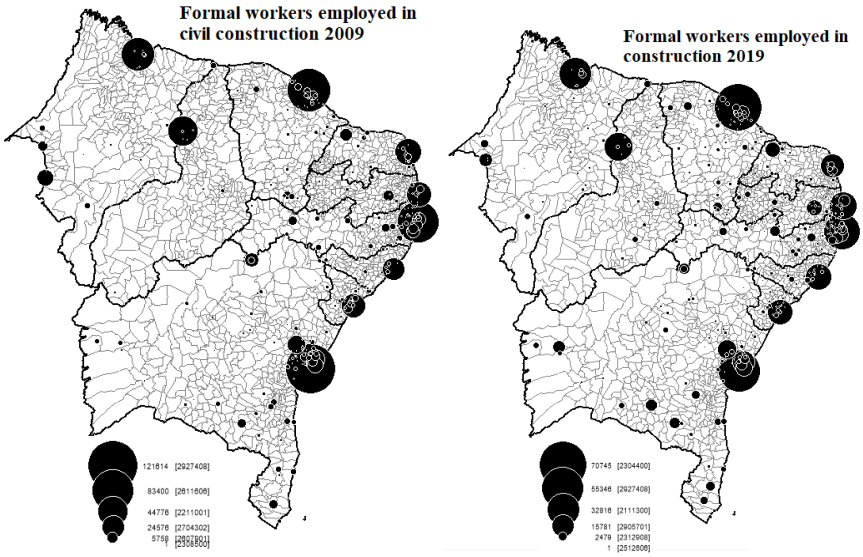

Figure 2. *Municipal distribution of formally employed persons in the northeastern states – 2009/2019*
Source: author's elaboration based on RAIS-ME Microdata

The civil construction sector suffers a significant decline from the year 2014 onwards due to the onset of the economic crisis in the country, according to analyzes by the National Confederation of Industry (2019). However, the sector is once again gaining prominence through public policies to increase the national GDP, such as Minha Casa, Minha Vida, which stood out as a popular housing model in the period, being replaced by the Casa Verde Amarela program, which had the same focus.

Therefore, for the year 2019, Figure 2 shows a considerable reduction in formal employment in the civil construction sector in general terms. There is, however, a notable reversal of roles between the states of Bahia and Ceará, where the latter is visibly the one with the highest concentration of labor employed in the sector in that year. Regarding the other states in the northeastern region, the positions practically remained the same, with emphasis on a slight increase in the formally employed in the state of Paraíba.

Thus, according to Araújo (2021), for civil construction to be able to reach high contributory levels in the generation of formal employment in the country, as currently seen, a stimulus was needed through the implementation of new industrial investments, as well as the implementation of important economic and social infrastructure projects, and the dynamism of real estate activity in the cities of the region, through the development policies of the country and its respective regions.

4.2. Characterization of the formally employed in other sectors and in civil construction in the Brazilian Northeast – 2009/2019.

It is argued that the civil construction industry is defined as an economic sector of strategic importance due to its size and direct impact on the Brazilian economy and national productive structure (Teixeira & Carvalho, 2005).

In view of this, the data displayed in Table 1 expose the different female and male participation and insertions in the labor market in the Northeast region, given the civil construction sector and other sectors, as well as the length of stay in the job, the level of education of workers and company size. Regarding

the participation of women in the Northeastern labor market, it is noted that they are not very representative in the civil construction sector in the two years analyzed, regardless of race/color.

Table 1. *Characterization of formally employed in other sectors and in civil construction in Northeast Brazil – 2009/2019.*

Variables	2009		2019	
	Other Sectors	Construction	Other Sectors	Construction
Age	33.17	35.23	35.57	37.53
White man	19.3	19.0	12.9	12.6
White woman	12.7	1.6	10.1	1.5
Yellow man	0.6	1.5	0.5	0.7
Yellow woman	0.4	0.1	0.4	0.1
Black man	4.1	7.5	3.9	6.2
Black woman	1.5	0.3	2.0	0.3
Brown man	40.4	66.7	42.4	72.8
Brown woman	21.2	3.3	27.8	5.8
Disabled person	0.8	0.4	1.2	1.2
Industry opting for the simple national	27.1	8.4	29.1	15.8
Microestablishment	34.0	25.3	34.6	31.4
Small size	23.0	26.4	23.5	29.6
Midsize	18.4	30.4	18.5	24.2
Large	24.6	17.9	23.4	14.8
Up to 1 year busy	46.3	75.4	32.7	54.4
More than 1 to 2 years busy	17.2	13.1	16.6	18.2
More than 2 to 3 years busy	9.6	4.2	10.4	8.3
More than 3 to 5 years busy	10.6	3.6	13.2	8.3
More than 5 to 10 years busy	9.6	2.4	16.9	8.1
More than 10 years busy	6.7	1.2	10.1	2.8
Uneducated and incomplete primary education	20.9	46.4	10.4	27.1
Complete primary education and incomplete secondary education	20.1	25.3	12.5	21.5
Complete high school and incomplete higher education	50.6	25.6	62.8	47.2
complete higher education	8.1	2.7	13.7	4.1
Master's degree	0.2	0.0	0.5	0.0
Doctorate degree	0.1	0.0	0.1	0.0
Income from formal work	1,801.13	1,992.05	2,031.67	2,057.94

Source: preparation of auotres from RAIS-ME Microdata
Note: labor income figure are in 2019 reais.

In civil construction, the largest female participation is represented by brown women in 2009 (3.3%) and in 2019 (5.7%). This relationship, in accordance with the national determinants of formal insertion according to IPEA (2021), due to the portrayal of gender and racial inequalities in the country, shows that women are mostly inserted in other sectors, such as services, due to the ease of hiring in "genuinely" female branches (domestic cleaning, for example). According to IPEA (2021), women are included in the civil construction sector with about 1% less formalization, on the national average.

Regarding the male workforce, it is worth noting the high participation in all sectors of the labor market, but especially in the civil construction sector. It is observed that in 2009, brown men had a very high participation rate in the civil construction sector with 66.7%, and other services the rate was

concentrated at 40.4%. In 2019, the number in the civil construction sector grows to 72.8%, and in other sectors, to 42.4%. In agreement with studies by Cacciamali & Hirata (2005), this fact can be associated with the question that male labor easily fits into occupations that are considered "genuinely" masculine, and that do not require a high level of education. In the case of civil construction, the largest male hiring is centered on the construction site, in occupations that require greater physical effort, such as bricklayers and servants.

Sebben *et al.* (2007) characterize the turnover rate in the civil construction sector nationwide in 2007 as expressive; the authors mention that, according to the Ministry of Labor, the average permanence of workers at the construction site is only 9.75 months. In this perspective, a factor that draws attention due to its high results in Table 1 shown below is the length of stay in the job that presents the labor market as a whole in the Brazilian Northeast, in particular the civil construction sector, regardless of the year analyzed. In 2009, in the civil construction sector alone, 75.4% of those employed remained in the job for less than a year 54.4% compared to other sectors.

Regarding average remuneration, salaries in the civil construction sector have a higher level when compared to other sectors – R$ 1,992.05 in 2009 and R$ 2,057.94 in 2019. Despite some research (Dieese, 2011; Barros, 2014) show that the sector has a significant wage devaluation due to the high outsourcing that the sector holds, precisely as a means of cutting costs and speeding up works, the results did not converge to the Northeast. In contrast, for the Brazilian Northeast, IPECE (2012) highlights the years 2007-2010 with real wage gains that were attributed to civil construction, with a high rate of 20.24%, and relate this increase to the heating of the segment with the large absorption of labor from the period onwards.

4.3. Socioeconomic and demographic determinants of labor income inequality between men and women: Ordinary Least Squares (OLS) results

From the Ordinary Least Squares (OLS) estimation, presented in Table 2, it is observed that all coefficients of demographic and socioeconomic variables were statistically significant at 1% to explain the natural logarithm of income per hour of work, considering workers of civil construction in the Northeast in the years 2009 and 2019.

Table 2. *Estimates of income differentials from formal work in civil construction in the Northeast according to socioeconomic and demographic characteristics – 2009/2019*

Variables	*Dependent variable:* ln_rendatrab	
	2009	2019
Commuting migrant	-0.040 *** (0.001)	0.017 *** (0.002)
Male	0.185 *** (0.003)	0.262 *** (0.002)
Age	0.024 *** (0.0003)	0.045 *** (0.0003)
Age²	-0.0002 *** (0.00000)	-0.0004 *** (0.00000)
Disabled worker	-0.162 *** (0.009)	-0.149 *** (0.005)
Company opting for Simple	-0.111 *** (0.002)	-0.067 *** (0.002)
Small	0.057 *** (0.002)	0.075 *** (0.001)
Medium	0.174 *** (0.002)	0.216 *** (0.001)
Great	0.407 *** (0.002)	0.334 *** (0.002)
More than 1 year to 2 years	0.025 *** (0.002)	-0.008 *** (0.001)
More than 2 years to 3 years	0.023 *** (0.003)	0.033 *** (0.002)
More than 3 years to 5 years	0.033 *** (0.003)	0.081 *** (0.002)
More than 5 years to 10 years	0.100 *** (0.004)	0.138 *** (0.002)
More than 10 years	0.274 *** (0.005)	0.296 *** (0.003)
Complete primary education and incomplete secondary education	0.096 *** (0.001)	0.051 *** (0.002)
Complete high school and incomplete higher education	0.303 *** (0.001)	0.174 *** (0.001)
Complete higher education	1,361 *** (0.004)	0.928 *** (0.003)
Master's degree	0.770 *** (0.036)	0.899 *** (0.029)
Doctorate degree	1,406 *** (0.056)	0.834 *** (0.066)
Constant	6,259 *** (0.007)	5,924 *** (0.006)
Comments	803,364	647,932
AdjustedR ²	0.285	0.297
F Statistic	16,858,000 *** (df = 19; 803344)	14,425,140 *** (df = 19; 647912)

Note: *p<0.1; ** p<0.05; *** p<0.01. Robust standard errors.
Source: author's elaboration based on RAIS-ME Microdata

In the two selected years, there is a positive effect on labor income when the individual is male. Specifically, holding everything else constant, in 2009 male workers earn approximately 20.32% more, and in 2019 this figure increases to approximately 29.95%. This inference points, therefore, to inequality in terms of gender in income earned in civil construction.

Thus, even in the face of social movements and efforts to reduce gender discrimination in the labor market, women still earn lower incomes. This inequality, in fact, is accentuated in the civil construction sector, given the tradition of being a segment predominantly occupied by men. The study by Amaro, Silva Filho & Santos (2016), analyzing an overview of women's participation in formal employment in civil construction, concluded that the largest number of formal occupations by women in this sector is situated in the range of one to two minimum wages, that is, they earn lower incomes, have higher turnover rates and a small workforce share in absolute terms.

This wage inequality, in several sectors, is a persistent problem in the Brazilian labor market, being reported in the national literature in several studies, such as, for example, Ferraz & Oliveira (2015), Amaro *et al.* (2016) and Jorge (2021). Moreover, it is important to emphasize that, even in the context of greater female insertion in the formal labor market in civil construction, the biggest problem lies in the inequality of earned income.

Age also has a positive effect on earnings from work, and the effect is greater in 2019 compared to 2009. In this regard, everything else constant, one year more age for a civil construction worker increases their income from work in approximately 2.43% in 2009 and 4.6% in 2019. This increase can be attributed to experience that increases with an individual's age and practice. In this sense, it is convenient to point out that the civil construction profile shows that workers in this sector, on average, are older. This pattern present in the Northeast is corroborated by the literature (Cantisian, & Castelo, 2015; Dal Bello, 2015; Dieese, 2020).

In general terms, this positive effect of age on earned income, whether in total or sectoral formal employment, is expected in the scientific literature, and is empirically found by Gledson e Silva, & Fernandes e Silva Filho (2020). Furthermore, a decreasing marginal effect of age on labor income is observed, that is, income increases with age, and however, it reaches a maximum point and tends to decrease.

Furthermore, the importance of the size of the company in the practice of wages is observed. With this, it is observed that for workers allocated in the Company opting for Simples Nacional (Company Opting for Simples[2]) there is also a negative effect on the income obtained in the civil construction market in the Northeast in 2009 and 2019. The data, therefore, reveal everything more constant than, in 2009, for the worker of the company opting for Simples Nacional, the income is approximately 11.63% lower, whereas, in 2019, this figure is approximately 7.25% lower.

Regarding the size of the company, it appears that workers concentrated in large establishments are able to earn greater gains in labor income in both years, with approximately 50.68%, in 2009, and 39.10% in 2019, comparatively to the earnings from microenterprises. It is worth noting that workers allocated to microenterprises obtained lower earnings, regardless of the size of the company.

Regarding the turnover of workers in companies, it is noted that the longer the employee stays in employment, the greater the earnings from work. When comparing workers in the reference category (employed in the period from less than 1 year to 1 year) with those with a longer tenure (more than 10 years),

[2]Tax simplification program for companies that meet the requirements of Complementary Law No. 123, of December 14, 2006.

it is clearly seen that for the individual who remains for more than ten years, earnings make about 31% and 34.99% in 2009 and 2019 respectively.

Short tenure in civil construction is a common phenomenon, given the particularities of this sector, which usually include temporary contracts. In other words, as the works and other construction segments have a fixed period for completion, it is common for a contraction of workers to occur in each period and subsequent dismissal, translating this rotational movement. The Dieese (2020) study corroborates these inferences.

About the level of education, in Table 2, it can be seen that as the level of formal education grows, in the year 2009, the income earned by individuals increases, whereas when looking at the year 2019, this statement it is not entirely true. In 2009, a worker with a doctorate degree was able to earn approximately 307.96% more than those who did not have any education or even with incomplete primary education (reference category). In 2019, it is observed that this picture of 2009 does not remain, when it is inferred that everything else constant, graduates with doctorates have reduced earnings, reaching about only 130.25%. This demonstrates that wage returns to education in this sector exist, but they are reduced between the years compared, shortening the existing *gap*.

The scientific literature is almost unanimous about the return to education in terms of earnings, in which more years of schooling provide higher wages. On the other hand, it is known that in civil construction a large part of the work is done manually, which includes a contingent of semi-qualified people in terms of years of schooling. In this regard, data from Dieese (2020) show that, in 2019, 47.3% of construction workers had completed high school. Furthermore, the civil construction sector ends up not absorbing a large contingent of professionals with master's and doctoral degrees, given that professionals with such levels of training enter, more frequently, higher education institutions dedicated to training professionals in this sector, as well as in research institutions.

4.4. Socioeconomic and demographic determinants of labor income inequality between men and women: results from the conditional distribution of income from formal work in civil construction.

In turn, Table 3 presents the estimated coefficients of the models through quantile regressions. It is noteworthy that the application of this method allows analyzing the influence of demographic and socioeconomic variables among workers with lower and higher incomes between quantiles, observing whether they are affected in the same way.

Table 3. *Coefficients of estimates by quantile regressions of differentials in earnings from formal work among those employed in civil construction in the Northeast – 2009/2019*

Variables	*Dependent variable:* ln_rendahoratrab					
	1st decile 2009	1st decile 2019	Median - 2009	Median - 2019	2009 Percentile Figure	2019 Percentile Figure
White woman	-0.041 *** (0.002)	-0.181 *** (0.014)	-0.141 *** (0.004)	-0.154 *** (0.006)	-0.182 *** (0.013)	-0.125 *** (0.010)
Black man	-0.004 *** (0.001)	0.019 *** (0.002)	0.012 *** (0.002)	0.033 *** (0.003)	-0.033 *** (0.006)	0.036 *** (0.005)
Black woman	-0.046 *** (0.002)	-0.543 *** (0.002)	-0.153 *** (0.009)	-0.249 *** (0.010)	-0.237 *** (0.022)	-0.180 *** (0.020)
Brown man	-0.007 *** (0.001)	0.010 *** (0.001)	0.002 * (0.001)	0.005 *** (0.001)	-0.041 *** (0.004)	-0.015 *** (0.003)
Brown woman	-0.070 *** (0.001)	-0.304 *** (0.011)	-0.171 *** (0.003)	-0.257 *** (0.003)	-0.232 *** (0.009)	-0.201 *** (0.006)
Commuting migrant	-0.008 *** (0,000)	0.011 *** (0.001)	-0.037 *** (0.001)	0.014 *** (0.002)	-0.100 *** (0.003)	0.011 *** (0.004)
Age	0.005 *** (0,000)	0.030 *** (0,000)	0.024 *** (0,000)	0.040 *** (0,000)	0.033 *** (0.001)	0.048 *** (0.001)
Age²	-0,000 *** (0.00000)	-0,000 *** (0,000)	-0,000 *** (0,000)	-0,000 *** (0,000)	-0,000 *** (0,000)	-0,000 *** (0,000)
Disabled person	-0.037 *** (0.0005)	-0.095 *** (0.006)	-0.141 *** (0.004)	-0.147 *** (0.006)	-0.197 *** (0.022)	-0.144 *** (0.007)
Company opting for the simple	-0.011 *** (0.001)	-0.018 *** (0.001)	-0.066 *** (0.001)	-0.050 *** (0.001)	-0.193 *** (0.004)	-0.119 *** (0.003)
Small	0.023 *** (0.0005)	0.024 *** (0.001)	0.052 *** (0.001)	0.063 *** (0.001)	0.084 *** (0.003)	0.124 *** (0.003)
Medium	0.044 *** (0.001)	0.079 *** (0.001)	0.150 *** (0.001)	0.210 *** (0.002)	0.268 *** (0.003)	0.327 *** (0.003)
Great	0.109 *** (0.001)	0.159 *** (0.002)	0.364 *** (0.002)	0.354 *** (0.002)	0.728 *** (0.005)	0.474 *** (0.004)
More than 1 to 2 years	0.014 *** (0.001)	-0.016 *** (0.001)	0.027 *** (0.002)	0.0002 (0.001)	0.028 *** (0.004)	-0.001 (0.003)
More than 2 to 3 years	0.033 *** (0.001)	0.023 *** (0.002)	0.039 *** (0.003)	0.031 *** (0.002)	0.009 (0.006)	0.041 *** (0.004)
More than 3 to 5 years	0.044 *** (0.002)	0.044 *** (0.002)	0.062 *** (0.003)	0.077 *** (0.002)	0.021 *** (0.007)	0.085 *** (0.004)
More than 5 to 10 years	0.065 *** (0.003)	0.056 *** (0.002)	0.121 *** (0.004)	0.115 *** (0.002)	0.107 *** (0.008)	0.192 *** (0.005)
More than 10 years	0.140 *** (0.006)	0.143 *** (0.006)	0.263 *** (0.007)	0.248 *** (0.005)	0.388 *** (0.013)	0.435 *** (0.009)
Complete primary education and incomplete secondary education	0.013 *** (0.0005)	0.008 *** (0.001)	0.068 *** (0.001)	0.045 *** (0.001)	0.183 *** (0.003)	0.088 *** (0.003)
Complete high school and incomplete higher education	0.049 *** (0.001)	0.042 *** (0.001)	0.240 *** (0.001)	0.142 *** (0.001)	0.561 *** (0.004)	0.277 *** (0.003)
Complete higher education	0.596 *** (0.008)	0.426 *** (0.003)	1,500 *** (0.007)	0.857 *** (0.006)	1,789 *** (0.010)	1,359 *** (0.007)
Master's degree	0.055 *** (0.008)	0.139 (0.101)	0.427 *** (0.111)	0.844 *** (0.094)	1,705 *** (0.076)	1,405 *** (0.071)
Doctorate degree	0.462 ** (0.207)	0.127 *** (0.034)	1,444 *** (0.015)	0.902 *** (0.068)	2,093 ** (0.833)	1,412 *** (0.048)
Constant	6,660 *** (0.003)	6,290 *** (0.008)	6,397 *** (0.004)	6,286 *** (0.006)	6,663 *** (0.015)	6,441 *** (0.012)
Comments	803,364	647,932	803,364	647,932	803,364	647,932

Note 1: *p<0.1; ** p<0.05; *** p<0.01.
Note 2: ln_rendahoratrab = natural log of income per hour of work
Source: elaboration by the authors based on RAIS-ME Microdata

In this way, the examination of the Table shows that there is a salary difference between the categories and the reference category in each attribute along the income distribution. When examining individuals' gender and race/color, the higher the income quantiles, the greater the income inequalities between these categories. Particularly, it appears that white men (reference category) can earn the highest gains on average in both years, with the exception of the first decile (2019) and median for the two years studied for black and brown men. With this, there is a considerable degree of discrimination when analyzing gender and race/color.

Regarding income inequality according to gender, it reiterates the reasons given for the previous model. In this sense, it should be noted that even women obtaining lower incomes in the formal labor market, they often have higher levels of professional qualification. The study by Aguiar & Vaz (2016) found that, although women receive lower incomes than men, on average, they have a higher level of education.

About age, it is observed that earnings increase with age in all quantiles analyzed regardless of the year. Furthermore, there is a decreasing marginal effect of age on labor income in civil construction, given the negative sign of the age² variable in all quantiles presented. Thus, the results for the effect of age on income are in line with the inferences obtained for the model with OLS, confirming that experience, given the profile, in terms of age, acquired throughout one's professional life tends to provide an increase in income from work, until reaching the limit.

Taking into account the workers allocated in the companies that opted for the national simple, it is noticed that they had lower average earnings than the other categories of industries, with about 21.29% less in 2009 and 12.64% in 2019. From this perspective, when observing the size of the company, we can verify that the larger the size, the greater the average earnings acquired, since large companies hold considerable percentages indifferent to the year analyzed, compared to micro-establishments, with approximately 107.09% in 2009 and 60.64% in 2019 at the 0.90th percentile.

In relation to the worker's permanence time at work, it appears that the longer the person employed at work, the greater their average earnings acquired, given that workers who have been employed at the company for more than 10 years, have higher returns compared to those who do not settle for more than one year employed, reaching around 47.40% and 54.50% at the 0.90^{th} percentile, in 2009 and 2019, respectively. Thus, the problem of the short time spent in employment in the civil construction sector is reiterated. In the perspective of Silva (2019), due to its intensive labor force in short periods, the civil construction sector is more penalized by the high turnover rates in the country.

About the worker's level of education, he observes that the higher the level of education, the higher the average earnings captured by the employee, since workers with a doctoral degree have a relatively high percentage of average earnings, earning around 209% and 141% in 0.90^{th} percentile of 2009 and 2019, respectively, in relation to workers who do not have some level of education.

Thus, as already highlighted, most civil construction workers have a low level of education; however, those with more years of study that are acquitted by the market earn higher incomes. According to Ferraz, Oliveira and Assumpção (2015), this fact occurs considering that professionals with a higher degree of quality become strategic resources for companies. This aspect is of

great importance in civil construction, as this sector has experienced technological changes and increasingly requires workers with such a profile.

5. Final considerations

The female insertion in the formal labor market has been a widely discussed topic in recent years. In the case of the civil construction sector, this discussion is especially relevant, considering that it is a sector mostly occupied by male labor. Despite the increase in women's participation in the formal civil construction labor market in recent years, studies have highlighted large wage differentials in terms of wage inequalities, in which, even with more years of schooling, women receive lower wages in relation to men.

Along the same lines, the empirical evidence found in this study for the Northeast indicated the presence of wage inequality, especially between men and women, thus showing segregation in this labor market.

The results of the estimates show that there is income inequality between men and women, with men earning higher wages in civil construction, as well as wage inequality by race/color persists, with white men earning higher. Another inference supports that income from construction work tends to increase with age and education, evidencing the assumptions of the Human Capital Theory. Furthermore, the length of stay and the size of civil construction companies positively affect the income of workers in this sector, and the longer the length of stay, as well as the size of the employing establishment, the greater the wage returns of those employed.

Thus, the need for greater public and private actions is highlighted in order to reduce such persistent wage inequalities, as well as other discriminatory problems that affect the formal labor market in civil construction in the Brazilian Northeast. Such actions are essential, given the positive repercussions of civil construction for the economy, being a key sector for the generation of local income and economic growth, especially for the part of the workforce with less education, in proportional terms to the total employed population. The better distribution of income from work between genders and the race/color of those employed in this sector ends up promoting a policy of more equal distribution of income from work in the Northeast region of the country. This ends up causing greater spillovers, given that this is one of the poorest regions in Brazil.

Finally, based on the theme discussed, it is suggested that further research be carried out with a view to better understanding the determinants of the earnings of civil construction workers in the Northeast. In this sense, it is suggested the inclusion of other periods of analysis that can capture smaller intervals directly relating to the Brazilian economic situation. Moreover, regarding the issue of wage inequality, analyzes with models that can capture causal inference between the income differentials between men and women in the construction sector for the Northeast are relevant and suggestive.

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