Relationship of rural work with gender and education level

Relação do trabalho rural com gênero e nível de escolaridade

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ABSTRACT
The research analyzes the relationship between rural work gender and education level based on microdata from the Brazilian Federal Government's General Register of Employed and Unemployed. Using data from employment in the states of Ceará and São Paulo as a case study, the descriptive analysis from the demand curve confirms that male workers have higher average salary level than female workers, in rural areas and also in urban areas, regardless of schooling. The research used the calculation of the price elasticity of demand coefficient to capture the behavior of employment in response to wage variations and showed that for illiterate workers job is more stable in Ceará regardless of gender. On the other hand, for São Paulo illiterate workers have less job stability. For workers with incomplete elementary education, the demand for men and women is inelastic for both Ceará and São Paulo. The cross-elasticity coefficients showed that the higher the level of education, the lower the possibility of discrimination as both gender are considered substitute factors of production.

Keywords: rural work, schooling level, gender.

RESUMO
A pesquisa analisa a relação entre gênero e nível de escolaridade no trabalho rural a partir de microdados do Cadastro Geral de Empregados e Desempregados do Governo Federal do Brasil. Utilizando como

estudo de caso os dados do emprego dos estados do Ceará e São Paulo, a análise descritiva da curva de demanda confirma que os trabalhadores do sexo masculino possuem nível salarial médio superior ao do feminino, tanto na zona rural como na zona urbana, independentemente da escolaridade. A pesquisa utilizou o cálculo do coeficiente de elasticidade-preço da demanda para captar o comportamento do emprego em resposta às variações salariais e mostrou que para os analfabetos o emprego é mais estável no Ceará, independentemente do gênero. Por outro lado, em São Paulo, os trabalhadores analfabetos têm menos estabilidade no emprego. Para trabalhadores com ensino fundamental incompleto, a demanda por trabalhadores independente do gênero é inelástica tanto no Ceará quanto em São Paulo. Os coeficientes de elasticidade cruzada mostraram que quanto maior o nível de escolaridade, menor a possibilidade de discriminação, pois ambos os gêneros são considerados fatores substitutos de produção nesse caso.

Palavras-chave: trabalho rural, nível de escolaridade, gênero.

1 INTRODUCTION

Wage gap among man and woman workers has been the reason of many studies in Brazil and abroad such as Ames (1995), Cavalieri and Fernandes (1998) and Catho(2018).

Gary Becker (1971), considered the pioneer in the subject of wage gap in the labor market, argued that if men and women have the same level of productivity they should be treated as perfect substitutes, which in practice does not occur in Brazil and in the world. He attributed this fact to the existence of prior preferences and proposed a model of discrimination.

According to Joshi and Paci (2001), there is discrimination in the labor market whenever workers with identical productive characteristics receive different wages. The educational level is considered an important determinant to signal the productivity of a worker and for this reason education relates to gender wage gap was the basis of the recent study of Abdulloev et al (2019) and other previous researches concerning labor markets in developing countries in general such as Behhrman (1999) and Verich (2014), who considered female labor force participation in developing countries.

With regard to the decision to hire labor in the labor market and the gender pay gap, Sachsida and Loureiro (2012) investigated and confirmed the existence of discrimination in the labor market in Brazil. According to Barros et al (2001), the differences of preference for either gender are due to the different opportunity costs for each gender, which means that the female and male workforces are seen by the firms as two different factors of production and so not as substitute factors.

Concerning rural areas Bokemeier and Tickamyer (1985), Davis et al. (2005), Heredia e Cintrão (2006) and Castilho e Silva e Schneider (2010), focused on labor gender gap and market rural conditions. More recently Ferreira et al. (2019) studied the aging in the rural context with a focus on race, gender, education and social level. Many others focus on specific countries such as Pagan and Sanches, 2000, who approached market decisions in rural Mexico, Pagan, 2002, gender differences in rural Guatemala and Tamaka, 2019, female education and labor force participation in rural Bangladesh.

This study estimates the demand for labor by gender considering different levels of schooling in

rural areas compared to urban areas in the Brazilian states of Ceará and São Paulo based on the microdata of the General Register of Employees and Unemployed-CAGED and is organized as follows: data and descriptive statistics, methodology, main findings and final considerations.

2 DATA AND DESCRIPTIVE STATISTICS

Based on data from the General Register of Employed and Unemployed Workers-CAGED which records data on formal employment, the employment situation by gender in the states of Ceará and São Paulo, from 2007 to 2017, is described by estimating the demand curve for each range analyzed in order to allow a more detailed analysis of the labor market.

The descriptive analysis of the data confirms that the dominant notion that a higher level of education is reflected in the increase in the wage level is confirmed both in the state of Ceará and in São Paulo, both for rural and urban areas, however, for both states the wage/hour varies little with the levels of schooling between illiterate and full high school workers. Wages actually become higher for workers of both gender with incomplete graduation education and still more with for the graduated.

In fact, for Ceará in 2018 the wages/hour for the illiterate workers and workers with full secondary education ranged from R$3.00 to just over R$4.00 per hour, while graduated workers earned between R$9.00 and R$15,00 per hour. For the state of São Paulo, the wages per hour for illiterate workers and workers with full secondary education varied between R$4.00 to a little more than R$6.00 per hour, while graduated workers earned between R$13.00 and R$27.00 per hour.

Figures 1 and 2 show that in 2018, regardless the level of schooling and the work place, female workers earn lower wage/hour than male workers, except workers with incomplete elementary school level, both in Ceará and in São Paulo, as women in the urban area perceived higher wage/hour than men in rural areas.

When comparing the gender wage gap at the two extremes of educational levels, that is, illiterate and graduated, in relation to the variation in wage over the years, it is possible to capture some relations that vary according to the region and the analyzed market.

It can be seen that for rural illiterates, the gender pay gap is relatively low, even reducing over the years, mainly in the state of Ceará. In urban areas, however, the disparities tend to be somewhat larger over time, so that wage variations maintain a certain gender pay gap.

With respect to graduated workers, the distances between regression curves are relatively high in both urban and rural areas compared, meaning higher gender pay gap for higher levels of schooling for the States of Ceará and São Paulo, and this difference is even more intense in the rural areas.

It is possible to perceive that, although women workers with a higher education level receive an average higher remuneration than a low-educated working woman, there is a tendency for higher wage disparities among gender on more specialized jobs that require higher educational level, than on relatively
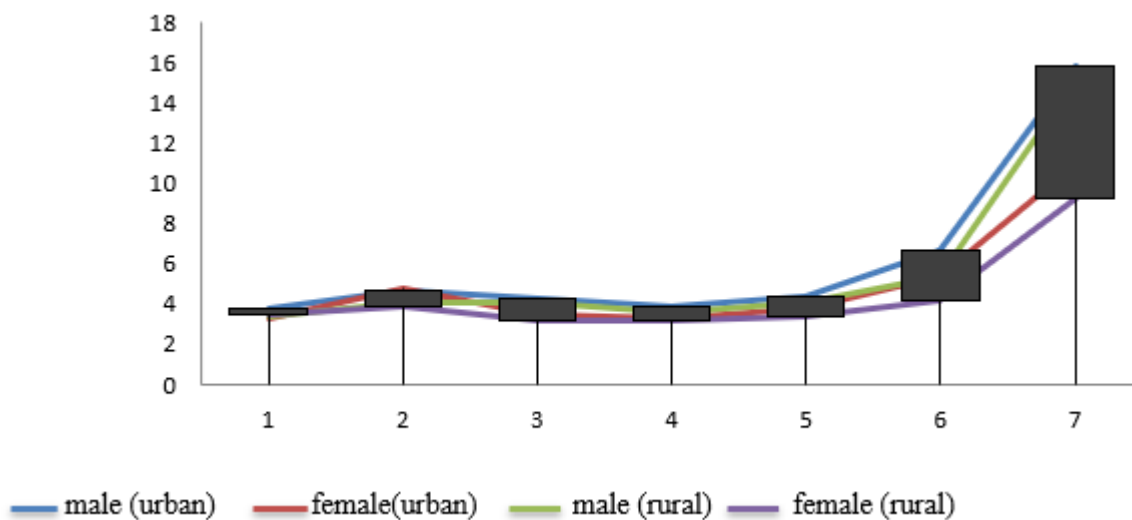
simpler jobs.

There are several possible explanations for this phenomenon. According to Cavalieri and Fernandes (1998), there are arguments that attribute such differences to lower productivity of women at work, or due to the lower labor experience of the female worker, thus representing a lower acquisition of human capital, or preference for positions on less productive jobs.

The reason for this second argument according to the authors is that women in the role of mothers and wives would end up suffering more discontinuity in the labor market or would demand jobs that, although less paid, would allow a greater dedication the family. In this case, women on average would make choices for jobs with less extensive work hours or those where the effort was milder, even implying lower wages.
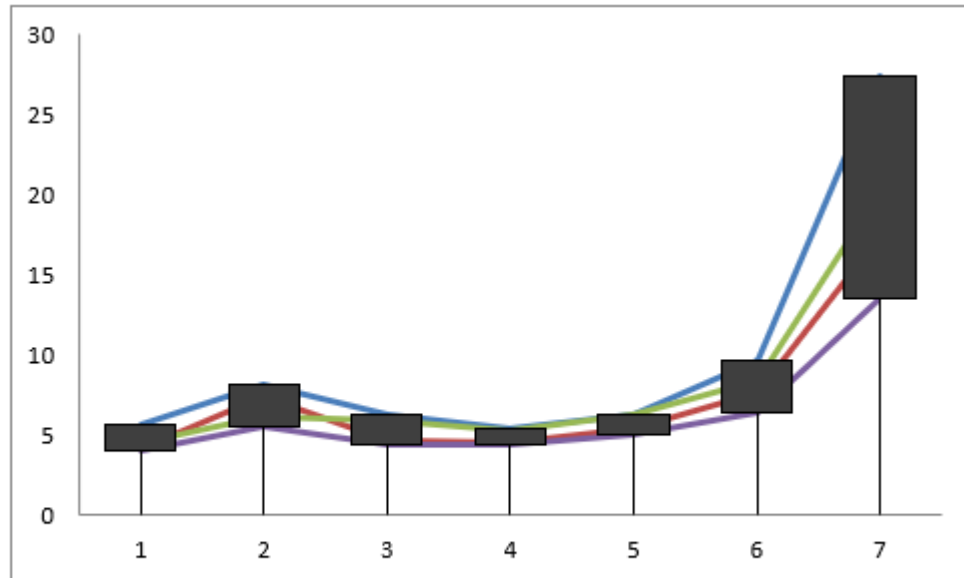
Cavalieri and Fernandes (1998) still emphasize the question of the age-experience relationship, and show that even considering similar patterns of schooling[2], the gender pay gap intensifies with higher ages, a fact that can be attributed to greater family responsibility and experience in the labor market.

Fig.1 Ceará: salary/hour (R$) and education level by gender and area 2017.

—— male (urban)   —— female(urban)   —— male (rural)   —— female (rural)

Source: by authors using CAGED data. Note: the axis of the ordinates corresponds to the monetary value in reals of the wage/hour and the abscissa axis represents the level of schooling being 1 illiterate, 2 with incomplete elementary education, 3 with complete elementary education, 4 with incomplete secondary education, 5 with complete secondary education, 6 undergraduate and 7 graduated.

Fig. 2 São Paulo: Ratio of salary / hour (R $) and level of schooling by gender and area 2017.

Source: by authors using CAGED data. Note: Source: own elaboration from CAGED.
Note: the axis of the ordinates corresponds to the monetary value in reais of the wage / hour and the abscissa axis represents the level of schooling being 1 illiterate, 2 with incomplete elementary education, 3 with complete elementary education, 4 with incomplete secondary education, 5 with complete secondary education, 6 undergraduate and 7 graduated.

Research with a database of 8 thousand individuals, Catho (2018), highlights the trend of wage disparities among individuals with higher education levels. The survey also concludes that men generally hold the best job positions.

In our study, the percentage of wage disparity is attenuated as schooling decreases, but the salary of working men is higher in all levels of schooling as shown in figures 1 and 2 for both Ceará and São Paulo, with rare exceptions and is lower in rural areas no matter the schooling level.

It should be noted that such observed wage differentials do not only occur in the Brazilian labor market, or in other typically unequal economies, since highly developed economies, such as the United States, also present gender pay gaps.

In this sense, Levine (2004) notes "Women with a bachelor's degree employed full-time earned $47,910 in 2003, while similarly educated men earned an average of $ 69,913. Male high school graduates were paid $ 38,331 on average, well above $ 27,956 paid to female high school graduates. Women typically earn less than men of the same age, as well."

During the analyzed period, the average percentage of the female worker wage/hour in relation to the male worker varies according to the educational level and the area where the work is located. In Ceará, illiterate female workers earn, on average, 88% of the male worker wage in urban areas and 93% in rural areas. In São Paulo, illiterate female workers earn, on average, 75% of the salary of the male worker in the urban area and 86% in the rural one. That is, the wage gap between illiterate men and women is lower in the rural areas.

Table 1 shows these percentages and the respective deviations for the two states at all levels of schooling and for both rural and urban areas. Attention is drawn to the fact that at the highest level of schooling, the widest is the wage gap between men and women workers. In fact, in Ceará, graduated female workers earned on average, 66% of the salary of the male worker in the urban area and 60% of a male worker in the rural area. In São Paulo, workers with a higher education level earned, on average, 68% of the salary of the male worker in the urban areas and 63% in rural areas. So, for both states the salary gap between men and women with a higher education level is greater in rural areas.

Table 1: Average percentage of wages/hour of women in relation to men by level of education, 2007-2017.

|		Mean CE	Deviation CE	Mean SP	Deviation SP
illiterate	Urbana	88	5,704862	75,27273	4,473984
	Rural	93,18182	4,628335	85,54545	2,349609
Incomplete middle school	Urban	87,45455	8,499878	77,72727	9,946136
	Rural	87,27273	5,153832	79,36364	5,086037
complete middle school	Urban	83,18182	0,715819	75,63636	2,93173
	Rural	81,72727	1,863082	72,54545	1,558766
incomplete high school	Urban	86,36364	1,149919	80,45455	1,499311
	Rural	88,18182	3,242283	78,54545	1,372697
Complete high school	Urban	86,54545	1,499311	82,18182	2,690663
	Rural	83,54545	2,016461	77,45455	1,671343
undergraduated	Urban	75,63636	2,568081	76,27273	1,958242
	Rural	73,09091	3,604405	72,63636	1,966664
graduated	Urban	66,27273	1,813631	68,27273	1,60062
	Rural	59,63636	3,391774	63,63636	2,057038

Source: elaborated by authors using CAGED data.

Before analyzing the data, some preliminary hypotheses regarding the gender wage gap, by level of schooling and work area if rural or urban were: (a) people with lower educational level, especially the illiterate ones, would present greater salary difference among genders with women earning far less than men; (b) women in rural areas would earn less in relation to men than women in urban areas; and, (c) the salary difference against women, would be much more evident for the state of Ceará than for São Paulo.

Such hypotheses were not fully confirmed in any of these cases. In fact, as already mentioned, the largest differences in wage rates occurred in the highest levels of schooling the graduated, and the lowest differences in the average wage among gender occurred at the lowest level of education the illiterate, which overturns the hypothesis (a).

The hypothesis (b) that women in rural areas would earn less relative to men than women in urban areas, did not prove to be consistent for illiterate women whose salary difference is lower in relation to men in rural areas than the salary difference of urban workers as shown in figure 3.

Figure 3: Percentage of the illiterate female worker's wage/hour (R$) in relation to illiterate male workers by state and area 2007-2017.

illiterate urban   illiterate rural
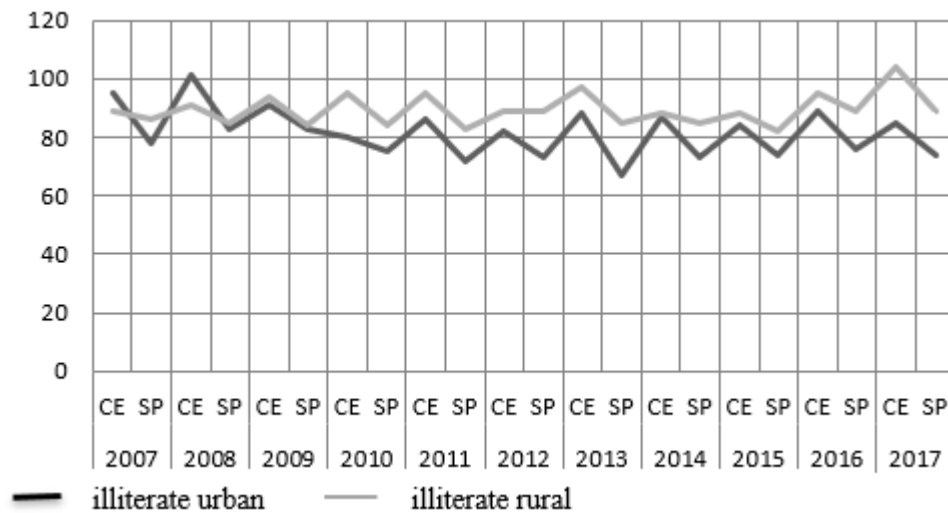
Source: own elaboration from CAGED.

Figure 4: Percentage of the wage / hour (R $) of the female worker with a complete upper level in relation to the male worker with a complete upper level by state and zone 2007 to 2017.

graduated urban   graduated rural
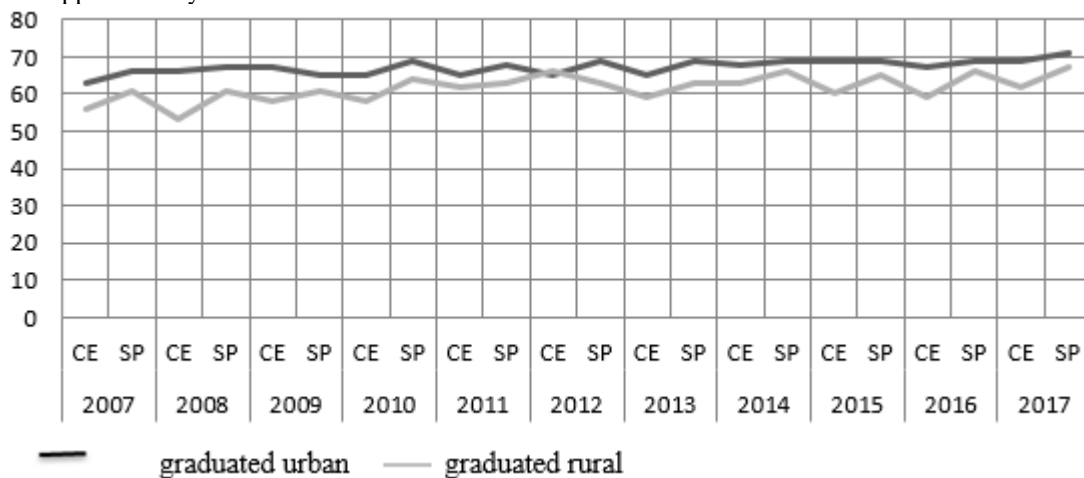
Source: own elaboration from CAGED.

The hypothesis (c), that the difference in wages for women would be much more evident for the state of Ceará than for São Paulo, was also not consistent, since in both urban and rural areas of the state of São Paulo female workers earn on average less in relation to the male workers than workers of the state of Ceará for all levels of education as the percentages shows in figures 3 and 4.

3 METHODOLOGY

The price elasticity of demand coefficient is defined as the ratio between the percentage change in quantity and percentage change in price and can be expressed as the ratio of price to quantity multiplied by the slope of the demand function.

The concept of elasticity can be applied as the variation in the amount of work demanded with the variation of the worker's wage level, in order to observe such behavior for each gender. In this case, when

the price elasticity of demand is greater than 1, it can be said that demand is elastic to wage and if less than unity can be considered inelastic to wage.

The price elasticity of demand for labor can be represented by the following formula, where Qd^i_t is the quantity of labor demanded with characteristic i at time t, while the term "Rem^i_t" represents remuneration of i at time t:

$$Ed^i = \left(\frac{Qd^i_{t-(t-1)}}{Rem^i_{t-(t-1)}}\right)\left(\frac{Rem^i_t}{Qd^i_t}\right)$$

Sachsida and Loureiro (2012), define gender discrimination as a result of the complementarity between two goods. Thus, if male and female labor are complementary goods, then there is gender discrimination in the labor market. If it is confirmed that men and women are competitive and therefore substitutes in the labor market, it is concluded that there is no discrimination.

By definition, the cross-elasticity of demand measures the percentage change in the quantity demanded of a commodity that results from the variation of 1% in the price of another commodity. It is worth emphasizing the definition of complementary good as an increase in the price of one good that causes a reduction in the quantity demanded of the other. On the other hand, two goods are defined as substitutes if an increase in the price of one of them causes an increase in the quantity demanded of the other (Becker, 1971).

Thus, a positive cross-elasticity of demand characterizes substitutes, while a negative cross-elasticity of demand characterizes complementary goods and it is possible to determine this condition in the labor market for male and female workers.

The substitution coefficient proposed here acts as a measure of behavior as it captures the sensitivity of proportional changes in male and female jobs in response to proportional changes in the relative wages of male and female workers.

The cross-elasticity of demand may be taken to be the change in the quantity demanded of female labor Qd^i as a consequence of male wage change Rem^j being i the number of female workers and j the number of male workers employed according to the levels of education from 0 to 6: (illiterate (0), incomplete elementary school (1), complete primary education (2), incomplete secondary education (3), complete secondary education (4), incomplete graduation (5), complete graduation (6).

$$Ec^{i/j} = \left(\frac{Qd^i_{t-(t-1)}}{Rem^j_{t-(t-1)}}\right)\left(\frac{Rem^j_t}{Qd^i_t}\right)$$

4 MAIN FINDINGS

The calculation of price elasticity of demand according to gender, level of schooling and employment location for the states of Ceará and São Paulo was aimed at demonstrating the rate of change in demand for labor as a function of the increase in remuneration evidencing particularities of labor market reactions.

The average price elasticity of demand shown in table 2, varies according to the educational level and is different for each of the states analyzed. In the lower level of education, for the state of Ceará, the average demand for labor is inelastic regardless of gender. This means that, on the average, illiterate and lower paid workers are more necessary since employers are less responsive to wage increases.

For the state of São Paulo, the opposite is true: illiterate workers present an elastic demand by employers, which means that workers of both genders are more easily dismissed when there is an increase in the salary level.

Table 2: Price elasticity coefficient of demand (2007-2017) of workers by gender, level of education, rurl and urban areas for the states of Ceará-CE and São Paulo-SP.

	A		Fi		Fc		Mi		Mc		Si		Sc	
	CE	SP	CE	SP	CE	SP	CE	SP	CE	SP	CE	SP	CE	SP
Hu	0,88	4,93	1,30	3,01	1,06	2,61	0,81	2,34	1,34	0,64	1,27	2,93	1,82	0,19
Mu	1,11	0,40	3,57	6,74	0,67	2,36	0,57	1,29	1,25	0,04	1,20	1,92	5,46	1,03
Hr	0,81	2,05	0,09	0,76	0,91	1,54	1,09	1,61	1,90	2,04	4,03	1,89	4,60	0,52
Mr	0,65	1,98	0,81	0,59	0,42	0,05	0,54	2,18	1,38	0,26	1,66	0,76	7,41	0,79

Source: by authors from the CAGED database. A = illiterate, Fi = elementary incomplete, Fc = complete elementary, Mi = secondary incomplete, Mc = secondary complete, Si = undergraduate, Sc = graduated, Hu= urban male worker, Mu=urban female worker, Hr= rural male worker, Mr=rural female worker.

For workers with incomplete elementary education, the demand for male and female workers in the urban areas is elastic (price elasticity coefficient>1,0) and in rural areas is inelastic (price elasticity coefficient<1) for both states. This means that rural workers have more employment stability than workers of urban areas.

Workers with complete elementary education of both genders, are demand inelastic for Ceará rural areas. However rural graduated workers are inelastic for São Paulo. This means stable work for rural workers of those level of schooling.

Cross-elasticities for both states are presented in figures 5 to 8 in order to evaluate the interference that the male worker market may cause on the female worker market and determine if there exists a condition of complementation or substitution among genders in the formal labor.

Figure 5, shows that the cross-elasticities of illiterate workers in São Paulo are essentially negative in the years presented, suggesting a condition of complementary good for labor suppliers, that is, raising the level of wages for male workers causes a reduction in demand by female labor, implying a possible existence of gender discrimination since they do not behave as substitute factors of production.

This result for São Paulo shows a strong evidence of preference for male illiterate workers than for the state of Ceará, which corroborates the findings in the descriptive analysis. In fact, cross-elasticity for illiterate workers in both in urban or rural areas is negative in 75% of cases for São Paulo and 45% for Ceará.

For illiterate workers of São Paulo state, only 20% of rural workers present substitution between genders, whereas for Ceará, the degree of substitution is of 50% for rural areas.

As the level of schooling advances, cross-elasticities become predominantly positive, indicating competition or substitution by male workers for female workers. Figure 6 shows the cross-elasticities for São Paulo and Ceará for workers with complete elementary education between 2008 and 2017. Rural workers are substitutable in 30% of the cases in São Paulo and in 60% of the cases in Ceará.

A rapid visualization of figure 7 that consider workers with complete secondary education shows that the positive cross-elasticity is much more evident than in the previous figures for both states and in both rural or urban areas with negative cross-elasticity in only 10% of cases for Ceará and 35% of the cases for São Paulo. This shows a much higher degree of substitution between genders at this level of schooling.

Figure 8, which shows the results of cross-elasticity for graduated workers, follows the same pattern of the previous figure with a higher degree of gender substitution. Ceará showed positive cross elasticity of demand in 70% of the cases more than São Paulo with 55% of positive cross-elasticity considering graduated workers in both rural and urban areas.

Note that in all analyzed cases the level of schooling that presented the highest degree of substitution was that of complete secondary education, even more than for graduated workers. This may indicate a shortage of workers at this level of schooling and, consequently, a higher demand regardless of gender.

Being a rural or urban worker does not show significant cross-elasticity differences, but it is possible to observe that there is a slight tendency of rural workers to be more discriminated by the gender issue, that is, to be more substitutable as results show.

On 71% of the cases analyzed between 2008 and 2017 the cross-elasticity is positive for the state of Ceará and for São Paulo it is on 55% of the cases, which indicates a substitution condition between the production factors of more than 50% for both States. That is, an increase in the price of the male worker's wage/hour ratio causes an increase in the quantity of female labor demand. This means that for both states the labor force by gender acts, for the most part, as substitutes and, therefore, competitors.

Figura 5: Cross Elasticity for São Paulo and Ceará-Illiterate Workers (2008-2017).
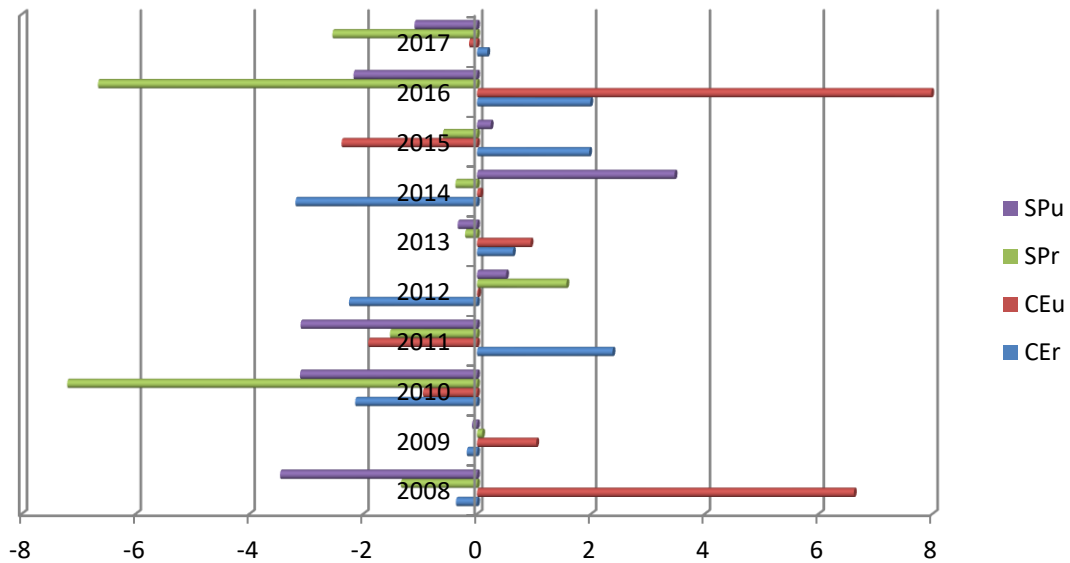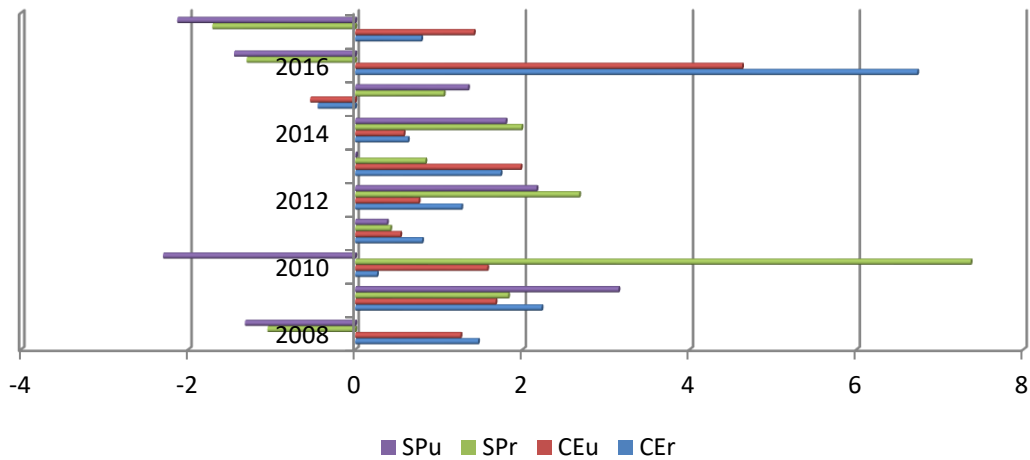

Source: by authors using CAGED data. Obs: SPu = workers from urban areas of the state of São Paulo, SPr = workers from rural areas of the state of São Paulo, CEu = workers from urban areas of the state of Ceará, CEr = workers from rural areas of the state of Ceará

Figure 6: Cross Elasticity for São Paulo and Ceará-workers with complete elementary education (2008-2017).
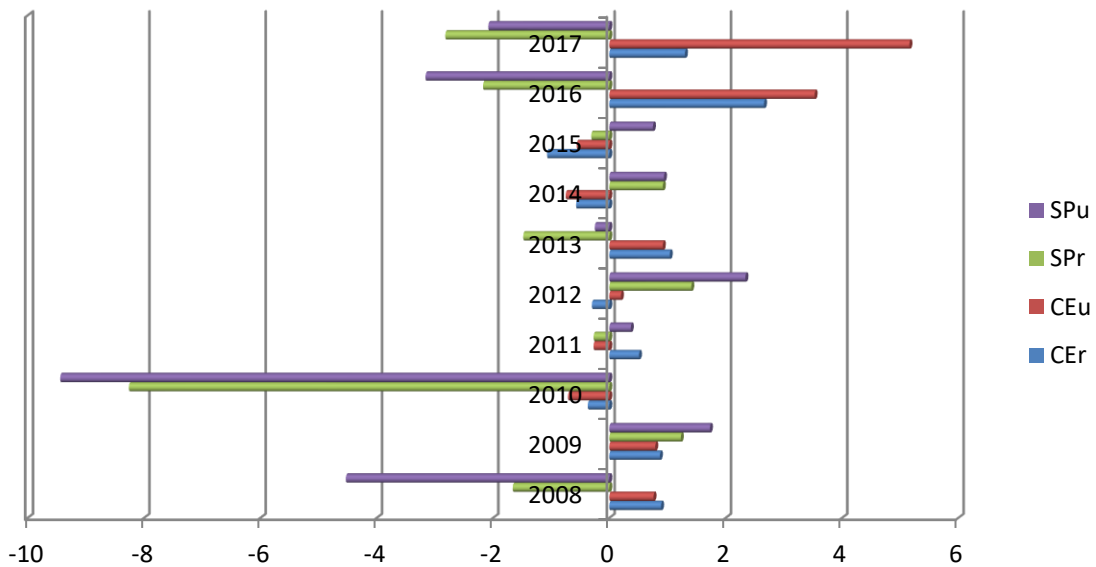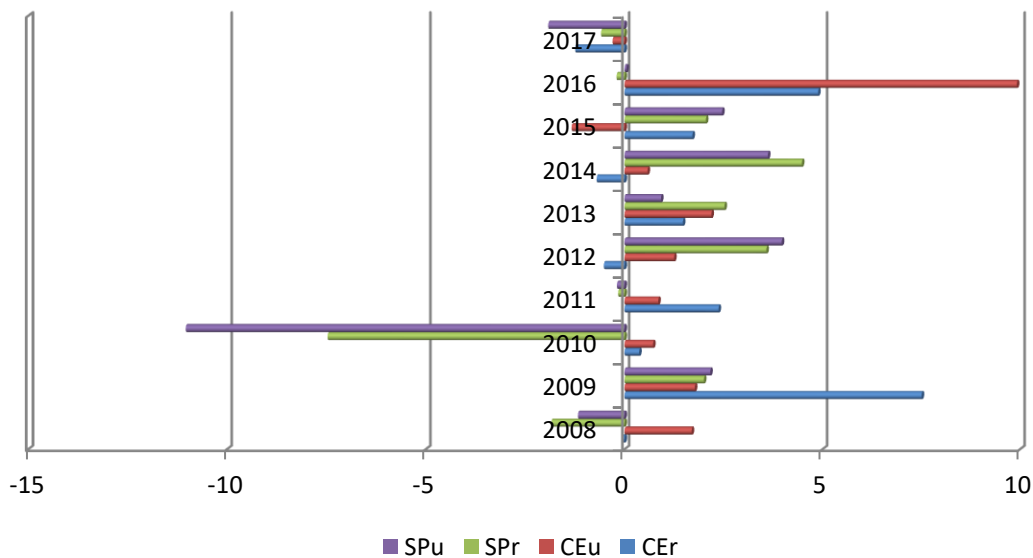

Source: own elaboration from CAGED data. Obs: SPu = workers from the urban area of the state of São Paulo, SPr = workers from the rural area of the state of São Paulo, CEu = workers from the urban area of the state of Ceará, CEr = workers from the rural area of the state of Ceará

Figure 7: Cross-Elasticity for São Paulo and Ceará workers with complete secondary education (2008-2017).

Source: by authors from CAGED data. Obs: SPu = workers from the urban area of the state of São Paulo, SPr = workers from the rural area of the state of São Paulo, CEu = workers from the urban area of the state of Ceará, CEr = workers from the rural area of the state of Ceará.

Figure 8: Cross Elasticity for São Paulo and Ceará - graduated workers (2008-2017).

Source: by authors using CAGED data. Obs: SPu = workers from the urban area of the state of São Paulo, SPr = workers from the rural area of the state of São Paulo, CEu = workers from the urban area of the state of Ceará, CEr = workers from the rural area of the state of Ceará

It is worth noting that the higher prevalence of labor substitution by gender for the state of Ceará is different from what would be intuitively expected, considering that Ceará is a poorer state, located in the northeastern region of Brazil and probably of a more traditional culture than São Paulo, a rich state located in the southeast of the country

5 FINAL CONSIDERATIONS

The study analyzed the demand for formal labor in rural areas focusing on gender wage gap and considering education level for the Brazilian states of Ceará and São Paulo based on the microdata from

the General Register of Employed and Unemployed-CAGED.

Descriptive analysis showed that, workers with lower levels of education, especially illiterate workers, presented a lower gender wage gap. However the wage of working men is higher at all levels of schooling, and the widest wage gap between men and women occurs among graduated workers in rural areas for both states.

This research captured the demand for labor sensitivity for male and female workers using as measures price and cross elasticities of demand coefficients.

In the lower level of education, for the state of Ceará, the average demand for labor is inelastic regardless of gender which means that, on the average, illiterate and lower paid workers are more necessary since employers are less responsive to wage increases. On the other hand, for the state of São Paulo, illiterate workers present an elastic demand by employers, which means that workers of both genders are more easily dismissed.

For workers with incomplete elementary education, the demand for male and female workers in rural areas is inelastic (price elasticity coefficient<1) for both states. This means that rural workers have more employment stability than workers of urban areas for this level of schooling.

Cross-elasticities coefficients for illiterate workers in São Paulo are essentially negative suggesting that raising the level of wages for male workers causes a reduction in demand by female labor. This result implies a possible existence of gender discrimination since male and female workforce do not behave as substitute factors of production. In fact, only 20% of rural workers show substitution among gender for São Paulo, whereas for Ceará, the degree of substitution is of 50% for the rural areas.

As the level of schooling advances, cross-elasticities become predominantly positive, indicating competition or substitution between male workers and female workers which are chosen not due to gender but to other characteristics.

Results make clear that what really matter for the presence or absence of discrimination is the level of schooling however the wage gap is for real and increases with the increase of schooling level.

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