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Cost of Living and Wages in the Brazilian Metropolitan Regions

(Preliminar Draft - Do not Cite)

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ABSTRACT

This paper analyses the relationship between household cost of living and wages in the Brazilian metropolitan regions. The country's economic growth in the last decade contributed significantly to structural economic changes at the regional level, in terms of employment, population growth and income at PPP levels. With low inflation and modest economic growth, families have been able to adjust their domestic budget on the long run, improving their welfare. In urban areas, poverty reduction has been significant and has increased the consumption of families, with changes in the basket of goods and services, as well in relative prices. Based on recent estimations of cost of living in the Brazilian metropolitan regions (Almeida and Azzoni, 2013), we tested if the elasticity between wages and living cost is unitary. In other words, if workers who live in the most expensive regions receive a full compensation through wages for living costs differences. We use micro data of the POFs of 1996, 2003 and 2009. Our results indicate that the elasticity of the price index in response to wage levels are above the unit. This result is consistent with the literature, but we found larger elasticities. The elasticity for the cost of housing is higher than for food and transportation, indicating that housing costs are more important in the definition of levels of well-being.

1. Introduction

The structural reforms implemented in Latin America, and more specifically in Brazil, in the 1990s had as its objective the elimination of the hyper inflationary process. In addition to the monetary stabilization plans, measures were implemented to further integration of economies to international markets (trade liberalization) and increasing the quality and efficiency of the institutions. After two decades of monetary stability and consolidation of social protection policies, there are significant changes related to poverty and inequality of income, labor market, health, education and nutrition (Neri, 2010).

Figure 1 shows that Brazil managed to reconcile price stability with a rise in average annual rate of growth. In the period 1994 to 2002, the average growth rate of GDP was 2.65% aa, while between 2003 and 2012 the average increased to 3.6% p.a.

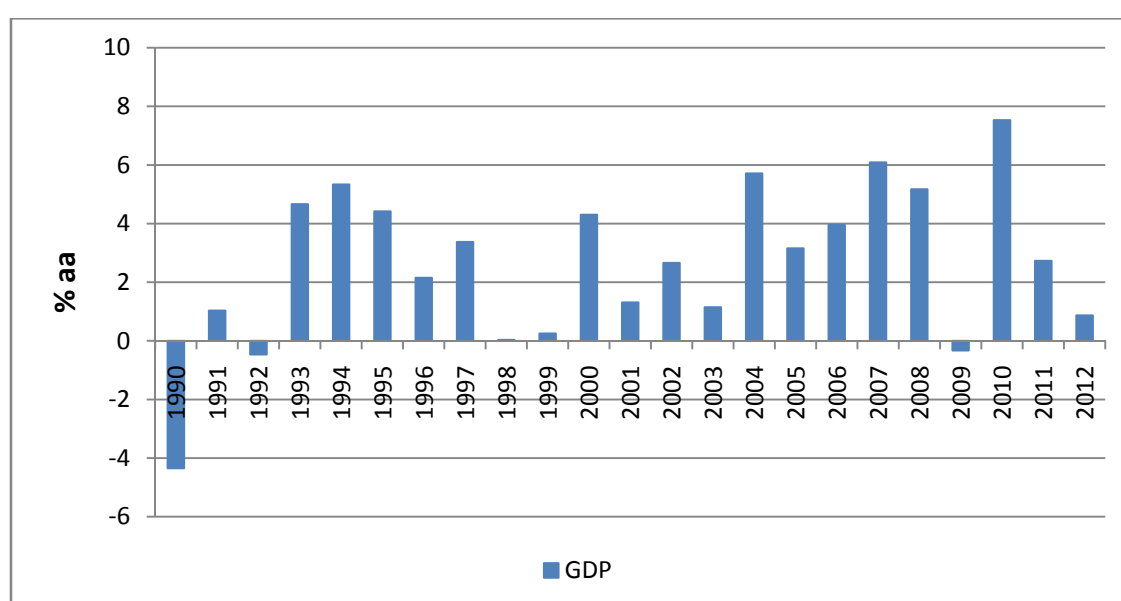


Figure 1. GDP-yearly real rates (% py) – 1990 a 2012.

Source: IPEADATA (www.ipeadata.gov.br)

Azzoni (2001) examined the period 1939 to 1995, and found signs of absolute convergence between Brazilian regions. However, the author noted the existence of cycles of convergence and divergence during the years analyzed, a phenomenon that can be explained by the fact that periods of economic expansion provide further growth to the regions more invigorated in the country, while in periods of economic downturn, these same regions are affected directly, with subsequent negative impact in the poorest regions. Menezes et al. (2012), from a base of microdata organized by age cohorts, which included demographic aspects related to life cycle, concluded that the regional income inequality in Brazil has different dynamics between regions, and income convergence is observed only for older generations; the greater participation in income of younger generations have produced a slow convergence in the country. Additionally, when it disregards pension payments and other government transfers of income convergence not observed also for older generations.

Figure 2 shows the evolution of GDP per capita by region for the period 1985-2010. It calls the attention the vigorous growth in the Midwest region, which had an average of 3.44% p.a., followed by the southern region (1.44%), Northeast (1.26%), Southeast (1.04%) and North (1.01%).

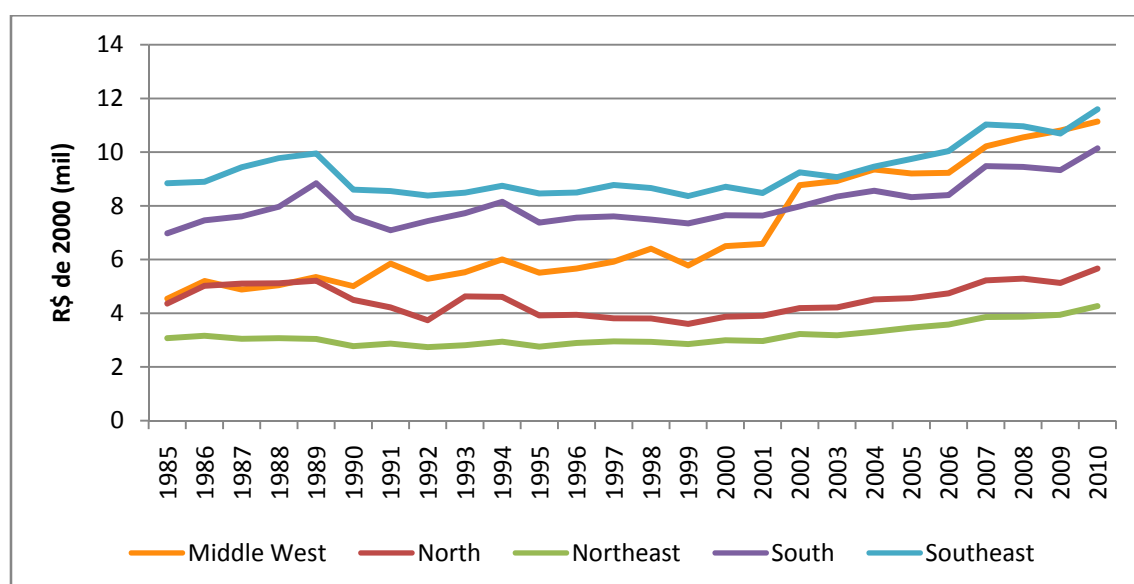


Figure 2. GDP *per capita* – R\$ thousands of 2000 – 1985 a 2010.

Fonte: IPEADATA (www.ipeadata.gov.br)

Despite the economic growth of the last two decades, yet here is still a great deal of regional disparity in income levels and well-being, as well as cost-of-living levels between regions and cities (Azzoni et al. .2003 APUD Almeida and Azzoni, 2013). On average, in the period 2000 to 2010, the Brazilian States that showed higher rates of GDP growth were respectively: Mato Grosso (7.26%), Holy Spirit (6.50%), Rondônia (6.11%) and Amapá (6.03%). On the other hand, States with lower average rates of growth in the period were: Rio de Janeiro (2.97%), Alagoas (3.20%), Santa Catarina (3.32%) and Rio Grande do Sul (3.35%). Differences in average GDP growth rates, however, were not sufficient to promote major changes in the participation of States in national GDP; the State of São Paulo, for example, maintains the largest share in the total Brazilian GDP.

Kretzmann& Cunha (2009) indicated that, for the period 1996 to 2006, there was an increase of jobs in relation to metropolitan regions that would represent, according to the authors, the result of a process of devolution, which generates increase in the supply of jobs with greater intensity in the interior of the country. Although the interior of the country have generated relatively more employment opportunities, Table 1 shows that in the period from 2002 to 2013, in absolute terms, Brazilian metropolitan regions had a vigorous growth of the economically active population occupied; in general terms, the total of the metropolitan areas surveyed by IBGE showed a growth of around 30% of the economically active population occupied. Although it was the fastest growing metropolitan region (43%), Salvador was the metropolitan area with the second smallest ration of occupied population. The metropolitan region of São Paulo maintained the largest contingent of occupied population, in absolute terms, as well as in relative terms. Its share was practically stable, around 42%, followed by Rio de Janeiro (25%, but decreasing) and Belo Horizonte (10% but increasing to 11%).

Table 1. Occupied working age population (millions) – 2002 - 2013

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Var.%
Recife	1,20	1,27	1,28	1,29	1,32	1,33	1,35	1,39	1,49	1,53	1,60	1,59	33,2
Salvador	1,29	1,33	1,39	1,46	1,50	1,58	1,60	1,65	1,72	1,73	1,77	1,84	43,0
Belo Horizonte	1,82	1,91	1,99	2,05	2,16	2,25	2,35	2,37	2,48	2,55	2,61	2,57	41,6
Rio de Janeiro	4,55	4,71	4,80	4,85	4,91	4,97	5,08	5,09	5,23	5,35	5,48	5,51	21,2
Sao Paulo	7,37	7,70	7,98	8,24	8,35	8,59	8,95	9,00	9,26	9,43	9,59	9,66	31,1
Porto Alegre	1,56	1,60	1,62	1,67	1,69	1,72	1,79	1,78	1,85	1,90	1,91	1,94	23,9
Total das regiões	17,78	18,52	19,05	19,55	19,93	20,43	21,12	21,28	22,02	22,47	22,96	23,12	30,0

Fonte: IBGE (www.ibge.gov.br), prepared by the authors

The economic literature on wage differential between regions shows that there is a compensation of wages, especially in the most populous regions, due to higher costs of displacement, greater pollution, and other factors that impact negatively on the quality of local life beyond, obviously, the differential in productivity of the workforce. Figure 3 shows the relative cost-of-living levels estimated by Almeida & Azzoni (2013) for Brazilian metropolitan regions, divided into three distinct periods: the average of 1996 to 1999, the average of the 2004 and 2006 the average 2010 to 2012. The authors observed that the most significant change occurred with Goiânia, that departs from a lower-than-average position and ends above it, making it the third most expensive metropolitan area in the country. This move followed what happened in Brasília, the nearby town, which showed strong growth in the last period, accentuating their position of higher cost of living in the country. In other cases, there were no substantial changes. However, there is strong approximation to the average of Belo Horizonte and, to a lesser extent, Salvador. On the other hand, Fortaleza becomes progressively cheaper, compared to the others.

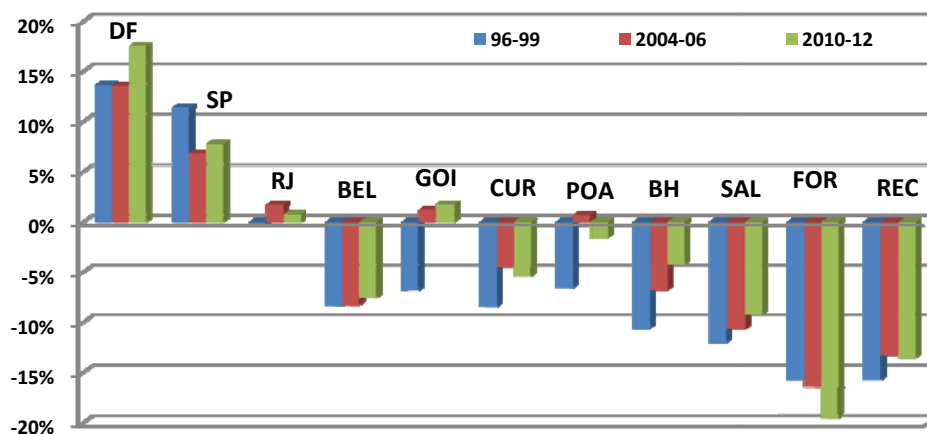


Figure 3. Cost-of-Living comparative levels in Brazilian metropolitan regions
Source: Almeida & Azzoni (2013)

Given the recent regional growth dynamics in Brazil, which includes increased income, employment and, also, cost of living in metropolitan areas, this work intends to carry forward the results obtained by Almeida and Azzoni (2013) on the cost of living of metropolitan regions. We set to test whether the differences in cost of living are balanced out by differences in salaries between regions, as the econometric model proposed by Winters (2009) suggests.

2. Literature Review

This section makes a brief review of some of the main findings on the compensation of salaries at regional level vis a vis higher costs of living. According to Greenwood et al. (1991), studies regarding the level of wages and rent levels have been developed to measure the quality of life at the regional level. According to the authors, in equilibrium, price differentials and salaries don't necessarily reflect differences of utility among economic agents, which can be arbitrated through migration. Therefore, if the inter-regional economic system is in equilibrium, price and wage differentials represent compensations and therefore can be used as proxies for differences in quality of life.

Dickie&Gerking (1987) examined interregional wage differences between full-time workers in the United States under two aspects: differences in the average level of the market value of workforce characteristics (level of education and experience at work, for example), and differences in the rate of return of these characteristics. The authors concluded that interregional factors and the movement of commodities tend to equalize payments rate of workers in the country.

In the theoretical model proposed by Beeson &Eberts (1989), the differences in salary between metropolitan regions are estimated from the equilibrium conditions of labour and land markets, which determine the balance between local firms and families. In this model, the cities have different characteristics, which affect the utility of the families, and the productivity of firms, although the utility between workers and unit cost between the firms are the same in equilibrium, with salaries and rent of the land are different, to compensate workers for interregional differences. In the estimated model, there was a predominance of differences of productivity as determinants of the difference between salaries.

In recent literature on economic development and regional differences, variables such as congestion, pollution, quality of schools and public infrastructure have marked the debate over public policies focused on quality of life at the level of States and municipalities (Gabriel et al. 2003). In a comparison between U.S. States between 1981 and 1990, Gabriel et al. (2003) found that there was a degree of stability in the quality-of-life ranking, despite a loss in the quality of life in states that have experienced a rapid population growth. Beeson &Eberts (1989) captured the positive effect of amenities in the wage differential. This effect would be via the increase in the supply of labor that would lead to a reduction of salaries.

On the other hand, although noting the relationship between quality of life and the proportion of the cost of living in the level of salaries, Albouy (2008) notes that neither population size or population density impacted on the quality of life of North American cities, since the amenities associated with the urbanization process have been able to mitigate the potential negative effects. The author argues that by including federal taxes, non-residential costs, and income from the work generates more consistent estimates of quality of life than observed in previous research. The model set by the author predicts that a 1% increase in wages is associated to an increase of 1.5% in the cost of housing, controlling for amenities. This result, according to the

author, is smaller than reported by previous studies that have estimated values of the order of 3% to 4%.

3. Model and methodology

From the works of Rosen (1979) and Roback (1982), Winters (2009) presented a theoretical model that relates wages, prices and amenities between cities and regions. The basic assumptions of the model are: firms produce goods x_1 and x_2 from a technology with constant returns to scale, using as production (N), capital (K) and (L); regional differences in productivity are linked to the effects of local amenities (Z). It is assumed that the price of capital is determined exogenously, and normalized to unity, while the cost of labour (W) and the price of land (PL) are determined in competitive local markets.

The workers, in turn, maximize utility subject to a budget constraint. In the model proposed by Winters (2009), the indirect utility function can be expressed in relation to wages and prices of x_1 and x_2 , given the local amenities:

$$V = (W, P_1, P_2; Z) \quad (1)$$

Winters (2009) demonstrates that, by differentiating expression (1) and applying Roy's identity, for $dV = 0$, one obtains the logarithmic form:

$$d\ln W = \left(\frac{P_1 X_1}{W}\right) d\ln P_1 + \left(\frac{P_2 X_2}{W}\right) d\ln P_2 - \left(\frac{P_2}{W}\right) dZ \quad (2)$$

The result represented by the expression (2) shows that, controlling for the effect of the amenities, for a 1% increase in the price of x_1 , an increase of the same magnitude in the expenditure on x_1 in relation to the salary should occur. Therefore, as Winters (2009) indicates: *"if total consumption expenditure is equal to wage income, $P_1 X_1 + P_2 X_2 = W$, then a one percent increase in the prices of all goods will require wages to increase by one percent to maintain equal utility"* (p. 633). The implication of this result for the labour market, admitting a homogeneity of the skills of workers and no restriction for migration or mobility of the workforce, would be a salary compensation for differences in prices between cities or regions.

Including the control of the amenities in the model of DuMond et al. (1999), Winters (2009) proposed the following model to test the compensation of wages for different prices between cities or regions:

$$\ln W_{ij} = X_{ij}\beta + \theta \ln P_j + \gamma Z_j + \varepsilon_{ij} \quad (3)$$

with,

W_{ij} is the wage received by worker i in city j ;

P_j is the level of prices in city j ;

X is a vector of personal characteristics (education, gender, marital status, etc.)

Z is a vector of amenities and
 ε is the error term with zero average.

4. Data base

To estimate the model represented by the expression (3), we used the cost-of-living indexes of metropolitan regions estimated by Almeida and Azzoni (2013). The other variables such as income, personal characteristics of workers have as their source the Pesquisa de Orçamentos Familiares (POF), conducted by the Brazilian Institute of Geography and Statistics (IBGE), between October 1995 and September 1996, from July 2002 to June 2003 and again from May 2008 to May 2009. The vector of amenities will include information such as temperature and precipitation, from the database of the National Institute of Meteorology (INMET).

5. Results

The results for the three surveys combined are displayed in Tables 2. The dependent variable is the log of wage of worker i in city j . The vector of worker characteristics includes education, age (and age squared), gender, household position (son, household head), temperature and total population. When we regressed total expenditure on the other variables, the results indicate that the elasticity of the price index in response to wage levels is above the unit. This is replicated in each year of the survey (between 1.3 and 2.1). This result is consistent with the literature, but elasticities we found are much larger.

Table 2 presents the results of the regression including the three surveys at the same time, but introducing dummies for two of the years, in order to capture differences between the surveys and the historical context in which they were implemented. The dummy coefficients are significant, indicating that indeed there are differences among the survey results. The coefficient for age is positive, and for age squared, negative, indicating that wage increases with age, but at a decreasing rate, as expected within the life cycle literature. Male workers receive more, and children receive less, as expected. Temperature is negative, as well as precipitation (although this was only marginally significant), indicating that wages are smaller in hotter areas, typically located in the poorest parts of the country. This is a good control for unobserved characteristics.

Expenditure was split into education, housing, clothing, health, food and transportation. The largest elasticity refers to housing expenditures (95% confidence interval: between 0.65 and 1.06). The second largest is for transportation (between 0.16 and 0.64). The other groups did not appear as significant, indicating that housing and transportation are the dimensions of consumer expenditure mostly related to wage levels. This suggests that housing costs are more important in the definition of well-being.

Table 2 – Regression results(dependent variable: log of wage)

	Coefficient	RobutsStd. Error	t	P> t	[95% Conf. Interval]	
Education	.0630185	.0807324	0.78	0.435	-.0952199	.2212569
Habitation	.8581009	.1036209	8.28	0.000	.6550002	1.061.202
Clothes	.3352658	.2145202	1.56	0.118	-.0852017	.7557333
Health	.0982193	.2144293	0.46	0.647	-.3220701	.5185086
Food	-.1875031	.270164	-0.69	0.488	-.7170344	.3420283
Transports	.4051299	.1221548	3.32	0.001	.165702	.6445578
Age	.0184585	.0011089	16.65	0.000	.0162851	.020632
Age2	-.0000215	1.27e-06	-16.99	0.000	-.000024	-.000019
Gender	.2225545	.0210724	10.56	0.000	.1812518	.2638571
Head ofHousing	.1731344	.029859	5.80	0.000	.1146096	.2316592
Son	-.207623	.0326364	-6.36	0.000	-.2715914	-.1436545
Others	-.2699248	.0409741	-6.59	0.000	-.3502356	-.189614
Temperature	-.0296158	.0044514	-6.65	0.000	-.0383408	-.0208908
Precipitation	-.000569	.0003344	-1.70	0.089	-.0012244	.0000863
Dummy 1996	-.7413368	.0221724	-33.44	0.000	-.7847955	-.6978781
Dummy 2003	-.5699954	.0241977	-23.56	0.000	-.6174238	-.5225669
Population	-.1508449	.1730384	-0.87	0.383	-.4900065	.1883166
Constant	6.613.585	.1143796	57.82	0.000	6.389.396	6.837.773
F(17, 32612)	308.18					
Prob> F	0.0000					
R-squared	0.2180					
Root MSE	1.0207					
NumberofObs	32630					

Source: Authors

6. Conclusions

This paper analyzed the relationship between household cost of living and wages in the Brazilian metropolitan regions. The country's economic growth in the last decade contributed significantly to structural economic changes at the regional level, in terms of employment, population growth and income at PPP levels. With low inflation and modest economic growth, families have been able to adjust their domestic budget on the long run, improving their welfare. In urban areas, poverty reduction has been significant and has increased the consumption of families, with changes in the basket of goods and services, as well in relative prices.

Based on recent estimations of cost of living in the Brazilian metropolitan regions (Almeida and Azzoni, 2013), we tested if the elasticity between wages and living cost is unitary. In other words, if workers who live in the most expensive regions receive a full compensation through wages for living costs differences. We use micro data of the POFs of 1996, 2003 and 2009.

When we regressed total expenditure on the other variables, the results indicate that the elasticity of the price index in response to wage levels is above the unit. This is replicated in each year of the survey (between 1.3 and 2.1). This result is consistent with the literature, but elasticities we found are much larger.

When expenditure was split into groups of items, we found the largest elasticity in relation to housing expenditures (95% confidence interval: between 0.65 and 1.06), and the second largest for transportation (between 0.16 and 0.64). The other groups did not appear as significant, indicating that housing and transportation are the dimensions of consumer expenditure mostly related to wage levels. This suggests that housing costs are more important in the definition of well-being.

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