

Regional Income Distribution in Portugal

Gertrudes Saúde Guerreiro¹

(Universidade de Évora, Departamento de Economia and CEFAGE-UE)

ABSTRACT

The structural evolution of the European economy has shown a real convergence between countries and divergence between regions (Mateus et al., 2000), so the economic and social cohesion, namely the approach of the various territories in terms of standard of living is assumed like a primary objective of economic policy. Concerns about inequality in income distribution have gained importance, encouraging the various studies that address specially inequality among individuals [see the studies of Rodrigues (1994, 1999 and 2008)]. Our research aims to address the problem of inequality in income distribution from a different perspective and we want to answer questions like if geography influences the pattern of inequality, or if the Portuguese's standard of living depends on the place of residence, and finally, if the spatial units that make up the Portuguese territory have been converging in terms of income in the process of growth. The aim of this paper (which emerges from my PhD Thesis) is to study the regional income differences among the regions and municipalities of Portugal. Our individuals are the territorial units. We intend to evaluate convergence or divergence in income growth using a static analysis, with conventional measures and other indicators, being aware the regional differences in economic performance. To meet the objectives set out, after the introduction, we present some considerations concerning the recent developments in the Portuguese economy, from a regional perspective, which represent the framework of socio-economic conditions that can justify the results in terms of inequality and convergence between the territorial units. Then, after a brief literature review and an analysis of income distribution among municipalities and among the NUTS III of Portugal, we present some inequality measures applied to municipalities' monthly average wage for the period 1991-2002. Finally, we conclude with a synthesis of results and possible future developments in the context of this work. We find a growing inequality between regional incomes over the period 1990-2006. In our view, the distribution of earnings reflects only the actual distribution of economic activity in Portugal, particularly concentrated in the coastal and metropolitan areas of Lisboa and Porto. The economic specialization and level of

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education among the population of each territorial unit are also, of course, crucial for this asymmetry on earnings.

Keywords: Income Distribution; Regional Inequality; Regional Convergence; Municipalities; Regional Data.

JEL classification: D30; R10.

1 Introduction

Regional imbalances represent an intrinsic characteristic of the Portuguese economy and its discussion became even more important with the entrance of Portugal in the European Union. In fact, as stated in Mateus et. al. (2000), the structural evolution of the European economy has shown a real convergence between countries and divergence between regions, so the economic and social cohesion, namely the approach of the various territories in terms of standard of living is assumed to a primary objective of economic policy. As such, concerns about inequality in income distribution have gained importance, encouraging the various studies that address specially inequality among individuals [see the studies of Rodrigues (1994, 1999 and 2008)]. Our research aims to address the problem of inequality in income distribution from a different perspective and we want to answer the following questions:

- ✚ Does geography influence the pattern of inequality?
- ✚ The Portuguese's standard of living depends on the place of residence?
- ✚ In the process of growth, the spatial units that make up the Portuguese territory have been converging in terms of income?

The objectives of our work relate exactly to the search for answers to these questions by introducing the treatment of convergence between smaller territorial units, municipalities.

Usually the economic literature examines, first, the convergence of income, and secondly, the inequality in income and living conditions or welfare of the people, as two separate topics or themes. For the study of economic convergence are used standard regional or national economic indicators such as Gross Domestic Product per capita (GDPpc) [considering the reference works of Barro and Sala-i-Martin (1992, 1995 and 1999), Barro (1991), Sala-i-Martin (1990, 1995, 1996 and 1996b) and about Portugal the applied studies of Soukiazis (2003), Soukiazis and Antunes (2004) and Soukiazis and Castro (2004)]. To study social inequalities, are usually used indicators like households (or individuals) income and / or

consumption of households, or microeconomic data on households [consider the reference works of Atkinson (1975 and 1997), Atkinson et al. (1995), Cowell (2008a and 2008b), and in Portugal the recent studies of Rodrigues (1994, 1998 and 2008)]. In our research, using data for each region and municipality, we intend to study at the same time, inequality and convergence, comparing results and linking the two areas of research.

In this paper we present the first results about regional income distribution, in a next paper, we'll explore another interesting debate in economic literature and more particularly in convergence studies, regards the two concepts of convergence introduced by Sala-i-Martin (1990): σ convergence and β convergence.

In summary, in this paper we study the regional income distribution between regions NUTS² III and Municipalities of Portugal, and in the next one we will examine the possible convergence between Portuguese territories.

To meet the objectives set out in this first paper, after a first item on the introduction, we present some considerations concerning the recent developments in the Portuguese economy, from a regional perspective, which represent the framework of socio-economic conditions that can justify the results in terms of inequality and convergence between the territorial units. It follows a brief literature review and an analysis of income distribution among municipalities and among the NUTS III of Portugal. In section 5 we present some inequality measures applied to municipalities' monthly average wage for the period 1991-2002. Finally, we conclude with a synthesis of results and possible future developments in the context of this work.

2 Recent developments in the Portuguese economy: a regional perspective

At this point in our work we intend to make a general characterization (economic and social) of recent developments in Portugal and its regions. The spatial units of analysis in this section are the regions NUTS III of 2002, which grouped the municipalities that we will be considered in the next sections. Indeed, beyond the restrictions regarding the availability of data, this characterization to the level of municipalities (275 in mainland Portugal), would become too long for the reader. NUTS III regions are the space unit immediately above the municipality and we worked with 28 regions instead of the 275 municipalities.

In the Portuguese mainland, we identified the weakest (most disadvantaged) regions and stronger regions, both in terms of population, as in socioeconomic terms. Regions with a

² Nomenclature of Territorial Units for Statistics, 2002 (annex 1).

higher population growth are also those experiencing lower rates of aging, and with regard to demographic indicators the dichotomy coastal / inland is notorious. Moreover, the regions of greatest population dynamics are the ones that attract more immigrants, focusing there much of work force, particularly in metropolitan areas of Lisbon and Porto, and especially at the first one.

When we analyze the educational level of the regional workforce, we find that Portugal, in 2001, had yet a high illiteracy rate (9.0%) and regional disparities in this indicator are evident. The Alentejo region in the same year, presents the highest value (15.9%) and the Lisboa region the lowest one (5.7%). The regions of Grande Lisboa, Península de Setúbal, Baixo Mondego and Porto are the ones where the working population has bigger education degree (secondary school and university).

Throughout the 90s there was a growing and widespread respect to tertiary sector of the economy, which is only less obvious in some sub regions of the industrial Norte, as Entre Douro e Vouga, Tâmega, Ave and Cávado, and the sub-region Baixo Vouga in Centro.

Entrepreneurial activity is concentrated in the Norte, Centro and Lisboa. Within each of these regions, in the Norte is the sub-region of Grande Porto that has the largest proportion of companies in 2002 (37%), in Lisboa, 76% of businesses are located in the sub-region of Lisboa, but in Cento region the spatial concentration of firms is not so evident. The size of enterprises (companies) in terms of average number of employees also varies greatly from region to region, and in 2002 the industrial regions of the Ave, Tamega, Entre Douro e Vouga and Baixo Vouga assume the highest values.

The analysis of location quotients of economic activities, depending on the number of employees for the year 2002, confirms the clues that indicate the previous indicators. We identify as the agricultural regions, sub-regions of the interior as the Douro, Beira Interior Sul, and all sub-regions of Alentejo, including the exception of the Alentejo coast. We confirm the location of manufacturing in sub-regions as Cávado, Ave and Entre Douro e Vouga, and the preferential localization of the tourism sector in the Algarve region.

With regard to domestic production, the largest contribution to GDP comes from the regions of Grande Lisboa, Porto and Península de Setúbal, which account for 50% of gross output in 2005. As regards productivity, the regions are in different placements over the national average, highlighting, on the one hand, low values of the subregions of the Norte (excluding Grande Porto) and Centro, perhaps because in most of these regions, industrial activities (labor intensive) have an important weight, and on the other hand, the values above the national average in the regions of Lisboa, Alentejo and Algarve. But when we analyze the

evolution of indices of disparity in GDP, the reality is quite different and there are wide disparities between the sub regions of each region NUTS II and is evident in almost all regions, a dichotomy between the sub regions of coast, with values above the national average and the inland regions with values far below the national average.

Finally, as regards the rate of per capita purchasing power, the generality of the NUTS III assumes values below the average, excluding the regions of Porto, Baixo Mondego, Grande Lisboa, Algarve and the Península de Setúbal, which in 2002 exhibit higher rates to half national average, with emphasis on the value of Grande Lisboa, almost 60% above this average.

Thus, we identify as the stronger region, both in economic and social terms, the Grande Lisboa, with a tendency to depart increasingly from the other regions. The region of Porto has also been a positive move away from the other regions, in most indicators. It then detects a large demographic and economic dynamics associated with the metropolitan areas of Lisbon and Porto, which can influence regional differences in income that are studied in Sections 4 and 5.

3 Literature review

In our research, as noted in the introduction, we performed two kinds of analysis that cross two research areas: first, the regional distribution of income inequality (treated at this paper) and secondly, regional convergence in income growth, treated in a following paper.

There is a vast literature on the study of income distribution, where we find traditional studies based on microeconomic data such as those from household surveys (equivalent to the household budget survey - IOF-Portugal) and applied mainly to internal studies or comparative between groups of countries, or regions (NUTS II level) within each country.

As reference studies in comparing levels of inequality and income distribution in different countries, please see Mookherjee and Shorrocks (1982), Atkinson et al. (1995), Jenkins (1995), Atkinson (1997), Lovell (1998), among others.

As for studies of inequality and regional income differences applied to the inner regions of other countries than Portugal, we can mention as an example, the work of Mishra and Parikh (1997) in India, Loikkanen et al. (1998 and 2002) in Finland, Mitrakos and Tsakloglou (2000) in Greece, Zandvakili and Gustafsson (2000) in Sweden, Garcia and Molina (2001) and Goerlich and Mas (2001) in Spain, Meng et al. (2005) in China, Shanahan and Corell (2000), Krueger and Perri (2002) and Kitov (2005) in the United States, Frick and Goebel (2005) in Germany.

In Portugal, mostly of the studies developed use data from Household Budget Surveys, as noted in the table below, where we synthesize some published works, as well as the conclusions drawn regarding the distribution and inequality income between regions, given the scope of our paper.

Table 3.1: Key findings of empirical studies of inequality and income distribution in Portugal

Authors	Information and analysis units	Major Findings
Rodrigues, C. F. (1994)	Micro data from 1980-81 and 1989-90 IOF (INE), with disaggregation at the NUTS II	There is a small reduction, but clearly, the inequality associated with the distribution of individual income over the period under review
Cardoso, A. (1994)	Wages in manufacturing (MESS, Quadros de Pessoal 1983-1989); information processing at the level of NUTS II	Regional inequality at the level of wages in manufacturing increased during the 80's
DPP (2000)	Average annual net income per adult equivalent with disaggregation at the NUTS II region (INE, IOF 1989-90 and 1994-95)	Reduction of dispersion of average income levels of households between regions, but increasing inequalities income distribution in all regions except the autonomous regions and the Algarve.
Rodrigues, C. F. (2008)	Microeconomic Data IOF 1989-90, 1994-95 and 2000 (INE), with disaggregation at the NUTS II	Despite the improvement of living conditions, inequalities have widened over the review period (decade 90), with high levels of economic poverty.

Source: Constructed by the author and based on the studies cited in the table.

Among the works in the frame, we highlight the one by Cardoso (1994), because it uses a common source of information to our research – wages (from Quadros de Pessoal) - as described below, although with a different disaggregation. This author examines regional inequality (at the NUTS II regions) of wages in Portugal over the period 1983-1989, through the Theil index, decomposing inequality among workers, by region, economic activity and education level of workers.

After the analysis we propose to accomplish it would be interesting to compare the results and conclusions of this work, with studies previously applied to our country (Table 3.1), but this comparison becomes difficult when the units of analysis are different. Our units of analysis are the NUTS III regions and municipalities, which is not repeated in any of these other studies.

In fact, our purpose and scope of study are different from those for previous works. We propose to study the differences and inequalities in income, not between individuals, or groups of individuals (families, households), but between spaces (regions) of a country, i.e., our subjects under study are the territorial units (regions and municipalities) which constitute the Mainland of Portugal.

We intend to "measure" inequality, or, put in another way, obtain indicators of inequality, not between families A and B or between C and D individuals, but between regions Alentejo and Algarve, or between the municipalities of Évora and Faro, for example.

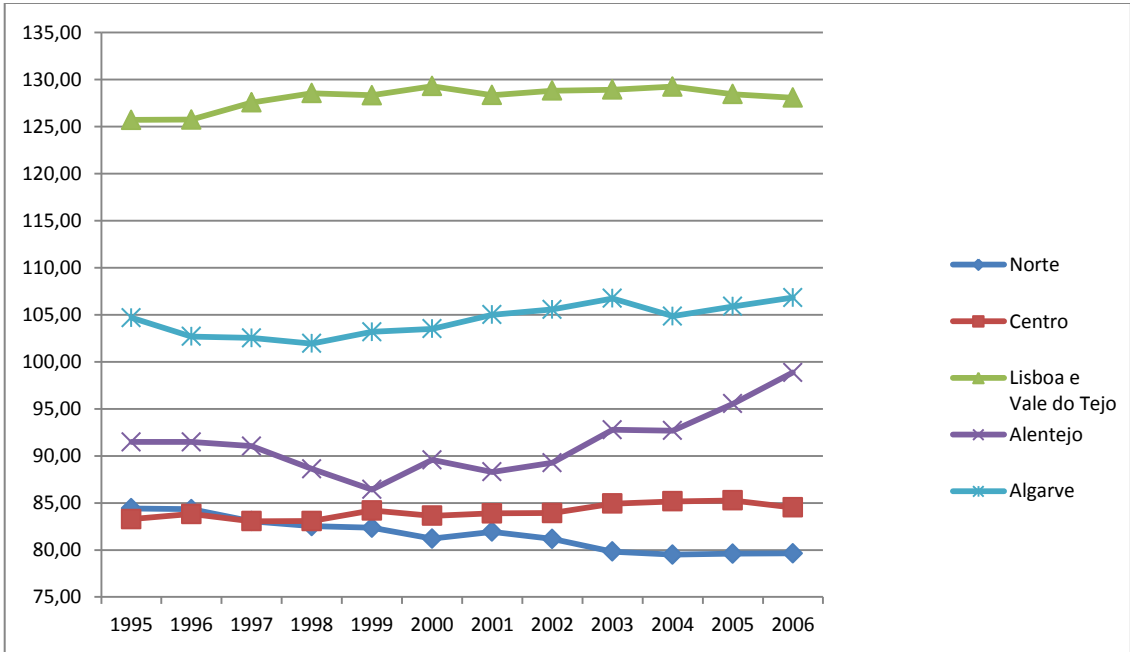
4 Regional income disparities: some data

In a first analysis of regional disparities in income, we confront two types of indicators, the indicator of well-being per capita GDP and income actually available for consumption expenditure and saving, i.e, the Gross Household Disposable Income (GDI_f) per capita.

We chose a source of official information, the Regional Accounts of the INE (National Statistics Office). As such, given the availability of information, the comparative analysis of regional disparities in terms of two indicators, GDP and GDI_f , both per capita at current prices, is made only at the NUTS II level and from 1995 to 2006.

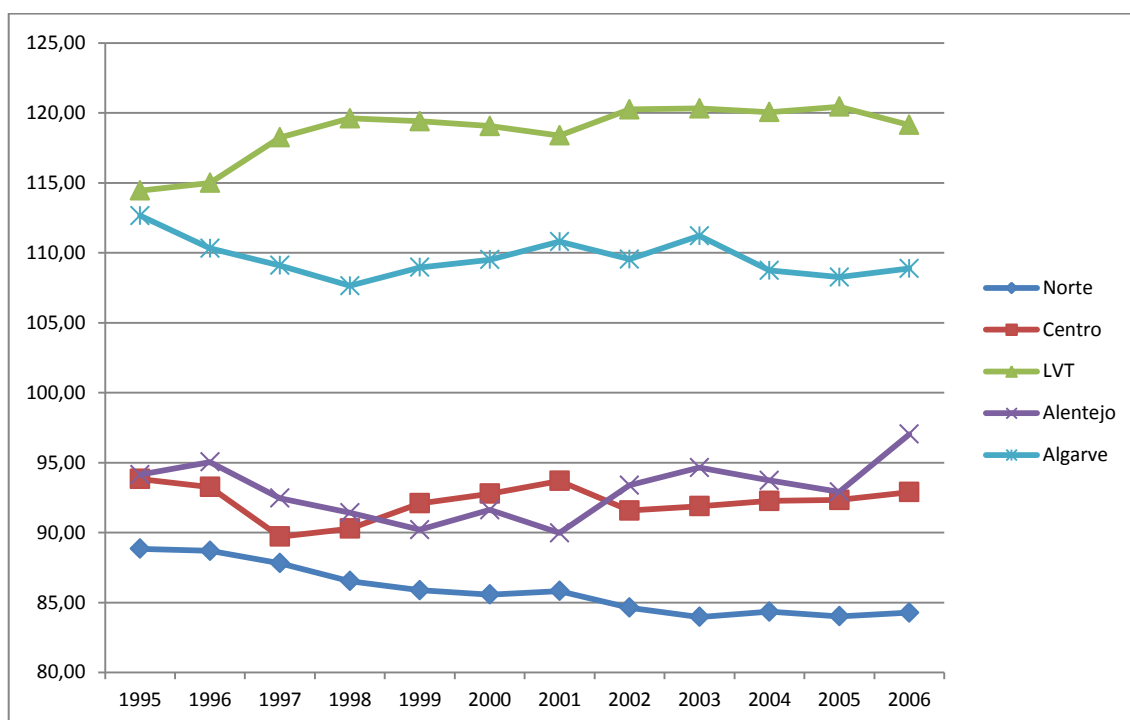
Figures 4.1 and 4.2 show, respectively, the evolution of the disparity in rates of GDP and GDI_f , per capita, considering the value of the Continent equal to 100.

Figure 4.1: Regional disparity indexes (Continent = 100) in per capita GDP for the period 1995-2006



Source: Constructed by the author and based on National Accounts (INE, 2009).

Figure 4.2: Regional disparity indexes (Continent = 100) in per capita GDI_f for the period 1995-2006



Source: Constructed by the author and based on National Accounts (INE, 2009).

The relative positioning of regions in terms of two indicators is similar, but the disparity is greater in per capita GDP.

The regions of Lisbon and Vale do Tejo (LVT) and the Algarve are always above the average of the continent, both in terms of GDP, as GDI. In the case of the LVT region, the disparity is greater in GDP values per capita (above the average of the continent between 25 and 30%). The Algarve region reveals an inverse situation, with values for per capita GDP slightly above average (between 2 and 7%) and a higher differential in per capita GDI (8 to 13% above the average of the Continent).

Actually, these values are not surprising, because GDP refers to the place of production, while the GDI reports income of households, and the LVT region is an attractive region of work force, which receives everyday people working in this area, but who lives elsewhere.

In Algarve, the difference in disparity between the two indicators is not so clear, but may indicate that the resident population in the Algarve is being forced to seek work outside of this region during the months outside beach time. The tourism is the economy support of this region, and reaches its maximum activity during the bathing season, during the summer, creating seasonal employment. As such, in the autumn and winter, this region has a repelling

effect, contrary to the LVT region, and residents contribute to the production assets elsewhere.

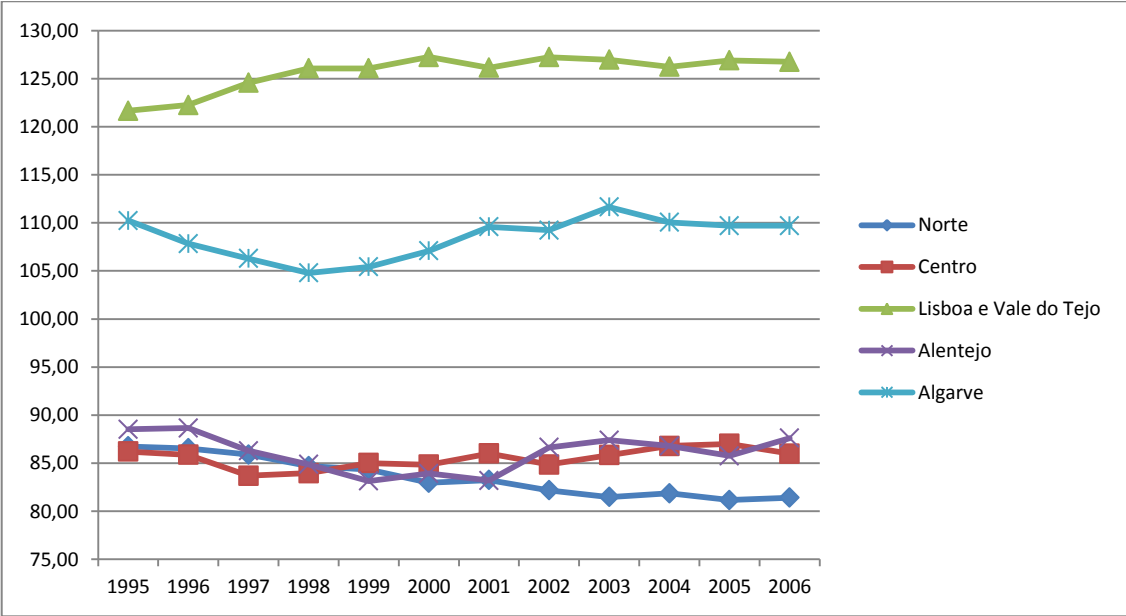
The other three regions, Norte, Centro and Alentejo reveal disparity indicators below the average of the continent, both in GDP, as in GDI.

The Alentejo reveals a tendency to converge to the average in both indicators, but more evident in the GDP. The behavior of GDP per capita in the Alentejo is very influenced by the pole of the petrochemical industry, and port of Sines, which has resulted in increasing regional productivity.

The Centro region does not show a trend clearly convergent or divergent, but the Norte region has been increasing, albeit slightly, the average departure from the continent, both in terms of GDP, as GDI.

If we look at the figure 4.3, on the regional disparities in rates of primary income³, and compared with those for the GDI, we can confirm the redistributive function of the state, not between individuals or families, but between regions. Since the GDI results from the algebraic sum of primary income and redistribution transfers, it is expected that the differences in disposable income per capita between regions, are generally less pronounced than in the case of primary income.

Figure 4.3: Regional disparity indexes (Continent = 100) in primary income per capita for the period 1995-2006



Source: Constructed by the author and based on National Accounts (INE, 2009).

³ Primary income consists of the Workers' Compensation received, of the gross operating surplus, plus the balance of property income for households living. Gross disposable income differs from Primary Income on account of Redistribution Transfers.

For values per capita, there is indeed a transfer of income, although slight, from the regions that have Primary Income per capita above the national average (Lisboa e Vale do Tejo and Algarve), to the other regions. Those regions have higher levels of disparity index in primary income, approaching the middle of the continent with regard to GDI, while the regions Norte, Centro and Alentejo, take an opposite behavior, and are also close to this average in GDI, because they benefit from the redistribution transfers.

Variables such as age structure of population and rates of aging and dependency of the regional population, as well as population activity rate and employment (or unemployment), are factors that influence the values of redistributive transfers in each region. Actually, the regions with the youngest population, more working age population and lower unemployment rate, tend to be net payers, while the regions with the aging population and higher dependency ratios will tend to be net recipients.

The regional dispersion in terms of primary income (and hence disposable income of households) can be studied through the wages, since they represent about 40% of the total resources of families⁴.

The fees are the only component of income, for which we have information available at the level of municipalities (geographic units of analysis under analysis), we studied further by their relative positioning in terms of average monthly compensation per employee on account of others (TCO), the current prices of each year. Information relating to the remuneration and working for others, by county and industry of employment is derived from the survey plan, implemented by the Office of Strategy and Planning (DGEEP) of the Ministry of Labour and Social Solidarity⁵.

By choosing the county as the spatial unit of analysis, it raises the problems of change in nomenclature of them, because during this period were created new administrative units at this level (new county). As such, for our annual results being comparable, we will be based on the Nomenclature of Territorial Units for Statistics for 1990 (Annex B), and for subsequent years, we convert the data into the same classification of counties.

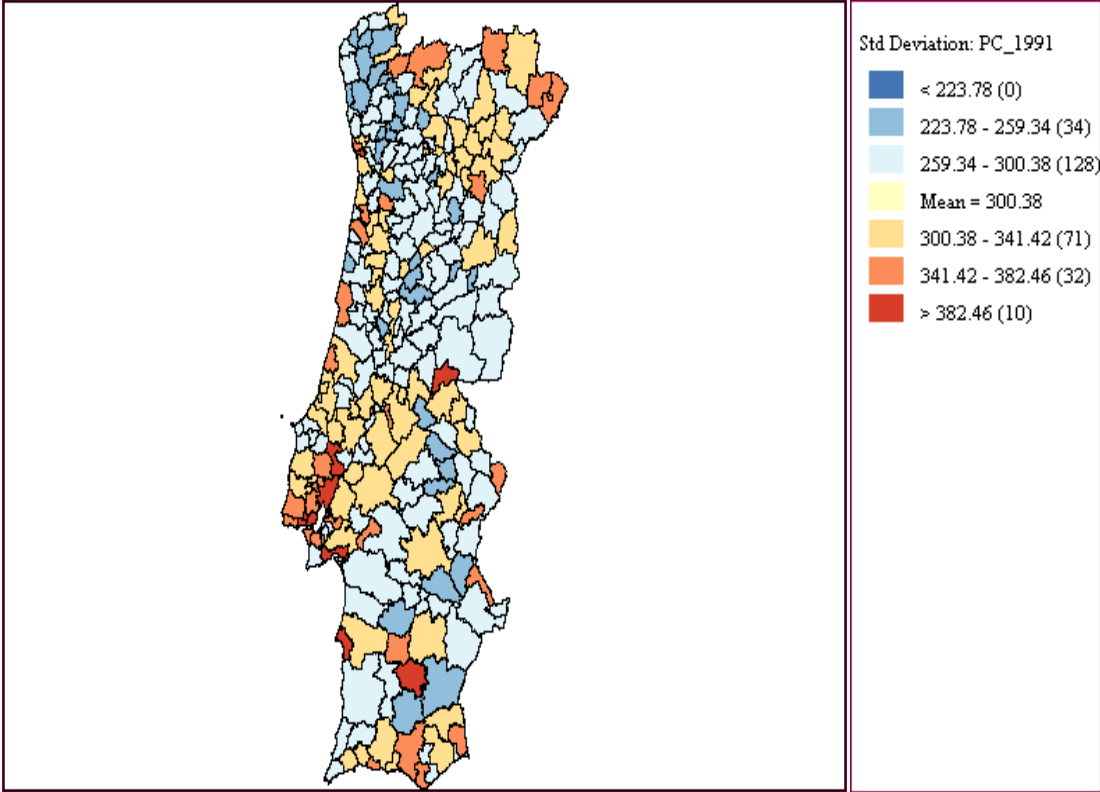
We divide the temporal scope of our study in three points of analysis: the initial year of our series, 1991, the final year of our convergence study conducted in the next working paper (2002) and 2006 with the most current data available.

⁴ Saúde (1997) confirms the high proportion of wages, in structure of total income in each region, as well as the contribution of this variable to deviations in GDI per capita of each region and their respective national average.

⁵ According to the Decree-Law no. 123/2002 of 4 May, it is a legal obligation for all employers, including the services of central, regional and local levels, and all public institutions with workers at its service, under a contract of employment.

Our analysis rests on three types of indicators: standard deviation of the average monthly remuneration in each municipality, from the average of these, cartogram and graphical representation of disparity indices and identification of outliers' municipalities.

Figure 4.4: Map of the standard deviations in the average monthly wage per municipality in 1991



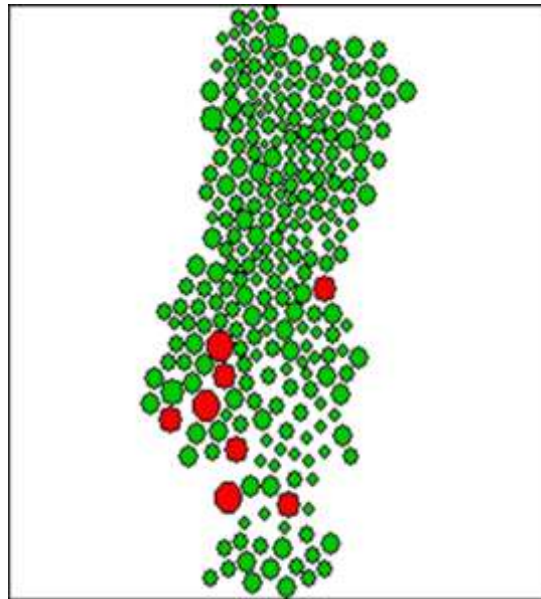
Source: Constructed by the author in GeoDa, and based on monthly average wages per municipality in 1991.

As Figure 4.4 shows, the average wage for the Continent in 1991 was € 300.38, while the vast majority of municipalities (162), had an average wage less than this value. Only 10 municipalities register a wage much higher than that average. These municipalities (*high outliers*) are treated as outliers by the software GeoDa⁶, and the higher values (also with high disparity indicators) are shown in Figure 4.5 by red circles (the diameter of the circles is directly related to the value of the index of disparity assumed for each municipality).

For a better identification of these municipalities, in the scatterplot of earnings (Figure 4.6), we list the municipalities with higher and lower disparity indicators (the value 100 corresponds to the average monthly compensation for Portugal).

⁶ Software developed by Luc Anselin for handling spatial data, which allows the construction and manipulation of maps and charts, as well as the analysis of spatial and realization of spatial regression.

Figure 4.5: Shaded representation of disparity indicators (and identification of outliers) in average earnings in 1991 per municipality

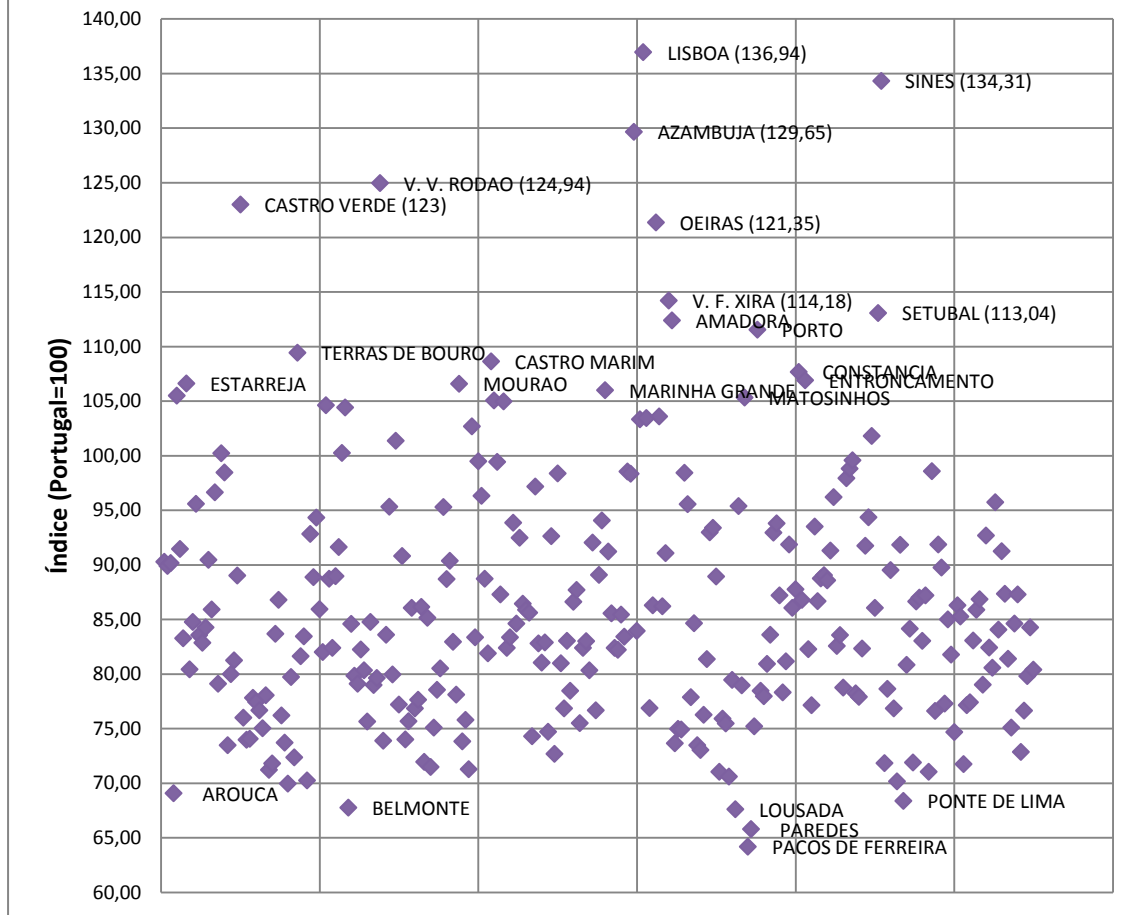


Source: Constructed by the author in GeoDa.

We identify the municipalities of Lisboa (37% monthly wage above the average for the country), Sines (34% above average), Azambuja (30%), Vila Velha de Rodão (25%), Castro Verde (23%), Oeiras (21%), Vila Franca de Xira (14%) and Setúbal (13% above average), with the highest average monthly wage in Portugal. The explanation of this phenomenon are certainly factors such as economic specialization of municipalities, the qualification of the workforce and company size.

The municipalities with the lowest average monthly compensation are Paços de Ferreira (36% below average), Paredes (34%) and Lousada (32%).

Figure 4.6: Disparity index, by municipality, in average monthly compensation in 1991

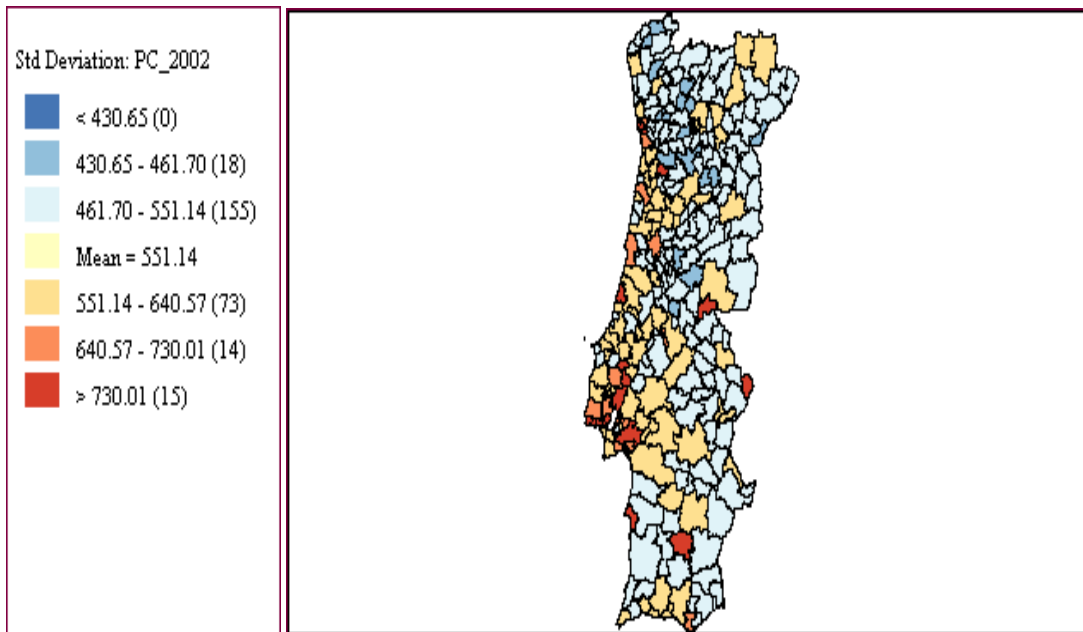


Source: Constructed by the author and based on monthly average wages per municipality in 1991.

In 2002, we have more municipalities (173) below the average monthly compensation from the mainland (€ 551.14), and there are also more municipalities (now 15) in the upper range of distribution, as shown in the figure 4.7. This can be a first sign of increase in the dispersion, or in inequality in monthly average wages for the municipalities. Throughout this chapter, through various instruments, we will try to answer this question.

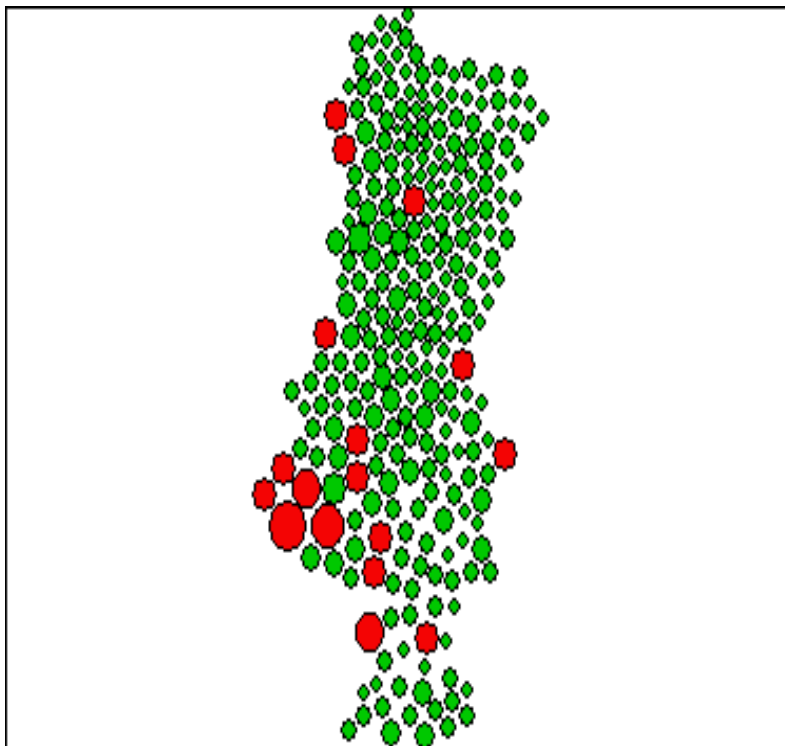
Again, the municipalities of very high values in terms of average wage (very high disparity indicators) in 2002 are highlighted in red in Figure 4.8 and identified in Figure 4.9.

Figure 4.7: Map of the standard deviations in the average monthly wage per municipality in 2002



Source: Constructed by the author in GeoDa, and based on monthly average wages per municipality in 2002.

Figure 4.8: Shaded representation of disparity indicators (and identification of outliers) in average earnings in 2002 per municipality



Source: Constructed by the author in GeoDa.

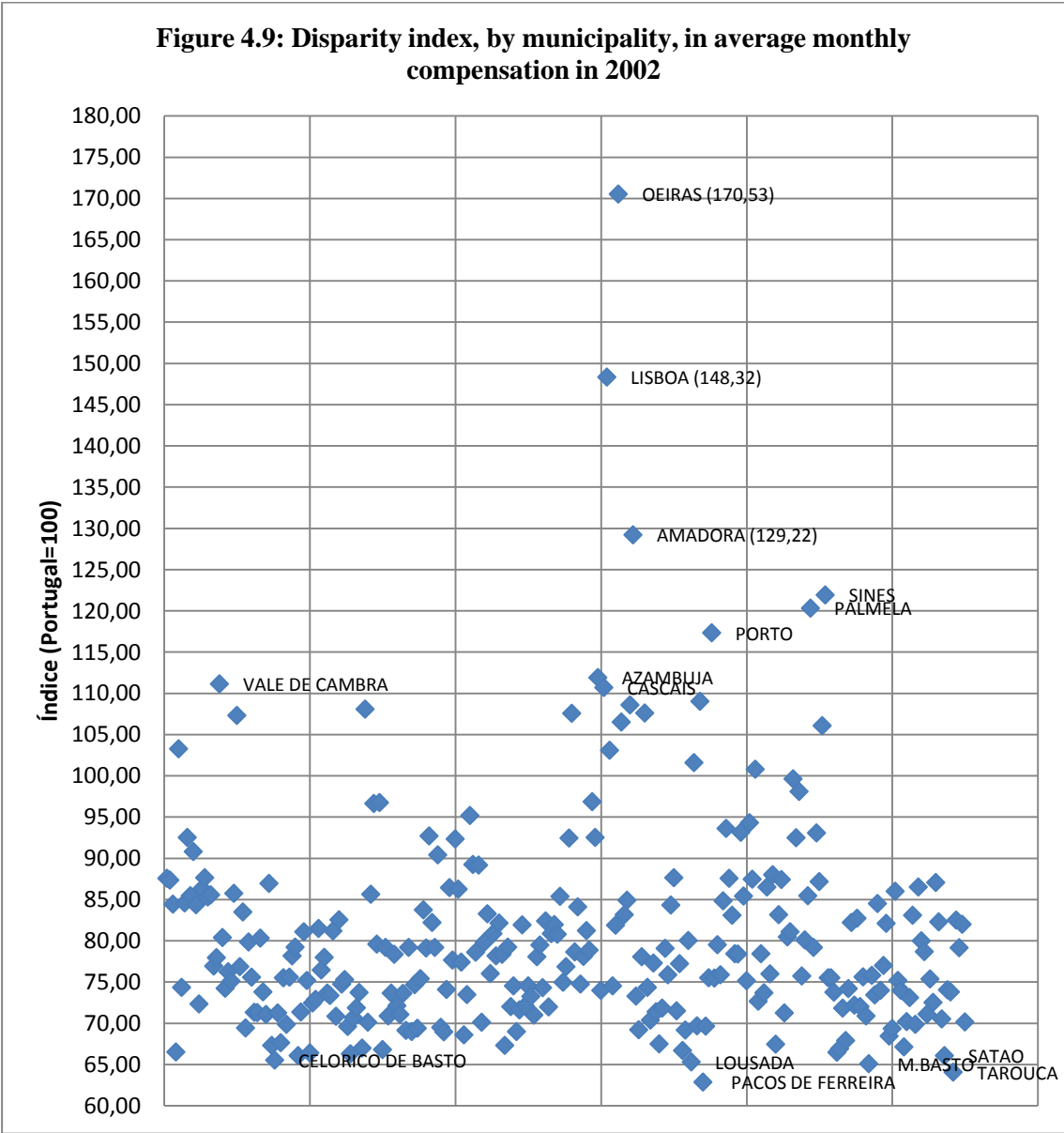
The municipalities in the metropolitan area of Lisbon (Oeiras, Lisbon, Amadora Sintra, Cascais, Vila Franca de Xira, Setúbal and Palmela), with extension to Azambuja,

accompanied now by the municipalities of Porto and Matosinhos (Metropolitan Area of Porto) and Marinha Grande in Centro region and Sines in Alentejo, all on the coast, have the best indexes.

On the inside, in addition to Vila Velha de Rodão and Castro Verde, which have already indicated above-average earnings in 1991, in 2002, we have the municipalities of Vale de Cambra (11% above average) and Campo Maior (7.6 %).

We would like to draw attention to the high variance of the average pay in Oeiras and Lisboa compared with the average for the continent, reaching 71% and 48% above average, respectively, which points to large disparities in income distribution.

Again we find Paços de Ferreira with the lowest monthly earnings (37% below average).

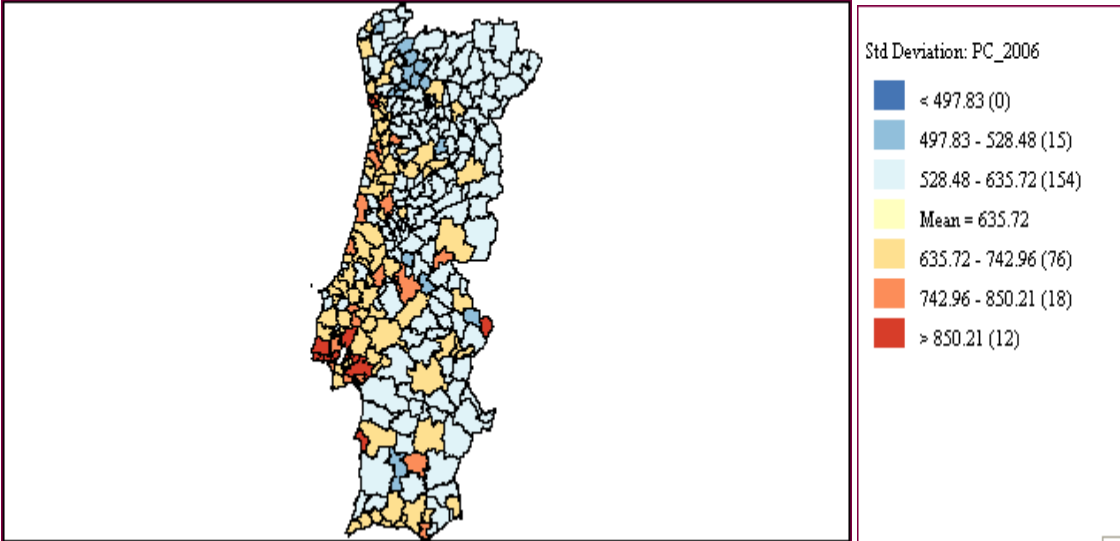


Source: Constructed by the author and based on monthly average wages per municipality in 2002.

In 2006, the reality in the dispersion of average monthly wages slightly modified, but now we have 169 municipalities below the average for the continent, and 12 municipalities at the highest level of distribution, as elucidated in Figure 4.10.

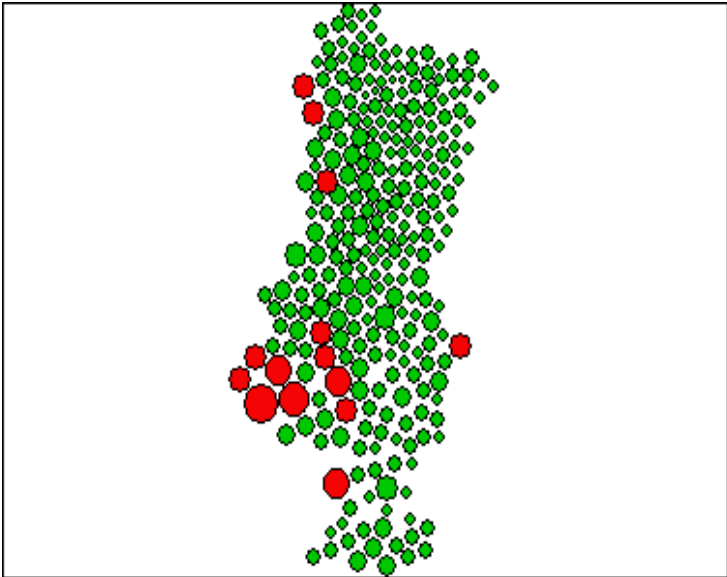
There were however, changes in the high outliers' municipalities and also of their relative positions. Figure 4.11 identifies 8 high outliers in the metropolitan area of Lisboa (Lisboa, Oeiras, Amadora, Cascais, Sintra, Vila Franca de Xira, Montijo and Palmela), extending to Azambuja. Alcochete appears now as a high outlier (about 50% above average), being the municipality with the second highest rate of disparity, just after Lisboa.

Figure 4.10: Map of the standard deviations in the average monthly wage per municipality in 2006



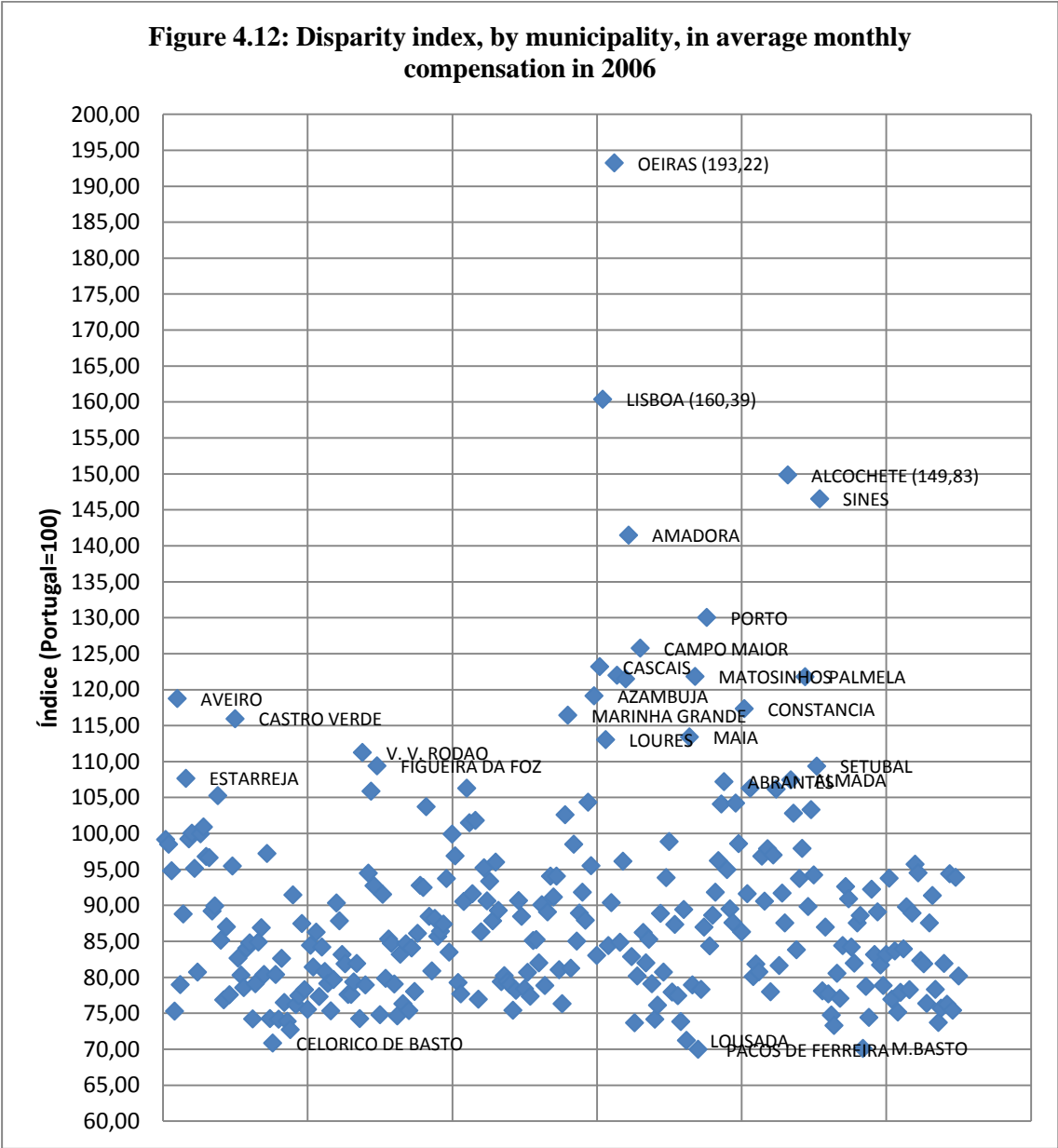
Source: Constructed by the author in GeoDa, and based on monthly average wages per municipality in 2006.

Figure 4.11: Shaded representation of disparity indicators (and identification of outliers) in average earnings in 2006 per municipality



Source: Constructed by the author in GeoDa.

Lisbon has now the highest disparity indicator, compared to 2002 and 1991, with an average monthly wage 60% above national levels, and Oeiras has a monthly average wage that is almost the double of national rate.



Source: Constructed by the author and based on monthly average wages per municipality in 2006.

Again the municipality of Paços de Ferreira, remains in last place in terms of average monthly compensation, although the gap relative to the average is now lower (30% below the national average).

5 Inequality measures applied to municipalities' monthly average wage for the period 1991-2002

In order to be able to infer about the inequality we obviously must use inequality indicators. One indicator of inequality is an index that, given a particular distribution of

income, provides a number, a value for the inequality that this distribution displays, thus allowing to compare several distributions, It is a statistical summary of the distribution, such as mean and variance, the latter could even be used as an indicator of inequality (the coefficient of variation is calculated from the variance) [Cowell (2008)].

As such, we recover here some of the indicators proposed by Portnov and Felsenstein (2005) [Table 5.1] and applied to the distribution of average wages (per employee- TCO) per month and per municipality, in the period 1991-2006.

Table 5.1: Measurements of regional inequality

Indicator	Formula
Coefficient of variation (CV) (unweighted)	$CV = \frac{1}{\bar{y}} \left[\frac{1}{n} \sum_{i=1}^n (y_i - \bar{y})^2 \right]^{1/2}$
Population weighted coefficient of variation (Williamson index (WI))	$WI = \frac{1}{\bar{y}} \left[\sum_{i=1}^n (y_i - \bar{y})^2 \frac{A_i}{A_{tot}} \right]^{1/2}$
Theil index(TE(0))	$TE(0) = \frac{1}{n} \sum_{i=1}^n \ln \frac{\bar{y}}{y_i}$
Atkinson index(AT)	$AT = 1 - \left[\frac{1}{n} \sum_{i=1}^n \left[\frac{y_i}{\bar{y}} \right]^{1-\varepsilon} \right]^{1/(1-\varepsilon)}$
Hoover coefficient (HC)	$HC = \frac{1}{2} \sum_{i=1}^n \left \frac{A_i}{A_{tot}} \frac{y_i}{\bar{y}} - \frac{A_i}{A_{tot}} \right $
Coulter coefficient (CC)	$CC = \left[\frac{1}{2} \sum_{i=1}^n \left(\frac{A_i}{A_{tot}} \frac{y_i}{\bar{y}} - \frac{A_i}{A_{tot}} \right)^2 \right]^{1/2}$
Gini (U) (unweighted)	$Gini = \frac{1}{2n^2 \bar{y}} \sum_{i=1}^n \sum_{j=1}^n y_i - y_j $
Gini (W) (population weighted)	$Gini = \frac{1}{2\bar{y}} \sum_{i=1}^n \sum_{j=1}^n \frac{A_i}{A_{tot}} \frac{A_j}{A_{tot}} y_i - y_j $
<p>Note:</p> <p>A_i e A_j = nº of individuals in regions i e j, respectively (regional populations); A_{tot} = national population; Y_i and y_j = <i>per capita</i> development parameters observed respectively in region i e j (e.g., <i>per capita</i> national income); \bar{y} = national average; n = number of regions; ε is an inequality aversion parameter, $0 < \varepsilon < \infty$ (the higher it is, more society is concerned about inequality).</p>	

Source: Portnov e Felsenstein (2005).

Among the indicators of inequality proposed by Portnoy and Felsenstein (2005) for application to territorial units (rather than individuals or households), we selected the coefficients of variation, weighted and unweighted, Gini coefficients, weighted and unweighted And the Theil indices, and apply to our own distribution (Table 5.2). As weights we used the number of employees by municipality and for each year, because it is recommended in the literature [Cowell (2008a and 2008b)]: when we use average values per capita or per worker, as is our case, it should be used as weight the population that is the basis of this calculation (employees - TCO).

Table 5.2: Measurements of regional inequality applied to wage distribution among municipalities, at current prices

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2002
<i>Coefficient of variation (unweighted)</i>	0.137	0.147	0.146	0.147	0.152	0.148	0.154	0.156	0.158	0.155	0.162
<i>Coefficient of variation weighted by number of workers</i>	0.209	0.218	0.223	0.224	0.240	0.236	0.242	0.246	0.255	0.259	0.270
<i>Theil Index</i>	0.009	0.010	0.010	0.010	0.011	0.010	0.011	0.011	0.011	0.011	0.012
<i>Atkinson Index(C=1)</i>	0.009	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.010	0.011
<i>Gini Coefficient</i>	0.073	0.077	0.076	0.077	0.077	0.076	0.078	0.076	0.078	0.077	0.078
<i>Gini Coefficient weighted by number of workers</i>	0.117	0.121	0.124	0.124	0.132	0.130	0.133	0.135	0.139	0.141	0.145

We repeat the calculations to the indicators of inequality for earnings at constant prices of 1991, but virtually no change in the results and especially in the trend (table 5.3) could be observed, so we base our analysis on the evolution of indicators calculated on the salaries at current prices. For the calculation in constant prices, since we are working wages under the income approach and not by the production approach, the deflator used was the Consumer Price Index (CPI). The CPI is calculated only at the level of disaggregation of NUTS II (level II of the Nomenclature of Territorial Units for Statistics), so municipalities' values are deflated by the CPI's NUTS II region in which each municipality belongs.

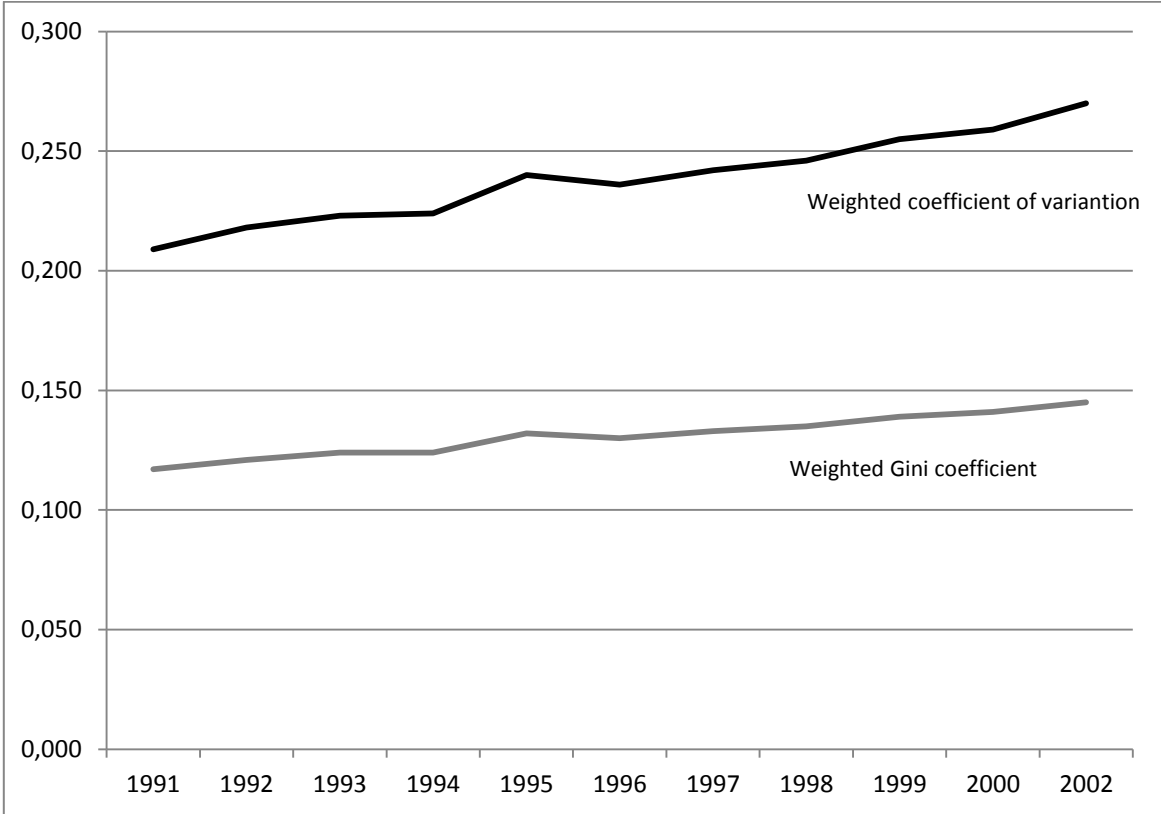
Table 5.3: Measurements of regional inequality applied to wage distribution among municipalities, at 1991 prices

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2002
<i>Coefficient of variation (unweighted)</i>	0.137	0.145	0.143	0.144	0.149	0.145	0.150	0.151	0.153	0.151	0.159
<i>Coefficient of variation weighted by number of workers</i>	0.209	0.210	0.215	0.216	0.233	0.230	0.234	0.236	0.246	0.251	0.264
<i>Theil Index</i>	0.009	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011
<i>Atkinson Index(C=1)</i>	0.009	0.009	0.009	0.009	0.010	0.009	0.010	0.010	0.010	0.010	0.011
<i>Gini Coefficient</i>	0.073	0.076	0.075	0.075	0.076	0.074	0.076	0.074	0.076	0.076	0.077
<i>Gini Coefficient weighted by number of workers</i>	0.117	0.117	0.120	0.120	0.129	0.126	0.129	0.130	0.135	0.137	0.142

As stated by Cowell (1998a), if the receiving units of income (households, or by adapting to our study, territorial units) have different dimensions in terms of population, these differences should be reflected in calculation of inequality indicators, incorporating weights, and in our work, the generic weight w_i corresponds to dividing the number of workers in municipality i , by the total number of workers on the Continent, for each year separately.

In fact, our municipalities have very different characteristics, both in demographic and economic terms⁷, so it only makes sense to analyze the behavior of the indicators weighted coefficient of variation (WI) and weighted Gini [Gini (W)], which are represented in Figure 5.1. Moreover, Portnoy and Felsenstein (2005) show the indices WI and Gini (W) to be the most appropriate, when measuring regional inequality in small countries.

Figure 5.1: Weighted coefficient of variation and weighted Gini Coefficient from 1991 to 2002



Taking into account that these coefficients assume values between 0 and 1, corresponding the 0 to a absence of inequality and the value 1 to a maximum inequality, we conclude that we have a spatial distribution of salaries moderately uneven, but tending to become increasingly unequal, since both indicators increased over the period under review.

⁷ The structure of number of employees (TCO) by municipality turns out to reflect differences in activity rates and employment, and also the asymmetries on the spatial concentration of economic activity and company size.

6 Conclusion

The evolution of inequality measures reveals an increased divergence (and therefore no convergence) at the level of average wages by municipality.

With a different analysis (measures of inequality between individuals or families), Rodrigues (2008) also concludes that in Portugal, despite the improvement of living conditions, inequalities have widened over the decade of 90. In fact, the gap between the municipalities of Portugal revealed in our research reflects the inequality between the individuals who inhabit these regional units, which is studied in Rodrigues (2008).

We identified the presence of outliers in terms of municipality's average wage, in particular some municipalities of the metropolitan area of Lisboa and also some of the metropolitan area of Porto, although the former have always higher values. The value of average wages of municipalities in metropolitan area of Lisboa, especially in Lisboa and Oeiras, is increasingly distant from the average value for the other municipalities in the country, thus accentuating the dispersion in the distribution and the inequality.

In our view, the distribution of earnings reflects only the actual distribution of economic activity, particularly concentrated in the coastal and metropolitan areas of Lisboa and Porto. The economic specialization and level of education among the population of each territorial unit, are also, of course, crucial for this asymmetry on earnings.

However, in the next step of our research, applying a different methodology - testing the two concepts of convergence introduced by Sala-i-Martin (1990): σ convergence and β convergence - we will try to better understand if there is or not convergence between the municipalities, in respect to the growth of earnings over this period.

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