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## **Decomposition of labor earnings: an analysis between metropolitan regions and non-metropolitan regions in Brazil**

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**Abstract:** This paper aim at examining the dispersion of intra and inter-regional of principal labor earnings of the Metropolitan Regions (MR) and Non-Metropolitan Regions (NMR) of the States of Bahia, Ceará, Minas Gerais, Pará, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Sul and São Paulo, Brazil. It were applied the Chow structural test and decomposition of Oaxaca, and Heckman procedure. It was used data from the National Research by House Sample at 2006. The theoretic approach was based on the Theory of Human Capital and Theory of Segmentation Labor Market. The results indicated that regional aspects and personal attributes of workers contributed for explaining the gap between labor earnings but were not homogeneous among States. Finally in the States that have highest Gross Domestic Product the regional effects were more important factors for explaining the differences for labor earnings among of MR and NMR.

**Key-words:** wages dispersion, labor market, labor earnings, regional economy.

### 1. INTRODUCTION

The State of São Paulo leaded the process of industrial concentration until 1970s. This State becomes the biggest State industrial of Brazil, mainly its Metropolitan Region (HUMPHREY, 1990). But, this situation changed along the time following next decades, it was evidenced a phenomenon had not been seen almost sixty years since the beginning of national industrialization: the industrial decentralization.

Industrialization was seen as a paradigm of economic development, because the industry was highly correlated to the other sectors of the economy, and employed a large proportion of the workforce coming from the rural areas and small agricultural cities. The industry has proved to be greatest responsible for "pulling" the spread of productive activities to other regions, which it helped to raise the economic dynamism of the smaller metropolitan areas (RAMOS e FERREIRA, 2005; SABÓIA and KUBRUSLY, 2008).

In 1973 was created the first eight metropolitan regions (MR) of Brazil: Belém, Belo Horizonte, Curitiba, Fortaleza, Porto Alegre, Recife, Salvador and São Paulo. In the following year was created the MR of Rio de Janeiro. In those regions the industrial and urban concentration were more intense than the other Brazilian regions. The flow of capital was greater to those regions, that attracted the biggest companies and corporations because of several advantages not found elsewhere, for example, more qualified workers, closely of the consumer markets, logistics cheaper, and others (FIRKOWSKI e MOURA, 2001).

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Moreover, in the Non-Metropolitan Regions (NMRs), usually the traditional activities tend to be installed: low rate of innovation, labor intensive, require low-skilled workers and limited consumer market. In fact, NMRs within its great area has broad production structures, which can be defined in other territorial units, connected vertically to each other and with MRs (STADUTO et al., 2008). Some areas of NMR have productive activities with high rate of innovation and capital-intensive, however, are exceptions, found in some cities of the states in the Southeast and South.

The phenomenon of productive dispersion was initiated in 1970s, and was practically interrupted in the 1980s. This decade whole attention was looking at process of price acceleration. On the hand, the government was trying to control the raise of prices and on the other hand, the private sector trying to develop strategies economic and financial to survive in an environment of high fluctuation of prices. In the 1990s, the dispersion production was restarted on economic environment more favorable: trade liberalization, processes of deregulation and privatization and monetary stability. The governmental policies of incentives aim for new domestic and foreign investments that benefited more the metropolitan areas of the States of South and Northeast than other States.

The productive centrality of the metropolitan regions and concomitant movement of decentralization contributed to boost economic structure of various States of Brazil. However, many NMR also benefited, but degree intensity depends on each State. The productive dispersion at long time reflected on the labor earnings of private and the public sectors.

Despite the importance of studying about dispersion production and differences of labor earnings for urban and industrial planning, also it is important for studying the rural development. Many occupations in agricultural activities are seasonal, therefore, part of the year these workers are engaged in urban activities in the small cities of NMR. Moreover, there are many urban workers who only live in rural areas, thus they contribute directly to income for their rural households.

Table 1 evidences that all the selected States the ratio Gross Domestic Product (GDP) and population was larger on MR, except in Rio de Janeiro. Because there are the petrochemical and oil extraction industries located in NMR that contribute for high GDP. The planning of increasing metropolitan region in 1970s was effective to attract productive capital still nowadays having strong repercussions.

Table 1- GDP and population of MR and NMR selected - 2006

States	GDP*				Population			
	MR	%	NMR	%	MR	%	NMR	%
Pará	15,680,140	35	28,695,626	65	2,086,906	29	5,023,559	71
Ceará	29,457,256	64	16,852,628	36	3,415,455	42	4,801,630	58
Pernambuco	36,123,989	65	19,380,928	35	3,646,204	43	4,856,399	57
Bahia	48,130,796	50	48,428,133	50	3,408,273	24	10,541,873	76
Minas Gerais	80,601,060	38	134,212,450	62	5,494,095	28	13,985,261	72
Rio de Janeiro	184,373,438	67	90,989,287	33	11,467,222	74	4,094,498	26
São Paulo	450,604,630	56	351,947,061	44	19,677,506	48	21,378,228	52
Paraná	55,829,012	41	80,851,826	59	3,261,168	31	7,126,210	69
Rio Grande do Sul	71,913,065	46	84,969,558	54	4,101,032	37	6,862,187	63
Avarege	972,713,386	53	856,327,497	47	56,557,861	42	78,669,845	58

Source: IBGE (2009).

\* 1,000 reais (R\$).

This paper aims to analyze the intra-regional dispersion of principal labor earnings between metropolitan regions and non-metropolitan regions of Brazil, and examining local factors and worker attributes by using the method of decomposition of income. The States that were analyzed: Bahia, Ceará, Minas Gerais, Pará, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Sul and São Paulo, at 2006.

## 2. DISPERSION OF WAGES: THEORIC AND METHOD APPROACHES

### 2.1. Theoric Approach

Human capital has been contributing to studies of wage differentiation according to empirical evidence research from Brazil (Da SILVA, 1987, SANTOS and TEXEIRA, 2000; ARBACHE and De NEGRI, 2002; FOGUEL and AZEVEDO, 2006; FREGUGLIA et al., 2007; STADUTO and MALDANER, 2008). The first theoretical elaborations have been published since the end of 1950's by Jacob Mincer (1958 and 1974) and Gary Becker (1962). They reformulated the classical model when centered attention on the explanatory power of schooling and work experience as determinants of different levels of individual income.

The approach of segmented labor market is broader, and got more highlight in literature from the criticisms that were done on the linearly that the theory of human capital had on the income and education. Duality is the most basic concepts of the Theory of Segmentation Labor Market. However, the distribution of industries among regions introduced spatial dimension in the segmentation approach. Then for better understanding of the wage dispersion can be considered the factors built up over time and settled in the region

through incorporation of habits and customs of the industry and market local work (TAUBMAN and WACHTER, 1986; SAVEDOFF, 1990).

According to Bluestone (1970) and Vietorisz and Harrison (1973), the duality of technology is the result of capital concentration, and is strongly related to market structures of various types of economic activities. The various levels of technology contribute to segmentation market labor. On one hand, the oligopolistic firms: high productivity, high profits, capital intensive and high degree of unionization. On the other hand, peripheral firms: small, labor intensive, low profits, low productivity and low degree of unionization. Moreover, the oligopolistic industries can transfer most of their increased costs to consumers through prices and by high labor productivity. Competitive industries that had low profitability are unable to transfer (or absorb internally) to consumers any significant increase in costs.

The theory of segmented labor market also considers regional segmentation on current its analytical approach. The empirical researches of wage differences reveal how important is role of the local or regional factors, because it had influence on labor market and wage rates. According to Topel (1986), regions that had increase of employment above the average had relative increase in wages and reduction in the unemployment rate compared to other locations. But this behavior is not observed in the empirical researches, because that part of the wage dispersion observed among regions is explained by personal characteristics of resident in the region and by the characteristics of the region.

Molho (1992) identifies two factors that influence the determination of the local wages. The first factor is features of local wages that are institutional factors: social, legal and economic. The second factor is market forces: supply and demand. Some regions have different physical characteristics and populations. Thus, the wages are different among regions have been way to compensate regional differences (cost of living, environmental quality, and others). Labor markets are not perfectly flexible, if it were the wage differences would tend to reduce to zero by movement population of workers.

According to Foguel and Azevedo (2006), in Brazil from 1984 to 2005, the unmeasured variables had significant contribution in determining the labor difference earnings. The regional wage differentials are not only due to differences in labor productivity (GALINARI et al, 2007). Some local institutional factors explain the regional differences in wages, such as the cost of living between cities, local amenities and local habits and customs (SANTOS, TEIXEIRA, 2000; AZZONI and MENEZES, 2006).

## 2.2 Method of Estimation

Oaxaca's method (1973) has been used intensively in the analysis of discrimination in the labor market, sex and skin color; however, other authors applied this methodology for analysing the geographical distribution of income. Santos and Texeira (1999) examined wage distribution between coastal and central regions of Portugal through by Oaxaca method. These authors modified the model of Oaxaca to include an inter-temporal analysis. Besson and Groshen (1991) analyses income distribution applying the method of Oaxaca (1973) for the United States to capture the effect of the size of cities (small and large cities). Venturini and Villoio (2000) also used the same methodology to analyse the effect of the size of Italy's cities for employment and wage of immigrants.

Oaxaca's method (1973) is based on estimates of Mincer's equations of wage functions for each group considered in the analysis: Metropolitan and Non-Metropolitan Regions. Oaxaca's decomposition was adjusted for analysing labor earnings in the Metropolitan and Non-Metropolitan Urban Regions, and has the following equations:

$$\ln w_{MRi} = \alpha_i + \beta_{MRi} X_{MRi} + \mu_{MRi} \quad (1)$$

$$\ln w_{NMRi} = \alpha_i + \beta_{NMRi} X_{NMRi} + \mu_{NMRi} \quad (2)$$

Where:

$\ln w$  = natural logarithm of labor earnings from main job;

$w_{MR}$  = current wage of workers of MR;

$w_{NMR}$  = current wage of workers of NMR;

$\alpha$  = intercept of regression;

$X$  = vector of variables;

$\beta$  = vector of coefficients;

$\mu$  = error term;

MR = Metropolitan region;

NMR = Non-metropolitan region.

Developing the equations (1) and (2), it got follow expression:

$$\overline{\ln w_{MR}} - \overline{\ln w_{NMR}} = \underbrace{(\hat{\alpha}_{MR} - \hat{\alpha}_{NMR}) + \bar{X}_{NMR} (\hat{\beta}_{MR} - \hat{\beta}_{NMR})}_{1^\circ \text{ term}} + \underbrace{\hat{\beta}_{MR} (\bar{X}_{MR} - \bar{X}_{NMR})}_{2^\circ \text{ term}} \quad (3)$$

The first term  $(\hat{\alpha}_{MR} - \hat{\alpha}_{NMR}) + \bar{X}_{NMR}(\hat{\beta}_{MR} - \hat{\beta}_{NMR})$  represents regional effects, and is the difference between inter-regional labor earnings caused by structure differences of the labor markets, which is a function of the productive structure of economic spatial, as such compensation by urban congestion, culture, business organizations and other local circumstances. The second term  $\hat{\beta}_{MR}(\bar{X}_{MR} - \bar{X}_{NMR})$  represents worker attributes effects, it reflected on differences labor earnings caused by personal attributes of workers in each region, such as level of education and experience.

For calculating the equation (3), it was assumed that there are two labor markets with different characteristics which can be estimated by two equations: metropolitan and non-metropolitan regions. For raising the robustness this hypothesis that there are two markets will be applied the Chow test (1960) of structural change for verifying there are differences between the hedonic regressions on neighbor regions (MR and NMR), according to Hill et al. (2003). It can estimate a single equation when coefficients and error terms are same for both regions estimated. But, if this last situation is not confirmed, then coefficients estimated from restrict model (4) will be biased and, consequently, inconsistent. Restricted (4) and non-restricted (5) models are estimated for calculating F statistic. For Greene (2002), in situations where the sample is so large, case this study, the Chow test is appropriate.

$$\ln w_i = \alpha_i + \sum \beta_{ik} X_{ik} + \mu_i \quad (4)$$

$$\ln w_i = \alpha_i + D_i \gamma_i + \sum (\beta_k X_{ik} + D_i \eta_k X_{ik}) + \mu_i \quad (5)$$

$D_i$ : 1 = MR; and 0 = NMR.

The equations estimated by OLS may eventually generate bias coefficients due to the selectivity of sample, which it has only individual with occupation. The individuals not have same reserve wages so may "prefer" no participate of labor market for current wage. To avoid this selectivity bias in the estimates, Heckman (1979) developed procedure which is to include in the wage equation the variable  $\lambda$  (lambda) that is the inverse of Mills' ratio. It is calculated by estimation of worker participation in the market work by the probit method.

Table 2 describes the variables used to calculate and it were choose based on the researches of Kassouf (1994), Menezes et al. (2005); Maia and Lira (2002); Staduto and Maldaner (2008).

Table 2 - Description of the variables used in the study

Variables	Variable Descriptions
Earn	Earnings from main job
Lnearn	Neperian logarithm of principal income
Earnout	Income unrelated to work
Earnper	Per Capita income of the family
School	Years of study
Experi	Years of experience
Experi <sup>2</sup>	Experience <sup>2</sup>
Exper*Ed	Experience*Education
Color	White = 1 e non-white = 0
Sex	Male = 1 female = 0
Head	Head of family = 1 other positions = 0
Spouse	Spouse = 1 others = 0
Child14	Child less than 14 yrs = 1 others = 0
Workhrs	Worked hours per week
Yrsworked	Number of years in the job
Formal	Formal =1 and informal = 0

Source: PNAD/IBGE – 2006. Elaborated by authors.

It was used data from the National Research by House Sample (PNAD) at 2006 of the Brazilian Institute of Geography and Statistics (IBGE). It was opted to analyse urban areas in order to reduce the influence of farm activities, raise the homogeneity of the intra-regional (MR and NMR) structure of labor earnings. However, there will always be workers who live in urban areas and work in rural areas. It was selected the States of Bahia, Ceará, Minas Gerais, Pará, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Sul and São Paulo. Because there are available data for metropolitan areas and its respective non-metropolitan regions.

The dependent variable is the current labor earnings of people who work 10 or more years old at the week that was made data collection. Thus, the sample analysed includes all individuals who work independently of the employment position: formal employment, informal employment, self-employment, public employment, employers and others. This methodological option becomes more broad sample, therefore, will be accounted labor earnings and not only wage of the private sector employees.

### 3. DECOMPOSITION OF LABOR EARNINGS IN THE METROPOLITAN AND NON METROPOLITAN REGIONS OF BRAZIL

#### 3.1 Participation in the Labor Market



Although all estimated coefficients of non-restricted equations were no significant, Chow test was significant for all States. According to Gujarati (2000), the Chow test in fact does not explicit which variables are different in the two samples (Table 3). Consequently there is evidence to affirm that two samples are different regression functions (JUDGE et al., 1988). Thus, it could follow to what was proposed and, next step, estimating the variable lambda.

Table 3 – Equation of labor earnings of the models restricted and non-restricted labor market of the States selected - 2006

State	R <sup>2</sup>	F-Chow test
Bahia		24.87*
non-restricted	0.54	
restricted	0.53	
Ceará		63.32*
non-restricted	0,54	
restricted	0,51	
Minas Gerais		34,45*
non-restricted	0,55	
restricted	0,54	
Pará		8,72*
non-restricted	0,48	
restricted	0,47	
Paraná		14.34*
non-restricted	0.53	
restricted	0.52	
Pernambuco		14.16*
non-restricted	0.52	
restricted	0.51	
Rio de Janeiro		10.39*
non-restricted	0.50	
restricted	0.50	
Rio Grande do Sul		21.99*
non-restricted	0.53	
restricted	0.52	
São Paulo		30.91*
non-restricted	0.54	
restricted	0.53	

Source: elaborated by authors.

\* significant estatistically to 1%.

To facilitate the presentation and discussion, all data and following procedures, the results were organized according to Brazilian official macroregions. The first region showed was North. Table 4 shows the results of employee participation in the labor market of the State of Pará. Also shows that most variables are statistically different of zero in both the NMR and MR. The variables of human capital (level of education and experience) have

relation positive with the participation in the labor market. The workers that have higher personal attributes should have higher earnings because these characteristics are directly related to the productive capacity and are valued by employers in both regions of the State. In the case of the variable-experience the participation increases at decreasing rates. The interaction between experience and education also showed negative coefficient, but it was expected to be positive. On the same hand, Menezes et al. (2005) and Staduto and Maldaner (2008) also showed the same results.

Table 4 – Equation of participation of the labor market in the MR and NMR on State of North Region - 2006

Coefficient	Pará					
	RM			RNM		
	$\hat{\beta}$	Z	Sig.	$\hat{\beta}$	Z	Sig.
Constant	-2.84489	-35.29	0.00	-2.62168	-43.71	0.00
School	0.19566	26.05	0.00	0.18831	32.33	0.00
Experi	0.18197	37.02	0.00	0.17263	45.17	0.00
Experi <sup>2</sup>	-0.00250	-37.74	0.00	-0.00242	-46.63	0.00
Exper*Ed	-0.00651	-23.32	0.00	-0.00619	-27.44	0.00
Earnper	0.00014	5.57	0.00	0.00014	6.26	0.00
Earnout	0.00068	7.93	0.00	0.00085	10.33	0.00
Head	0.53242	12.09	0.00	0.62038	17.18	0.00
Spouse	-0.19624	-4.46	0.00	-0.30264	-8.55	0.00
Child14	0.04750	1.48	0.14	0.04005	1.56	0.12
Lambda	-0.86002	-13.20	0.00	-0.82072	-18.21	0.00
Likelihood ratio	2,679.04			3,944.54		
Observation number	9,930			15,454		

Source: Elaborated by authors.

Table 4 also shows that the variables income per capita family not originated from labor were positively associated with employee participation in the labor market on both regions, but the magnitude of coefficients had small dimension. In this case, the substitution effect tends to be higher than the income effect. Menezes et al. (2005) and Staduto and Maldaner (2008) founded similar results.

The coefficients of the variables family head and spouse (associated with the position at family) had the expected signs, positive and negative, respectively, in both regions. Still considering the family aspect, the coefficient of worker with children under fourteen year old in the MR can be considered significant and positive sign, but should be expected to be negative. The existence of another member in the family can create the need of more income, thus resultant the increased of participation of worker in the labor market. Finally, the

coefficient of lambda variable was significantly different of zero, suggesting that there is selection bias in the sample, and then is recommended the application of the Heckman procedure to yield unbiased estimators.

In labor market of the Northeastern States (Bahia, Ceará and Pernambuco) and other States the variables associated of human capital (education level and experience) had positive association with the worker's decision to participate in the labor market, that is according to with Brazilian empirical studies, for example, Kassouf (1994) and Menezes et al. (2005).

In the Northeast the variable of worker with children under fourteen years old showed no relation with worker's decision to participate in the labor market, may be associated with the number of children per couple. In this region average number of children per couple is higher than in other regions, and then probably the older children take care of the small children, releasing the parents to work. Analyses of other variables are very similar to performed to State of Pará (Table 4).

Table 5 – Equation of participation of the labor market in the MR and NMR of State of Northeast Region - 2006

Coefficient	Bahia						Ceará						Pernambuco					
	RM			RNM			RM			RNM			RM			RNM		
	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig
Constant	2.673	37.83	0.00	-2.455	-49.48	0.00	-2.575	37.31	0.00	-2.498	43.46	0.00	-2.808	39.53	0.00	-2.488	44.24	0.00
School	0.190	29.23	0.00	0.181	38.18	0.00	0.194	29.45	0.00	0.193	34.65	0.00	0.201	30.43	0.00	0.179	33.15	0.00
Experi	0.173	39.50	0.00	0.161	51.73	0.00	0.165	39.87	0.00	0.154	45.33	0.00	0.169	39.72	0.00	0.154	44.19	0.00
Experi <sup>2</sup>	0.003	40.77	0.00	-0.002	-55.78	0.00	-0.002	41.21	0.00	-0.002	48.08	0.00	-0.003	41.85	0.00	-0.002	47.87	0.00
Experi*Ed	0.006	26.02	0.00	-0.006	-32.36	0.00	-0.006	25.60	0.00	-0.006	28.74	0.00	-0.006	26.92	0.00	-0.006	28.04	0.00
Earnper	0.000	7.80	0.00	0.000	9.35	0.00	0.000	4.40	0.00	0.000	4.28	0.00	0.000	6.48	0.00	0.000	6.93	0.00
Earnout	0.003	17.99	0.00	0.003	24.11	0.00	0.002	14.13	0.00	0.002	18.95	0.00	0.004	20.85	0.00	0.004	23.83	0.00
Head	0.524	13.50	0.00	0.589	19.97	0.00	0.541	13.81	0.00	0.638	18.92	0.00	0.594	15.85	0.00	0.618	18.95	0.00
Spouse	0.053	-1.32	0.19	-0.150	-5.07	0.00	-0.993	-2.53	0.01	-0.149	-4.49	0.00	-0.153	-4.03	0.00	-0.164	-4.98	0.00
Child14	0.023	0.80	0.43	-0.007	-0.31	0.76	-0.024	-0.85	0.39	0.001	0.04	0.97	-0.363	-1.28	0.20	-0.247	-1.02	0.31
Lambda	0.686	14.12	0.00	-0.760	-20.70	0.00	-0.780	13.28	0.00	-0.666	14.46	0.00	-0.525	39.53	0.00	-0.531	15.15	0.00
Likelihood ratio	3,776.72			6,431.97			3,537.82			4,956.59			3,788.87			5,058.35		
Observation number	13,079			23,457			12,584			17,480			13,958			18,613		

Source: Elaborated by authors.

In the labor market in the Southeast (Minas Gerais, Rio de Janeiro and São Paulo), specifically the States of Minas Gerais and São Paulo, the coefficient worker with children under fourteen years old was significant and negative. These are richest States in Brazil and have behavior according to economic theory. Workers who have small children reduce their participation at labor market, and being the mothers who lead this performance. Thus, it is according to the labor market of rich countries (Table 6).

Table 6 – Equation of participation of the labor market in the MR and NMR of State of Southeast Region - 2006

Coefficient	Minas Gerais						Rio de Janeiro						São Paulo					
	RM			RNM			RM			RNM			RM			RNM		
	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig
Constant	-2.394	30.66	0.00	-2.273	48.30	0.00	-2.769	39.54	0.00	2.68894	47.45	0.00	-2.689	40.39	0.00	-2.687	58.04	0.00
School	0.210	28.80	0.00	0.200	44.49	0.00	0.197	31.76	0.00	0.19552	38.11	0.00	0.196	36.56	0.00	0.217	53.59	0.00
Experi	0.151	34.28	0.00	0.152	55.63	0.00	0.179	45.51	0.00	0.17653	54.46	0.00	0.177	45.84	0.00	0.171	66.46	0.00
Experi <sup>2</sup>	-0.002	37.25	0.00	-0.002	62.10	0.00	-0.003	49.37	0.00	0.00251	59.13	0.00	-0.003	48.73	0.00	-0.002	71.78	0.00
Exper*Ed	-0.006	24.49	0.00	-0.006	36.38	0.00	-0.007	33.52	0.00	0.00683	39.77	0.00	-0.007	35.28	0.00	-0.007	49.65	0.00
Earnper	0.000	3.37	0.00	0.000	2.79	0.01	0.000	8.72	0.00	0.00010	9.56	0.00	0.000	10.88	0.00	0.000	10.51	0.00
Earnout	0.000	6.94	0.00	0.000	18.10	0.00	0.001	25.13	0.00	0.00145	28.04	0.00	0.001	26.22	0.00	0.002	34.52	0.00
Head	0.518	11.50	0.00	0.513	17.89	0.00	0.543	14.95	0.00	0.55943	18.07	0.00	0.559	15.06	0.00	0.535	21.66	0.00
Spouse	-0.165	-3.67	0.00	-0.250	-8.85	0.00	-0.245	-6.66	0.00	0.23279	-7.52	0.00	-0.233	-6.56	0.00	-0.232	10.09	0.00
Child14	-0.063	-1.94	0.05	-0.063	-3.13	0.00	-0.028	-0.99	0.32	0.00964	-0.42	0.31	-0.010	-1.93	0.05	-0.049	-2.38	0.02
Lambda	-0.987	13.96	0.00	-1.033	25.18	0.00	-0.645	17.74	0.00	0.69506	22.41	0.00	-0.695	22.66	0.00	-0.774	32.82	0.00
Likelihood ratio	3,300.75			7,739.66			5,390.41			7,466.41			5,637.46			11,403.91		
Observation number	10,522			27,442			15,921			22,659			17,851			37,462		

Source: Elaborated by authors.

The equation of participation in the labor market States of Southern Brazil (Paraná and Rio Grande do Sul), as well as the States of São Paulo and Minas Gerais, the coefficient of the variable worker with children under fourteen years old was significant and negative. Two richest regions of Brazil, Southeast and South, have similar behavior to the richer countries. The remaining variables did not differ significantly from comments made to the States previously examined (Table 7).

Table 7 – Equation of participation of the labor market in the MR and NMR of State of South Region - 2006

Coefficient	Paraná						Rio Grande do Sul					
	MR			NMR			MR			NMR		
	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig	$\hat{\beta}$	Z	Sig
Constant	-2.73762	-24.89	0.00	-2.56314	-37.38	0.00	-2.62735	-38.08	0.00	-2.54692	-45.53	0.00
School	0.23281	23.49	0.00	0.22138	34.94	0.00	0.22060	34.20	0.00	0.21452	40.76	0.00
Experi	0.17919	28.19	0.00	0.16718	41.64	0.00	0.17107	42.13	0.00	0.16671	50.98	0.00
Experi <sup>2</sup>	-0.00249	-29.69	0.00	-0.00238	-45.38	0.00	-0.00244	-44.67	0.00	-0.00240	-55.25	0.00
Exper*Ed	-0.00723	-21.03	0.00	-0.00642	-28.74	0.00	-0.00719	-32.37	0.00	-0.00696	-38.40	0.00
Earnper	0.00002	1.11	0.27	0.00001	6.26	0.54	0.00009	6.37	0.00	0.00009	7.30	0.00
Earnout	0.00097	10.37	0.00	0.00058	12.61	0.00	0.00076	17.12	0.00	0.00068	19.21	0.00
Head	0.53749	8.68	0.00	0.62972	15.13	0.00	0.55226	14.04	0.00	0.61228	18.96	0.00
Spouse	-0.19819	-3.28	0.00	-0.25678	-6.45	0.00	-0.08497	-2.17	0.30	-0.04802	-1.51	0.13
Child14	-0.00376	-0.09	0.93	-0.00708	-0.25	0.80	-0.01859	-0.67	0.51	-0.02988	-1.31	0.19
Lambda	-0.76952	-10.89	0.00	-0.92251	-19.46	0.00	-0.84683	-18.41	0.00	-0.95885	-24.00	0.00
Likelihood ratio	2,008,34			4,501.35			4,834.39			6,832.98		
Observation number	6,213			14,502			15,100			22,588		

Source: Elaborated by authors.

### 3.2 Equation of Labor Earnings

All estimated equations of labor earnings (Table 8, 9, 10 and 11) results of MRs and NMRs were well adjusted for tests  $R^2$  and F. The test of autocorrelation of error term Durbin-Watson proved to be inconclusive for the autocorrelation.

At estimates of the nine States the coefficients of variables educational level, skin color, sex, hours worked, time of employment and formality had similar behavior of significance, expected signal and also importance level for determination of labor earnings in both Regions: MR and NMR. It could be noted that the coefficient of skin color showed higher magnitude in the MR of Salvador compared to NMR of Bahia as well as other States, despite this State composed of mostly black population, it can be have relation with wage discrimination and also probably they must have less access to public jobs. On the hand, in MR of Curitiba coefficient of skin color had small magnitude probably due to great part of the population is white. The variable education has higher contribution than experience. In 2006 Brazil was in a phase of strong economic growth which probably warmed the labor market. Thus the most educated workers were more preferred by companies than most experienced workers.

Sex and formal employment are the variables that most contributed in the equation for determining of labor earnings in all MR and NMR. Therefore, the Brazilian labor markets are highly segmented by observable features of the worker, sex, and the characteristic of the occupation, the formality. This behavior is similar in all States, independent of level of economic development. The magnitudes these coefficients are much closed while Regions. The formality has an important role in employees' income, which helps to increase the total labor income. The importance of employees' sex is related to wage discrimination then just being a woman to have reduced income. The other variables have less contribution to the labor earnings and are not always significant except those already mentioned.

Table 8 – Equation of labor earnings in the MR and NMR of North Region - 2006

Cofficient	Pará					
	MR			NMR		
	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig
Constant	4.832	31.24	0.00	4.542	42.19	0.00
School	0.08637	9.84	0.00	0.08832	14.02	0.00
Experi	-0.00329	-0.46	0.64	0.0139	2.79	0.01
Experi <sup>2</sup>	0.00019	2.06	0.04	-0.00009	-1.37	0.17
Exper*Ed	0.00046	1.55	0.12	0.00018	0.81	0.42
Color	0.111	5.42	0.00	0.11	6.56	0.00
Sex	0.269	13.98	0.00	0.303	18.90	0.00
Workhrs	0.01287	17.70	0.00	0.01353	23.78	0.00
Yrsworked	0.01473	11.31	0.00	0.01297	12.11	0.00
Formal	0.318	16.30	0.00	0.348	21.73	0.00
Lambda	-0.549	-10.86	0.00	-0.427	-11.78	0.00
F	457.445			704.86		
R <sup>2</sup>	0.488			0.483		
Durbin-Watson	1.710			1.714		

Source: Elaborated by authors.

Table 9 – Equation of labor earnings in the MR and NMR of Northeast Region - 2006

Cofficient	Bahia						Ceará						Pernambuco					
	MR			NMR			MR			NMR			MR			NMR		
	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig
Constant	4.387	39.61	0.00	4.134	51.10	0.00	4.456	34.65	0.00	3.663	34.15	0.00	4.226	40.47	0.00	3.981	45.54	0.00
School	0.110	16.50	0.00	0.109	22.24	0.00	0.087	11.48	0.00	0.114	17.52	0.00	0.105	16.12	0.00	0.111	20.37	0.00
Experi	0.014	2.67	0.01	0.022	6.19	0.00	0.008	1.39	0.17	0.033	7.00	0.00	0.017	3.87	0.00	0.026	6.91	0.00
Experi <sup>2</sup>	0.000	-0.74	0.46	0.000	-3.67	0.00	0.000	-0.40	0.69	0.000	-5.77	0.00	0.000	-2.07	0.04	0.000	-4.91	0.00
Exper*Ed	0.000	-1.26	0.21	0.000	-1.28	0.20	0.001	3.07	0.00	0.000	1.16	0.25	0.000	-0.66	0.51	0.000	-1.06	0.29
Color	0.264	11.87	0.00	0.183	11.58	0.00	0.128	7.20	0.00	0.101	6.10	0.00	0.160	9.08	0.00	0.139	8.99	0.00
Sex	0.315	19.00	0.00	0.343	26.11	0.00	0.310	17.67	0.00	0.355	21.18	0.00	0.298	16.91	0.00	0.319	20.11	0.00
Workhrs	0.012	19.66	0.00	0.013	27.57	0.00	0.012	21.87	0.00	0.015	29.28	0.00	0.011	17.63	0.00	0.012	23.17	0.00
Yrsworked	0.017	13.90	0.00	0.011	12.99	0.00	0.012	10.37	0.00	0.002	1.70	0.09	0.017	14.04	0.00	0.012	11.82	0.00
Formal	0.430	25.10	0.00	0.491	36.50	0.00	0.383	21.21	0.00	0.479	27.75	0.00	0.458	25.69	0.00	0.482	30.13	0.00
Lambda	-0.567	14.74	0.00	-0.527	18.20	0.00	-0.498	10.71	0.00	-0.314	-8.18	0.00	-0.359	10.96	0.00	-0.331	11.24	0.00
F	766.163			1368.141			651.807			903.612			643.897			901.264		
R <sup>2</sup>	0.531			0.539			0.509			0.513			0.506			0.518		
Durbin-watson	1.633			1.650			1.672			1.627			1.626			1.638		

Source: Elaborated by authors.

Table 10 – Equation of labor earnings in the MR and NMR of Southeast Region - 2006

Coefficient	Minas Gerais						Rio de Janeiro						São Paulo					
	MR			NMR			MR			NMR			MR			NMR		
	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig
Constant	4.058	28.16	0.00	3.973	48.65	0.00	4.523	46.15	0.00	4.526	56.57	0.00	4.379	52.26	0.00	4.233	72.49	0.00
School	0.118	13.83	0.00	0.109	22.61	0.00	0.117	19.95	0.00	0.110	22.99	0.00	0.121	23.03	0.00	0.120	32.88	0.00
Experi	0.030	4.85	0.00	0.035	9.85	0.00	0.019	4.57	0.00	0.018	5.21	0.00	0.033	9.47	0.00	0.036	14.55	0.00
Experi <sup>2</sup>	0.000	-3.24	0.00	0.000	-7.61	0.00	0.000	-1.80	0.07	0.000	-2.42	0.02	0.000	-7.08	0.00	0.000	-11.01	0.00
Experi*Ed	0.000	-0.32	0.75	0.000	-1.04	0.30	-0.001	-2.73	0.01	0.000	-1.86	0.06	-0.001	-3.84	0.00	-0.001	-5.55	0.00
Color	0.162	9.26	0.00	0.144	13.58	0.00	0.169	11.21	0.00	0.150	12.12	0.00	0.172	13.11	0.00	0.133	14.20	0.00
Sex	0.344	18.76	0.00	0.360	30.81	0.00	0.280	17.85	0.00	0.306	23.38	0.00	0.264	19.85	0.00	0.307	32.88	0.00
Workhrs	0.015	23.02	0.00	0.016	37.99	0.00	0.010	17.47	0.00	0.011	22.31	0.00	0.013	24.69	0.00	0.014	37.99	0.00
Yrsworked	0.019	14.92	0.00	0.014	18.53	0.00	0.020	19.31	0.00	0.019	22.80	0.00	0.022	23.17	0.00	0.020	32.16	0.00
Formal	0.301	16.81	0.00	0.339	30.66	0.00	0.313	20.03	0.00	0.311	24.20	0.00	0.280	21.05	0.00	0.295	31.90	0.00
Lambda	-0.440	-7.92	0.00	-0.389	12.15	0.00	-0.411	13.32	0.00	-0.417	16.01	0.00	-0.468	16.85	0.00	-0.425	-20.99	0.00
F	711.511		0.00	1755.23		0.00	776.461		0.00	1134.16		0.00	1120.283		0.00	2350.525		0.00
R <sup>2</sup>	0.551			0.542			0.508			0.511			0.543			0.539		
Durbin-Watson	1.701			1.659			1.594			1.600			1.636			1.617		

Source: Elaborated by authors.

Table 11 – Equation of labor earnings in the MR and NMR of South Region - 2006

Coefficient	Paraná						Rio Grande do Sul					
	MR			NMR			MR			NMR		
	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig	$\hat{\beta}$	t	Sig
Constant	4.423	27.73	0.00	4.11	37.84	0.00	4.64	47.39	0.00	4.632	56.04	0.00
School	0.111	11.71	0.00	0.116	18.00	0.00	0.09942	16.68	0.00	0.08999	17.93	0.00
Experi	0.02812	4.00	0.00	0.03631	7.62	0.00	0.01155	2.71	0.01	0.00655	1.80	0.07
Experi <sup>2</sup>	-0.00025	-2.74	0.01	-0.00037	-5.86	0.00	-0.00004	-0.67	0.51	0.00001	0.18	0.86
Experi*Ed	-0.00054	-1.78	0.08	-0.00073	-3.54	0.00	0.00017	0.89	0.37	0.00047	2.90	0.00
Color	0.09653	3.91	0.00	0.122	7.62	0.00	0.147	8.38	0.00	0.147	9.97	0.00
Sex	0.286	13.06	0.00	0.327	20.47	0.00	0.27	18.91	0.00	0.292	24.39	0.00
Workhrs	0.01245	15.36	0.00	0.01312	23.93	0.00	0.01278	23.01	0.00	0.01445	32.57	0.00
Yrsworked	0.02205	14.78	0.00	0.02136	21.01	0.00	0.02147	22.14	0.00	0.01941	24.74	0.00
Formal	0.271	12.47	0.00	0.325	21.81	0.00	0.31	21.86	0.00	0.321	27.18	0.00
Lambda	-0.38	-6.37	0.00	-0.33	-8.24	0.00	-0.561	-15.35	0.00	-0.57	-18.48	0.00
F	363.274		0.00	896.218		0.00	949.126		0.00	1407.82		0.00
R <sup>2</sup>	0.508			0.526			0.534			0.533		
Durbin-Watson	1.651			1.655			1.686			1.669		

Source: Elaborated by authors.

In the next section was estimated Oaxaca decomposition, which was possible to explain the sources of differences of labor earnings average, which can be related to the worker (personal characteristics and attributes) or labor market of region (the productive structure, high-tech industries, among others).

### 3.3 Decomposition of Labor Earnings between the Metropolitan e Non-Metropolitan Regions

At sample were included public sector workers, which are extremely important for small cities for all States and especially in the poorest one that were located in the North and Northeast Regions. The government employs large portion of population in those less developed cities of the poorest areas of Brazil. The labor earnings not only reflects behavior of the private sector, which is expected that reflect large share of productivity of enterprises, but also reflect public sector, and is expected that indirectly in municipal salaries should reflect dynamics of the local economy. The dynamics of the national economy and of the States can have different or opposite patterns than local economies. The salaries of public sector workers may be different of the private sector, because the first depend which government level (Federal or State) that the worker is employed.

All metropolitan areas had higher rates of pay than their respective NMRs. These differences are because the aspects of the labor market and institutional factors. Prices were not adjusted between NMR and MR, because of absence of indexes that capture the variation of prices in the NMRs. The labor earnings of the State that pays less (Ceará) in comparison of the State that pays better (São Paulo) is equivalent to 56% and 54% respectively for MR and NMR (Table 12). In Brazil is very high wage dispersion among the States.

Table 12 – Average of the labor earnings of MR and NMR of the States – 2006\*

States	Average Earnings of MR	Average Earnings of NMR	NMR/MR (%)
RJ	1,242.75	1,151.13	92.63
SP	1351.08	1,249.60	92.49
PA	854.41	789.72	92.43
RS	1,231.04	1,132.04	91.96
PR	1,186.74	1,075.01	90.59
PE	856.36	769.11	89.81
CE	754.65	668.73	88.61
BA	915.23	766.35	83.73
MG	1,096.70	915.88	83.51

Source: Resultant of research.

\* The labor earnings were adjusted by IPCA (Index Price Customer Abroad) averages of 2008 every State.

For decomposition of Oaxaca (1973), the first term  $(\hat{\alpha}_{MR} - \hat{\alpha}_{NMR}) + \bar{X}_{NMR}(\hat{\beta}_{MR} - \hat{\beta}_{NMR})$  refers to the effect of regional return and represents the difference labor earnings between MR and NMR that caused by different labor markets structures, other words, depend of production structure of economic spatial. The second term corresponds  $\hat{\beta}_{MR}(\bar{X}_{MR} - \bar{X}_{NMR})$  to the



effect that represents the average difference in labor earnings caused by personal attributes of workers in each region, for example, the education and experience.

The characteristics regional and workers' personal attributes help to understand the differences in average labor earnings in all States. However, there is not unique behavioral pattern in the States that were analysed. For example, in the States of Ceará, Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul and São Paulo factors within the region contributed to these differences more than the attributes of workers. In the States of Bahia, Pará and Pernambuco contribution of workers' attributes for the differences in average labor earnings was higher than the regional attributes (Table 13).

Table 13 – Decomposition of the difference of the labor earnings in the Brazilian MRs and NMRs - 2006.

State	Difference of advantage group <sup>a</sup> $\overline{\ln w_{MR}} - \overline{\ln w_{NMR}}$	Return effect of region $(\hat{\alpha}_{MR} - \hat{\alpha}_{NMR}) + \bar{X}_{NMR} (\hat{\beta}_{MR} - \hat{\beta}_{NMR})$	%	Effect of personal attribution $\hat{\beta}_{MR} (\bar{X}_{MR} - \bar{X}_{NMR})$	%
BA	0.186	0.085740	46	0.100717	54
CE	0.177	0.108634	61	0.068523	39
MG	0.151	0.099445	66	0.051866	34
PA	0.070	0.009849	14	0.059903	86
PR	0.134	0.079892	60	0.054003	40
PE	0.114	0.037039	33	0.076728	67
RJ	0.065	0.039138	60	0.026019	40
RS	0.079	0.049201	62	0.029724	38
SP	0.080	0.079142	99	0.001067	1

Source: resultant of research.

<sup>a</sup> Advantage group: MR.

For States that have highest gross domestic products (GDP) the contribution of regional factors for the difference of average earnings labor between MR and NMR was most important factor, except the State of Ceará (Table 14). Despite this State is not one of the richest, it has the best indicators of quality of basic education compared to other Northeastern States. Probably the quality of the education system covering all cities of Ceará<sup>3</sup>.

The State of São Paulo illustrates the relation between high income and the trend of equity of observable characteristics of workers between MRs and NMRs. Represents 34% of GDP, and the worker attributes contributed with 1% to explain the difference in labor earnings and the local aspects of the labor market explain 99%. Topel (1986) identified

<sup>3</sup> It can see more about public educational system and its evolution of state of Ceará in Vieira (2007).

similar patterns in the United States; the characteristics of regions have more weight in explaining the pay gap than personal characteristics. However, institutional aspects from local can break this rule as was the case of the State of Ceará. On the other hand, State of Pará have very low GDP and worker attributes contributed 86% to variation in labor earnings between MR and NMR.

Table 14 – Gross Domestic Product of selection States (R\$) – 2006

States	GDP	%
São Paulo	802,551,691	33,87
Rio de Janeiro	275,362,726	11,62
Minas Gerais	214,813,511	9,06
Rio Grande do Sul	156,882,623	6,62
Paraná	136,680,839	5,77
Bahia	96,558,929	4,07
Pernambuco	55,504,917	2,34
Ceará	46,309,884	1,95
Pará	44,375,766	1,87
Other States	540,755,660	22,83
<b>Brazil</b>	<b>2,369,796,546</b>	<b>100,00</b>

Source: IBGE. 2009.

#### 4. CONCLUDING REMARKS

This study aims to analyse the intra-regional dispersion of principal labor earnings between the metropolitan regions (MRs) and non-metropolitan (NMRs) in Brazil. It was examined local factors and worker attributes by using the decomposition method of Oaxaca (1973). States analysed: Bahia, Ceará, Minas Gerais, Pará, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Sul and São Paulo in 2006. The data used from the National Research by House Sample (PNAD) of the Brazilian Institute of Geography and Statistics (IBGE) at 2006.

The productive dispersion in Brazil started in the 1970s coming from the State of São Paulo and contributed to change distribution spatial productive activities on many regions of country, impacting differently the economic sectors and labor earnings. The approach of market segmentation work shows the importance of the heterogeneity of the labor market to determine the wage, for example, industry membership of the employee, job characteristics, attributes of workers and the spatial distribution of activities. The institutional factors are

impacted by local aspects at long run that influence the labor earnings, which contribute to dispersion of income.

By Oaxaca's method it could be possible to verify the extent of dispersion of the sources of labor earnings between the MRs and NMRs due to differences in measurable attributes of workers and local labor market – aspects of the labor market segmentation are due to factors institutional and market forces. However, these two sources of dispersion of labor earnings have different intensities among States. In States of Ceará, Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul and São Paulo the characteristics of the local labor market has great power to explain the differences labor earnings. Finally, for the States of Bahia, Pará and Pernambuco the attribute of the worker provide more explanation on differences labor earnings. The educational system is very important to reduce differences in income, naturally has higher positive correlation with income of States. But this is not a rule, local aspect and not only aspect of labor market, for example, the excellent performance of public education system can shift this correlation, as such it was the case of the State of Ceará which is one of the poorest States.

The effect of regional returns reveals the importance of labor market forces and of institutional aspects, which involves variables no easy to measure, for example, the organizational culture of companies that pay above average and others. Probably the living cost of MR is higher than the NMR, but could not be corrected by the absence of data in the NMR. Other aspect that may be associated with this dispersion is labor union density, creative work and others. There is evidence to affirm that Brazilian labor market is segmented regionally.

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