Development and Regional Disparities – Testing the Williamson Curve Hypothesis in the European Union

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In this paper I examine the relationship between within-country regional disparities and the development of nations in the enlarged European Union. Using panel data methods, I find evidence on the Williamson curve hypothesis, which says that disparities are lower in the early stages of development, peak in middle-income stages, but diminish again as a country becomes rich. More importantly, however, I point out that several factors have a greater influence on disparities than national income. Among these country-specific factors, the date of EU accession plays an outstanding role, being responsible for more than one-half of the differences in regional disparities between the Member States. Four other factors connected to EU membership are also possible reasons for the disparities: the economic transition process in the new Member States, Economic and Monetary Union, the funds made available by the EU Structural and Cohesion Funds as well as effective institutions.

1 Introduction

According to the European Commission, in every fourth region of the enlarged EU, GDP per capita is below 75% of the EU average, which makes these regions eligible for the Convergence objective of the EU Structural Funds (European Commission, 2006). These "Convergence regions" are characterized by low levels of GDP and employment; their share in the EU's total GDP is only 12.5%, compared with a 35% share in the EU's total population. The same can be observed within certain EU countries. In some regions, economic welfare is lower than on average in the country. This applies especially to the "new" EU Member States. In Hungary, the GDP-per-capita level in the central region is slightly above the EU average, while in the poorest regions, it is only slightly more than 40% of the EU average. Similar effects can be observed in the Czech Republic, while in Slovakia, the Bratislava region is three times as rich as the poorest one. Bulgaria (currently the poorest EU member) faces lower regional differences, though, and we also have the impression that the Western European countries are more equal in this sense.

While there is a vast number of research papers on the convergence of individual EU countries, the regional dimension often seems to have been neglected. The aspect of convergence most frequently emphasized is that poorer EU countries must somehow catch up with the more developed ones. As data availability has improved, researchers have recently also started to focus on the convergence of regions, i.e. whether poorer regions as a group will be able to converge to the richer ones. However, little attention has been paid to within-country disparities and their development. Taking a look at these data, many questions arise. Are these regional disparities a characteristic of countries that have been poor anyway, or is it a common phenomenon in the EU? Is this difference related purely to the countries' income differences, or is

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there also a difference between "old" and "new" EU Member States? If the poorer countries are intent on speeding up the convergence process, will this not influence their regional disparities?

The aim and thus the contribution of my paper is to examine the hitherto neglected relationship between within-country regional disparities and development. I study whether the differences in a country's development level can explain the differences in regional disparities, or whether something else causes these inequalities. As regional GDP data are more reliable and more easily available now, it is possible to carry out the research for the whole EU, including not only those countries that joined the EU in 2004, but also Romania and Bulgaria. Previous research was not able to examine such a vide variation in the data, and thus had a limited use only. Besides, I do not only make a simple cross-country analysis, contributing to the studies that examine disparities, but I use panel data for the period between 1995 and 2004. This way I extend the research in two directions. On the one hand, I observe how disparities in a certain country evolve in line with its development, which means I am not limited to generalizing the results of a pure cross-country analysis. On the other hand, I examine also the relationship between the speed of development and of disparities, which is not possible if one looks at only one point in time.

The remaining part of the paper is structured as follows. Section 2 provides a review of the relevant theoretical and empirical literature. Section 3 compares two simulations of the evolution of regional disparities within a country group. Section 4 provides descriptive statistics of regional differences and their change for the examined EU countries. Section 5 estimates different panel data models in order to detect the relationship between a country's development and within-country regional inequalities as well as the relationship between the speed of a country's growth and the (speed of changes in) inequalities. Section 6 discusses the results, suggesting possible driving forces behind the findings of the previous sections, and section 7 concludes.

2 Literature Review

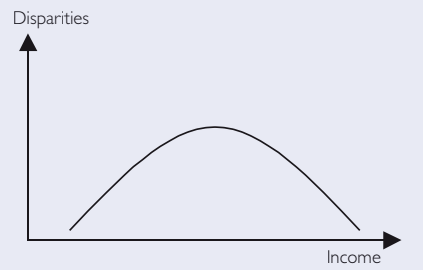
Based on Solow (1956), neoclassical economists thought that regional disparities diminish with growth simply because of diminishing returns to capital. In a competitive environment, regional labor and capital mobility leads to factor price convergence and thus also to the convergence of regions within a country. However, Myrdal (1957) and other post-Keynesians maintain that growth is a spatially cumulative process, which is likely to increase regional inequalities.

Williamson (1965) took up Kuznets' hypothesis, which describes the relationship between income inequalities among households and the development level of the country examined.[2] Similar to Kuznets, Williamson claims that national development creates increasing regional disparities in the

[2] *In particular, the Kuznets curve says that income inequality tends to increase with income at low income levels and to decrease at higher levels of income. One possible reason is that in the early stages of development, when investment in physical capital is the main engine of economic growth, inequality stimulates growth by directing resources toward those who save and invest the most. By contrast, in more developed economies, human capital accumulation takes the place of physical capital accumulation as the main growth driver, and inequality impedes growth because poor people cannot finance their education in imperfect credit markets.*

Chart 1

The Williamson Curve



Source: Williamson (1965).

early stages of development, while later on, development leads to regional convergence. This results in an inverted U-shaped curve as depicted in chart 1.

The main argument behind Williamson's finding is that in a catching-up country there are a few growth pole regions in which capital and skilled workers are concentrated. As a consequence of a faster rise in productivity, growth accelerates in these regions, which leads to increasing regional disparities. At later stages, as higher factor costs or diseconomies of agglomeration emerge in the growth pole regions, capital is likely to move to other regions with lower capital per worker. This, together with knowledge spillover effects, may enhance the reallocation of productive factors across sectors and regions, which leads to spatial convergence.

As mentioned before, only little empirical research has been devoted to this issue and applied to the EU. Among the few papers are Davies and Hallet (2002), who examine two groups of countries in the period from 1980 to 1999: the four cohesion countries Greece, Portugal, Spain and Ireland[3] as less developed countries, and Germany, the UK and Italy as more developed countries. They find some evidence of the ascending side of the Williamson curve, as the catching-up process is driven by a few growth poles while the other regions lag behind, which leads to increasing inequality. However, they obtain only a weak relationship between development and regional disparities on the descending side of the Williamson curve. Davies and Hallet find that institutional aspects, e.g. the degree of emphasis placed on proactive regional policy, are determinants of the reduction of disparities in the later stages of development.

Petrakos, Rodríguez-Pose and Rovolis (2003) include eight EU countries in their study (France, UK, Italy, Portugal, Spain, Belgium, Greece, Netherlands) and examine the period between 1981 and 1997 using spatial econometric analysis. Their results show that, ceteris paribus, faster GDP growth results in a higher increase in regional inequalities. Besides, higher GDP levels go together with lower levels of disparities. They also find that regional disparities at national and EU level are procyclical in the short run, increasing in periods of expansion and decreasing in periods of slow growth. Meanwhile, long-term development processes tend to favor a more equal allocation of activities and resources.

A different approach is used by Dall'erba and Le Gallo (2003), who extend their study to 12 countries (the EU-15 minus Austria, France, and the UK), covering the period between 1989 and 1999 and using spatial econometrics. They focus on within-EU disparities, dividing the EU into core and periphery

[3] *Ireland was also considered a cohesion country before its economic boom, as it was entitled to receive grants from the EU's cohesion funds.*

regions. The former include regions in more developed countries, while the latter cover regions in less developed countries. They find significant convergence among the periphery regions, but they do not obtain the same result for the core regions. Dall'erba and Le Gallo argue that the EU's structural funds have benefited the targeted regions; however, spillover effects from the funds' impact are present only in the core regions. The reason for this might be that core regions are generally smaller, and better connected with each other through trade and transportation networks.

Finally, Brasili and Gutierrez (2004) cover 15 EU countries in their study, examining the period between 1980 and 1999. They use both distribution dynamics and panel data analysis to have a wider look at the topic. They obtain considerable evidence of convergence: The distribution analysis shows that the per-capita income levels in poorer countries tend to converge toward the mean. They find no evidence of a polarization of the EU regions into "twin peaks." Their panel data analysis also confirms these findings and demonstrates that the convergence process is more intense among low-income regions.

3 The Relationship between Development and Disparities

If we assume that Williamson's hypothesis is correct and that there are some development hubs in the early stages of development which pull a country's overall performance, while other regions join in later, we can draw a picture of how disparities might evolve during the development phase. In the following, I will compare two simple models which result in different paths of disparities. This is useful because it provides an indication of the possible functional forms I should estimate.

Lucas (2000) sets out a simple growth model with four regions. Each of the regions has an income level of unit 1 at time 0. At time 1, income in region A starts to grow at a rate of 2%. 20 years later, region B starts to catch up, another 20 years later, region C joins in, and so on. The growth rate in each catching-up region (B, C, D) is 2% plus a factor $\beta = 0.0025$ times the income gap to region A in each preceding year.

Chart 2

Simulation of Disparities 1

Source: Author's calculations based on Lucas (2000).

As chart 2 demonstrates, at time 120, each catching-up region will have reached the income level of region A (actually, the gap is almost 0 already at time 100). If we take either the coefficient of variation or the standard deviation of per-capita GDP as a measure of regional inequality, the right panel of chart 2 shows that disparities start to increase fast as the privileged region begins to grow. Inequalities will diminish slightly only after the country's average income level has reached about 2.5 (this happens at year 60), and after the growth rate in the whole country has reached its maximum, which is 3%. Thus, the relationship between the development level and regional disparities is very similar to that examined by Williamson. It is easy to imagine that an analogous process is typical also of the EU. More developed countries indeed grow at a slower pace and we have the intuition that they are characterized by lower disparities.

A different approach is to follow Quah (1993). He divides the countries of the world into five groups depending on their relative development level. Then he estimates a transition matrix; a cell represents the probability of a country moving from one particular group to another in a given year. He finds that 97% of the rich countries remain rich and 99% of the poor remain poor, while some countries move from the middle toward either end. It can be shown that this results in "twin peaks," i.e. there will be more rich and poor countries and fewer middle-income countries. If we take 100 equally developed countries at time 0, in 100 years the distribution of income will look like in chart 3.

From this empirical result, we can deduce the evolution of disparities. In order to obtain a curve that is similar to chart 2, I took over the average income growth rates from Lucas' simulation, so that average income and income growth (right panel, blue and orange lines) are the same as before. The reason is that Quah's original paper is an empirical investigation of cross-country income levels, in which he did not include growth rates. If Quah's hypothesis prevails, the standard deviation of incomes will grow continuously in the second simulation, while the path of the coefficient of variation will show a

Chart 3

Simulation of Disparities 2

Source: Author's calculations based on Quah (1993).

logarithmic pattern, first increasing fast in line with development, but then stabilizing and remaining high even at a high development level. This level of inequality is also higher than the peak of disparities in Lucas' simulation.

Summarizing the results of the two simulations, the Lucas model suggests that convergence of regions indeed occurs. Regional disparities, after increasing in the early stages of development, will diminish as other regions also start to develop; this second group of regions will develop faster than the ones developing early. However, the model based on Quah initially assumes the existence of "twin peaks" with one permanently poor and one permanently rich group of regions, and from this it follows that disparities remain permanently high. From Lucas' model, the estimation of a quadratic regression follows, but from Quah's model, a search for a logarithmic relationship might be more fruitful. I will estimate both functional forms in section 6; however, I will pay more attention to the quadratic form for two reasons. First, it is more flexible than the monotonic logarithmic functional form, and second, the log function assumes the existence of twin peaks – which is, however, not evident in my sample.

4 Data Analysis

In this section I present the descriptive statistics regarding the regions examined. I use data on only 19 out of the 27 EU Member States.[4] The reason is that EU regions classified as NUTS 2 regions[5] are used as the inequality measure, and the other 8 EU countries themselves are classified NUTS 2. Thus, no regional differences can be observed at this level. Data on per-capita GDP at NUTS 2 level are currently available from Eurostat (the Statistical Office of the European Communities) for the period from 1995 to 2004. I also use data for some of the "new" Member States (including Bulgaria and Romania), which were, however, not EU members between 1995 and 2003: The Czech Republic, Hungary, Slovakia and Poland joined the EU in May 2004, Bulgaria and Romania did so in January 2007. Before that, Austria, Finland and Sweden became EU members in January 1995. I assume that EU membership has an effect both on a country's development and on regional inequalities. For the "old" EU members, the EU's regional policy tools (cohesion and structural funds) have been available even before the period under review, while the "new" Member States have just started to benefit from preaccession and cohesion funds.

4.1 Disparities within the EU

In 1995, GDP per capita (measured in purchasing power parities) in the observed 267 regions ranged from EUR 3,860 to EUR 37,600 with an average of EUR 14,400. By 2004, the average income level had gone up to EUR 20,800, while the range expanded, covering a minimum of EUR 5,070 and a maximum of EUR 65,100. Data for Romania are available only from 2000,

[4] *The countries are: Belgium, Bulgaria, Czech Republic, Germany, Greece, Spain, France, Ireland, Italy, Hungary, Netherlands, Austria, Poland, Portugal, Romania, Slovakia, Finland, Sweden, United Kingdom.*

[5] *For details about the classification of EU regions, see http://ec.europa.eu/comm/eurostat/ramon/nuts/introduction_regions_en.html*

Table 1

Descriptive Statistics of Incomes following EU Accession

	1995			2004		
	Whole sample	"Old" members	"New" members	Whole sample	"Old" members	"New" members
Mean	14,447	16,049	6,978	20,797	23,290	11,007
Median	15,180	15,846	6,198	21,534	22,714	9,811
Maximum	37,617	37,617	17,866	65,138	65,138	33,784
Minimum	3,858	7,836	3,858	5,070	11,714	5,070
St.Dev.	5,375	4,389	2,749	7,832	6,354	5,165
Skewness	0.51	1.41	1.88	0.79	2.04	2.28
Kurtosis	4.82	7.64	7.39	6.79	12.80	9.88
Jarque-Bera	48.52	266.34	63.96	193.41	1,018.56	156.15
(probability)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of observations	267	217	46	276	217	55

Source: Eurostat, author's calculations.

which means that the latter observation is valid for 276 regions with the somewhat downward-distorting effect of the Romanian regions. The standard deviation has also grown continuously during this period, which suggests the divergence of regions in terms of σ-convergence[6]. However, estimating the standard nonlinear equation for absolute β-convergence[7] results in $\beta = 1.3\%$ per year. This means poorer regions managed to catch up to the richer ones. This seems somewhat contradictory; however, it is not necessary that β- and σ-convergence work in the same direction. According to Sala-i-Martin (1990), β-convergence is a necessary condition of σ-convergence, and usually the former will tend to generate the latter, but it is possible for initially poor countries or regions to grow faster than initially rich ones without the cross-sectional dispersion falling over time.[8]

It is also interesting to take a look at how the distribution of income has evolved over time (table 1, rows 6 to 8). Taking all the regions, the distribution is non-normal and has a long right tail, which means there are some regions with very high incomes, while most of the regions have middle incomes. Between 1995 and 2004, the distribution became more "peaky" (i.e. the kurtosis increased) and the right tail became longer (i.e. the skewness also increased). This suggests that average-income regions have managed to gain more wealth, while some middle-income regions have joined the high-income ones, which have also developed fast. The left tail of the distribution representing the low-income regions has not changed significantly.

The long left tail indicates that incomes might concentrate in the region in which the country's capital is located. When I exclude these regions, the distribution becomes normal (highly supported by the Jarque-Bera test). Toward 2004, normality is slightly less observable as the skewness value (now

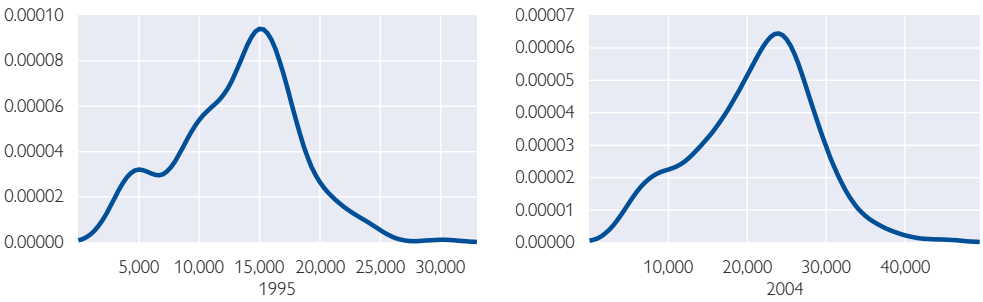
[6] *σ-convergence occurs when the standard deviation of income levels of a group of countries/regions decreases over time.*

[7] *The absolute β-convergence hypothesis says that less developed countries/regions grow faster only because they are poorer.*

[8] *For the exact correspondence between the two concept of convergence, see e.g. Sala-i-Martin (1990) or Barro and Sala-i-Martin (1995).*

Chart 4

Density Functions of Income Distribution



Source: Author's calculations based on Eurostat.

negative) decreases further while the kurtosis value falls below 3. The fact that the "capital regions" are the most developed and income is distributed normally in the other regions does not depend on EU membership. Splitting the sample into two groups (EU members and others) results in the same differences in distributions. Of course, there are large income differences between the two groups: An average "old" EU region is more than twice as rich as an average "new" EU region; however, the difference has decreased somewhat over the period under review. It is worth to take a look at the distribution graphs in chart 4 in which the capital regions are excluded. In 1995, some evidence seems to point to twin peaks – i.e. regions being divided into "old" and "new" EU regions – which have disappeared by 2004. This suggests that the assumption of the log function might not be fulfilled.

It can also be seen from the data that differences between the capital region and the other regions in the country are larger in the new EU Member States than in the others.

Between 1995 and 2004, GDP per capita (again measured in purchasing power parities) has increased continuously in almost all of the 19 countries examined. The fastest average annual growth was registered in Ireland (7.9%), while it came to more than 6% in the new EU Member States Romania, Hungary, Slovakia and Poland, to 4.6% in Bulgaria and to 4.8% in the Czech Republic. The less developed "old" members, Greece and Spain, also experienced an above-average expansion; Portugal's performance was, however, rather sluggish. From among the more developed members, the UK's high average growth (5.2%) might be surprising, while the other countries performed below average, with France, Germany and Italy being the slowest-developing countries.

4.2 Disparities within Countries

In the rest of the paper, I use the coefficient of variation as a measure of inequality, which is here the weighted standard deviation of GDP per capita levels within a country, divided by the country's GDP per capita level:

$$ineq_{it} = \left[\sqrt{\frac{1}{N} \sum_{r=1}^{n} (inc_{rt} - inc_{it})^2} \right] \Big/ inc_{it}, \qquad (1)$$

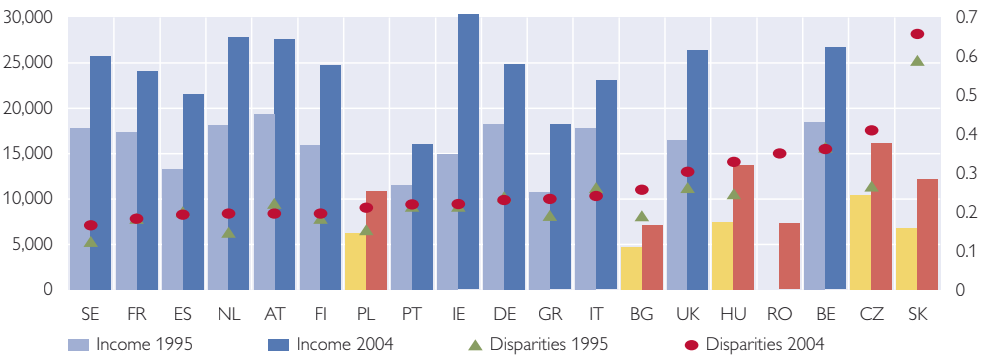
where inc_{rt} denotes GDP per capita in region r of country i. This equation is sort of a population-weighted coefficient of variation and standard deviation, since I take the squares of the deviations of the individual regional GDP per capita levels from the country's GDP per capita level, instead of using the mean of the regional GDP per capita, $\underline{inc}_{rt}$. The idea behind using this type of measure is that in countries where a relatively larger share of the population lives in the main region or in other hubs, the production process might be enormously concentrated there (also for historical reasons). This might have a significant negative effect on the other regions, and inequalities will be even higher. Compared to the "normal" coefficient of variation, the above measure produces higher disparity values when the main region is significantly larger in terms of population than the others. This is the case in France: One-third of the French population lives in Île-de-France and Bassin parisien. The results remain largely the same for countries with more than one large hub (most noticeably U.K.: London, Manchester, Leeds; or Germany: Stuttgart, Munich, Düsseldorf, etc.). Finally, measure (1) gives smaller values when the main region is only slightly larger than the others or the regions are rather equal in size.

Taking the most recent data available (2004), within-country regional inequalities are outstandingly high in Slovakia and are above average in the Czech Republic, Belgium, Romania, Hungary, and the U.K. Disparities are about average in Bulgaria, lower in the remaining countries and lowest in Sweden (see Appendix, table A.2).

The above data are presented in chart 5, together with incomes and within-country regional disparities in 1995 and in 2004. In most of the countries, regional disparities increased or remained at the same level, the only (slightly noticeable) exceptions being Austria and Italy. What does not seem to be very convincing in chart 5 is that the rise in inequalities was higher in the least developed countries. Instead, the change (and even the level) was higher in those countries which are said to have developed faster – the new EU Member States.

Chart 5

Incomes and Disparities in 1995 and in 2004



Source: Eurostat, author's calculations.
Note: Blue bars represent "old" EU members, yellow and red bars stand for the "new" members.

This observation raises the following question: Is it perhaps faster growth or convergence that drives the rise in regional disparities, rather than a country's development level? Or is it EU membership? I will answer these questions in the next section.

5 Methodology and Results

In this section I will introduce the methodology used and estimate the relationship between disparities and the level of income, as well as the relationship between disparities and income growth.

5.1 Methodology

Williamson originally applied his examination to the development path of only one country, but many empirical studies and Williamson himself draw conclusions from making cross-sectional comparisons. This has the advantage that one can compare different countries at different stages of development with different levels of regional disparities. However, it has the drawback, for example, that a cross-sectional analysis might disregard that regional inequalities expand or shrink during the economic cycle. If these cycles are not in sync in the countries under review, a comparison at an arbitrarily chosen point in time would result in biased estimates. Thus it seems logical to combine time- and cross-sectional analysis and use panel data.

Hence, I use a panel data regression model with unobserved effects of the general form:

$$y_{it} = \beta x_{it} + a_i + \varepsilon_{it}, \qquad (2)$$

where i denotes the country observation and t stands for time, while ai (also called heterogeneity effect) contains observable or unobservable (but so far unobserved) country-specific, but time-invariant factors that have an effect on the disparities. ε_{it} represents the idiosyncratic error, i.e. unobserved factors that change over time and affect y_{it}. Depending on what we think about the correlation between the unobserved effect and each of the explanatory variables, fixed or random effects estimation can be used. If the unobserved effect is independent of the explanatory variables, random effects estimation will be more efficient, because its estimators have much smaller variances than the fixed effect estimators. However, if we believe that the unobserved effect is correlated with any explanatory variable, only the fixed effect estimators are consistent (Wooldridge, 2002). In order to decide which method is appropriate, I use the random effect method, and then I carry out the Hausman test. Since the test rejects the null that the random effect model is consistent, I present the results using fixed effect estimation. This method practically estimates the a_i values for each country. It is also useful because one can see whether the chosen right-hand side variables or the country-specific effects have a bigger power in explaining regional disparities.

I apply the fixed effect model to the EU and to the Williamson curve, so equation (2) can be modified as:

$$ineq_{it} = \beta_0 + \beta_1 inc_{it} + \beta_2 inc_{it}^2 + a_i + \varepsilon_{it}, \qquad (3)$$

where $ineq_{it}$ is the measure of regional inequalities in country i in year t as defined by equation (1), inc_{it} is GDP per capita in purchasing power standards in country i in year t. It is likely that there are factors affecting regional disparities which are specific for individual countries but do not change over time, at least not over the period examined. These factors are represented by a_i. If the Williamson curve hypothesis holds, β_2 is smaller than 0, which indicates a reverse U-shaped curve. I also expect β_0 and β_1 to be strictly greater than 0. The first expectation implies that there is an initial level of inequality: A very poor country will also be characterized by some regional disparities. The second one implies that I will be able to observe not only the descending part of the curve.

By the same logic, it can be assumed that there are factors which have an impact on regional disparities; these change over time, but they have an equal effect on each country. Globalization is the most likely such factor. Thus I will also experiment with using period fixed effects, which modifies equation (3) as

$$ineq_{it} = \beta_0 + \beta_1 inc_{it} + \beta_2 inc_{it}^2 + a_i + b_t + \varepsilon_{it}, \quad (4)$$

where bt represents the vector of the period dummies.[9]

As mentioned in many relevant studies (see e.g. Petrakos, Rodríguez-Pose and Rovolis, 2003), it is very likely that the idiosyncratic error ε_{it} exhibits serial correlation and follows an autoregressive (AR) process so that

$$\varepsilon_{it} = \sum_{s=1}^{w} \rho_{is} \varepsilon_{t-s} + \upsilon_{it}, \quad (5)$$

where υ_{it} is uncorrelated across observations. After estimating equation (3), the correlogram of the residuals shows high autocorrelation. In the estimation of equation (5), the residuals exhibit a first order autoregressive process, AR(1). However, based on different unit root tests, we cannot decide on the presence of unit root.[10] Thus I use White period standard errors and covariance, which are robust for serial correlation.

As outlined in section 4, a logarithmic relationship between the disparities and a country's development might also be detected, it is, however, more rigid than the quadratic form. In order to further examine the relevance of the estimation of a log relationship, I removed country-specific effects from the data on regional disparities by regressing disparities only on country dummies, and plotted the residuals of this estimation against the income levels. Accordingly, chart 6 shows only that part of the inequalities that cannot be connected to country-specific factors. It seems that from an income level of some EUR 20,000 to EUR 24,000 upward, inequalities indeed start to decrease. However, as an alternative of the Williamson hypothesis, I estimate the logarithmic relationship of the form

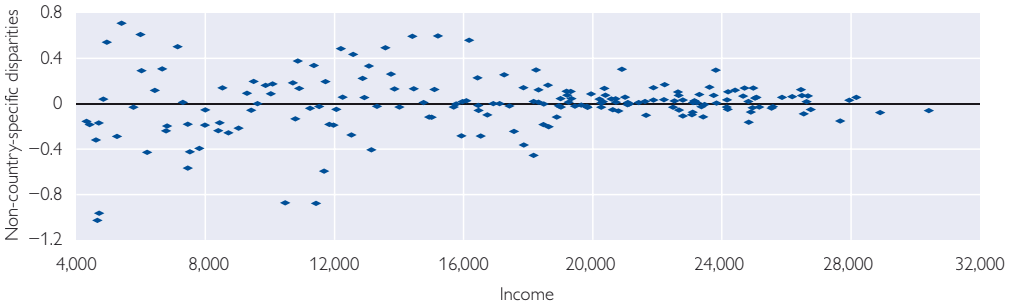
$$ineq_{it} = \beta_0 + \beta_1 \log inc_{it} + a_i + \varepsilon_{it}, \quad (6)$$

[9] *Given that I used unbalanced panel data (observations are missing in some years), using fixed cross-sectional and random period effects at the same time is not feasible.*

[10] *The Levin, Lin and Chu test, the Im, Pesaran and Shin test as well as the ADF-Fisher test are unable to reject the null of the presence of unit root, while the Breitung t-stat and PP-Fisher tests do reject it. The Hadri test cannot reject the null that there is no unit root. The specification of these tests is described in EViews (2004).*

Chart 6

Non-country-specific Disparities



Source: Author's calculations, Eurostat.

where the new variable is $\log inc_{it}$, which is the natural logarithm of the GDP per capita level of country i at time t.

Finally, as chart 5 suggests, it might be the case that countries posting faster growth experience larger or faster increasing inequalities. This is also what the two simulations in section 3 seem to suggest. In the Lucas-type simulation, disparities rise to the same point as income growth accelerates. The simple correlation between the two series is 0.29. In the Quah-type simulation, disparities grow faster during the period in which income accelerates, while the graph of inequalities becomes flatter when income growth decelerates. Here the simple correlation is 0.87. For that reason I also estimate the relationship between income growth and both the *change in* and the *level of* disparities, using the following regressions:

$$ineq_{it} = \beta_0 + \beta_1 \, \mathrm{d}\log(inc_{it}) + a_i + \varepsilon_{it}, \tag{7}$$

$$\mathrm{d}\log(ineq_{it}) = \beta_0 + \beta_1 \, \mathrm{d}\log(inc_{it}) + a_i + \varepsilon_{it}, \tag{8}$$

where $\mathrm{dlog}(ineq_{it})$ and $\mathrm{dlog}(inc_{it})$ stand for the change in the logarithm of the corresponding variable, assuming that
$\mathrm{d}\log(x_t) = \log x_t - \log x_{t-1} = \log(x_t / x_{t-1}) = \log(1 + growth(x_t)) \approx growth(x_t)$.
In two other regressions, I also include time dummies (b_t).

5.2 Income and Disparities

First, I estimate equation (4); the results are presented in table 2, model (I). Using cross-section dummies, both the coefficient on income and its square are highly significant. The coefficient on income is positive, while its square is negative, indicating an inverse U-shaped relationship between disparities and development.

The results show that regional inequalities within a country grow until the country reaches an income level of about EUR 22,800 per capita,[11] and then

[11] *This comes from finding the maximum of the estimated function by solving*

$$\frac{\partial cov}{\partial inc} = \frac{\partial(\beta_0 + \beta_1 inc + \beta_2 inc^2)}{\partial inc} = 0$$

Table 2

Income and Disparities

	Quadratic form		Log form	
	Model (I)	Model (II)	Model (III)	Model (IV)
Dependent variable *cov*	Cross-section dummies	Cross-section and time dummies	Cross-section dummies	Cross-section and time dummies
constant	0.011	0.081	−0.534	−0.935
	(0.808)	(0.316)	(0.011)	(0.157)
inc	$2.58*10^{-5}$	$2.02*10^{-5}$		
	(0.000)	(0.002)		
inc^2	$-5.67*10^{-10}$	$-4.94*10^{-10}$		
	(0.000)	(0.000)		
log(inc)			0.082	0.124
			(0.000)	(0.071)
R^2	0.967	0.968	0.959	0.961
Adjusted R^2	0.963	0.962	0.955	0.954
Cross-section F-stat	243.96	226.72	235.04	192.02
	(0.000)	(0.000)	(0.000)	(0.000)
Period F-stat		0.967		0.816
		(0.470)		(0.000)
Cross-section and period F-stat		162.68		134.17
		(0.000)		(0.000)
Number of observations	187	187	187	187

Source: Author's calculations.

Note: Marginal significance level (p-value) using White period standard errors in parenthesis.

they start to diminish. This level corresponds to the EU-25 average (the whole EU excluding Romania and Bulgaria) or Italy's development level of 2004. The estimated maximum of disparities is 0.305, which equals the disparities in the U.K. in 2004.

The F-statistics for redundant fixed effects shows that cross-section dummies and the explanatory variables are jointly significant, so that it is appropriate to use cross-section fixed effects. The R^2 of the regression is very high, but this is due to the use of the fixed effects method: cross-section dummy variables explain 88% of the variance in the data, while income and its square explain only 8%.

Model (II) also uses period fixed effects. The results change only slightly: The coefficients remain significant, but are a bit lower. From this, a lower turning point of disparities follows – EUR 20,500. The R^2 does not change, meaning that using time dummies does not improve the fit of the model. The F-statistics for redundant fixed effects show that period fixed effects in themselves would be redundant; however, together with the cross-section dummies, they are jointly significant. Thus, using period fixed effects does not have an outstanding value.

The log regression using cross-country dummies (model (III)) gives significant results as well. If the income level increases by 1%, regional disparities rise by 0.0082 in the former case. In country A with a per-capita income level that is 50% higher than that of country B, regional disparities are expected to be about 0.4 higher than in country B. (The mean of disparities in the examined 19 countries is 0.26 over the entire period.) Given the logarithmic feature of the estimation, the change in disparities slows down in the more

developed countries. Again, cross-country dummy variables explain most of the variation in disparities (90% out of 96% explained by the whole regression). Model (IV) uses period fixed effects again, and the result is significant only at 10% and the fit does not improve. For models (III) and (IV), the redundant fixed effects test produces the same results as before: Cross-section fixed effects are useful and have a strong explanatory power, while period fixed effects are not necessary.

The fact that the fit of the log regression is as good as the fit of the squared regression indicates that the more flexible squared regression catches rather the upward part of the Williamson curve, where the two functional forms do not deviate to a large extent. The deviation between the two starts increasing as income per capita rises above EUR 22,000 and becomes substantial above EUR 30,000 (the outstanding Irish level at the end of the period examined).

It is also interesting to observe the estimated cross-section dummies (table A.2): They are all positive for the new EU Member States (and Belgium), while they are negative for the other EU countries. This result strengthens my previous impression that disparities in the new Member States are higher, even when controlled for income levels. In order to further examine this issue, I create a dummy variable *nms*, which takes the value 1 for Romania, Bulgaria, Slovakia, the Czech Republic, Hungary and Poland and 0 otherwise. Slovakia, the Czech Republic, Hungary and Poland joined the EU in May 2004, and they have been eligible for the EU's Structural Funds from January 2004 on. Still, they have considerably less experience in using the EU funds than the old members. Then I regress the estimated coefficients of the cross-section dummies on the *nms* variable for all my previous models (I) to (IV):

$$country_i^M = \lambda_0 + \lambda_1 nms_i + \xi_i^M \qquad (9)$$

where the superscript *M* simply denotes the model's coefficients used.

Table 3 presents the results of the above estimations. In all equations, the nms dummy is significant at 1%. The constant represents the average disparities in the old members after controlling for income differences, and it is significant at 5%. These estimations verify that even when controlling for income differences between the countries, the new Member States face larger

Table 3

Income and Disparities

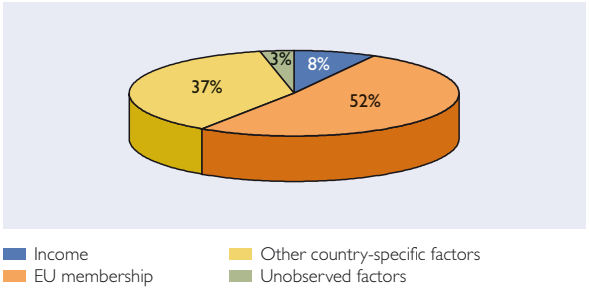
Dependent variable:	Quadratic form		Log form	
country dummies	Model (I)	Model (II)	Model (III)	Model (IV)
constant	0.149	0.121	0.128	0.155
	(0.017)	(0.048)	(0.037)	(0.014)
nms	0.213	0.173	0.183	0.221
	(0.002)	(0.009)	(0.006)	(0.001)
R^2	0.578	0.474	0.503	0.595
Adjusted R^2	0.554	0.443	0.474	0.570
Number of observations	19	19	19	19

Source: Author's calculations.

Note: Marginal significance level (p-value) using White heteroskedastic robust standard errors in parenthesis.

Chart 7

Decomposition of the Variance in Disparities



Source: Author's calculations.

disparities than the old members. The R^2 values tell that the date of EU accession explains more than 50% of the variations in disparities after controlling for income levels.

It is also visible in chart 6 that if we take model (I) as a baseline model, and decompose the variance in disparities according to the previous estimations, more than one-half of the total variation is captured by EU membership. Another significant part can be explained by some other country-specific factors. The income level, which is the main (and only) factor in the original Williamson framework, only explains 8% of the total variation. Other, unobserved factors have only negligible effects.

5.3 Growth and Disparities

I estimated four additional models on the basis of equations (7) and (8). Models (V) and (VII) use cross-country dummies only and models (VI) and (VIII) use both cross-country and time dummies. The results of these four estimations are summarized in table 4.

With the only exception of model (VI), in none of the estimated models was the coefficient on income growth (dlog*inc*) significant. The signs of the cross-country dummies in all models became tedious. Models (VII) and (VIII) are completely misspecified, proven by both the (adjusted) R^2 values and the F-statistics.

Table 4

Growth and Disparities

	Dependent variable: *cov*		Dependent variable: dlog*(cov)*	
	Model (V)	Model (VI)	Model (VII)	Model (VIII)
Constant	0.258	0.253	0.010	0.025
	(0.000)	(0.000)	(0.412)	(0.052)
dlog(*inc*)	0.100	0.204	0.110	−0.199
	(0.167)	(0.003)	(0.589)	(0.386)
R^2	0.957	0.967	0.079	0.158
Adjusted R^2	0.952	0.961	−0.040	−0.004
Cross-section F-stat	179.78	219.92	0.624	0.785
	(0.000)	(0.000)	(0.877)	(0.715)
Period F-stat		5.496		1.651
		(0.000)		(0.116)
Cross-section and period F-stat		156.40		0.955
		(0.000)		(0.532)
Number of observations	168	168	168	168

Source: Author's calculations.

Note: Marginal significance level (p-value) using White period standard errors in parenthesis.

Even though the coefficient on growth in model (VI) is significant, we have to handle this result cautiously. If I estimate equation (7) first, the coefficient on growth is not significant, and R^2 is below 0.03. Then I include period fixed effects, which again results in an insignificant estimator on growth, and the adjusted R^2 decreases below 0. Period dummies are not redundant though, according to the test statistics. When including cross-section dummies, both fixed effects are jointly significant. This suggests that it is time- and country-specific factors that explain disparities rather than the speed of growth. The coefficients in model (VI) are also economically quite unreasonable. The constant means that a country with zero growth has a disparity level of 0.253 – which is about the mean of disparities in the sample. If growth is by 1 percentage point higher, disparities increase by 0.2, which means that in a country with growth at 2%, disparities come to above 0.6 – disregarding country- and period-specific effects. This is far above the observable values in the EU, which indicates that the coefficient in model (VI) is biased upward. What we can say is that the speed of growth might play only a very minor role in explaining within-country regional disparities.

6 Discussion

As the results of the previous sections show, it is rather the ascending side of the Williamson curve which is supported in the case of the EU, while the link between growth and disparities is very weak. New and old EU members can be distinguished in two ways: (1) The new Member States can be placed on the earlier part of the ascending curve, while the old members are on the part where the curve becomes flat, and (2) the new members are characterized by a higher level of disparities, even when accounting for differences in the development levels. The evidence on the ascending side of the Williamson curve is in line with Davies and Hallet (2002).

Earlier studies focused on the differences between two or more groups of regions e.g. on the basis of core and periphery regions, but they did not take into account the differences between the former EU-15 and the former accession countries. The results of my study show, however, that it is the date of EU accession that matters. The new EU members were not yet members during the period under review. Now that they are all members, the EU must face the fact that these countries experience a higher level of regional disparities, and has to think about what factors might cause these differences between the old and new members. I emphasize four possibilities here.

(1) The Transition Process

The new EU Member States examined here are all post-communist countries that went through an economic transition process in the 1990s. This factor alone must have resulted in a considerable jump in disparities. On the one hand, in most of the countries the economic situation of significant heavy industry hubs deteriorated (e.g. in the Northern Hungary region) and as a result, unemployment increased dramatically, while income declined. On the other hand, with the breakup of the Soviet Union and the collapse of the Council for Mutual Economic Assistance, these countries lost their external markets. Looking at the consequences of both factors, the recovery was easier

for the capital region as well as for the regions close to the Western markets. When the liberalization and privatization process started, foreign direct investments preferred those areas in which the production and transportation infrastructure was in a better shape (capital region) or areas which were close to the Western markets. As a result, the capital regions developed fast and the eastern regions mostly lagged behind.

(2) Economic and Monetary Union

The European Commission often argues that, in order to reach and maintain higher growth rates in lagging regions, it is important to ally macroeconomic policies which also ensure financial stability. The common currency helps in achieving such stability. The Commission maintains that in the 1990s, while preparing for monetary unification, inflation was reduced considerably in the cohesion countries, especially in Greece and Portugal. At the same time, GDP growth was above average in all the cohesion countries (including Ireland) in the second half of the 1990s. Thus, nominal convergence was accompanied by real convergence (European Commission, 2002). However, within-country disparities increased in these countries in the 1990s, and started to decrease only from 2000, after the introduction of the euro. One reason of this is that, because of the constraints imposed by the Maastricht criteria, the poorest EU members (Spain, Portugal and Greece) could not implement domestically financed measures to support regional development. The Maastricht criteria required these countries to reduce their high public debt and budget deficit levels, thus cutting their capacity to develop further public investment programs; direct national financial support to private investment was mitigated (Getimis and Economou, 1996).

However, after meeting the Maastricht criteria and becoming euro area members, the countries could benefit from the favorable effects of the single currency and the single market. The single currency should increase competition and market efficiency. By reducing transaction costs and interest rate differentials, it should also lower the price of capital and increase its availability in lagging regions. Regional variations in labor costs are expected to become more transparent, which should help to focus attention on underlying differences in productivity, which are a major cause of differences in regional competitiveness (European Commission, 2002).

(3) The Role of the EU's Structural and Cohesion Funds

There is no doubt that the EU's Structural and Cohesion Funds provide an opportunity for the indigent regions to catch up. These resources have been available for the old Member States for quite a long period now. According to the European Commission's report (2002), the difference in income per capita between Objective 1 regions (those which are eligible for resources from the Cohesion Funds) and the EU average narrowed by one-sixth between 1988 and 1998. A number of regions, in particular Irish and Eastern German regions as well as the Lisbon region, performed better than the average. As to the other regions eligible for resources from the Structural Funds, the levels of employment and unemployment also moved in a more favorable direction than in the rest of the EU. Over the period from 1989 to 1999, structural

intervention had a significant effect in Greece and Portugal; the effect was smaller in Ireland and Spain, where money from the Structural and Cohesion Funds accounted for a smaller proportion of GDP. The European Commission (2002) notes that the funds also increase competitiveness and productivity in the lagging regions and thus help to expand income over the long term. Structural intervention addresses the roots of regional imbalances and is aimed at strengthening the factors which provide the basis for sustained growth, such as systems of transport, small and medium-sized enterprises, research and development, innovative capacity, education systems. The old EU Member States apparently have an advantage in that they know better how to use these funds successfully; however, the funds are now available for the new members as well. It is up to them how fast the learning process will be.

(4) Institutional Framework for Successful Regional Policy

Successful regional policy is not only a matter of the economic resources available – efficient institutions, the administrative background and a decentralized decision-making procedure also play a significant role (Getimis, 2003; Davies and Hallet, 2002). As many studies point out, the new EU Member States (former accession countries) are characterized by weak institution building and limited administrative capacity despite the implementation of concrete steps toward decentralization, compared to the old members. In the latter, efficient institutional structures at all levels of governance (European, national, regional, local) can help using the Structural Funds effectively (Bailey and De Propris, 2002; Marcou, 2002). In the new Member States, the process of institutional restructuring has not been finished yet, and it is contradictory. Top-down, command-and-control decision-making processes and the emergence of a new bureaucracy encumber the establishment of a decentralized, accountable multi-level system of governance.

Heinelt (1996) and Benz and Eberlein (1999), among others, study the relationship between the existence of decentralized, multi-level governance and the use of Structural Funds resources. They show that there are differences with regard to the political influence the state government and the lower levels of government exert in the programming, implementation, monitoring and evaluation of European regional policy. In unitary states such as Greece, Ireland and France, the national government dominated the whole procedure in the 1990s: from negotiating with the European Commission to programming and implementing regional development plans and operational programs. The subnational authorities had only limited political influence, but they gradually gained important benefits in institution building and learning at the regional level. In these three countries, regional disparities were not lower at the end of the period examined, compared to the mid-1990s (however, inequalities diminished in Ireland over the past few years). Contrary to unitary and centralist states, in federal states (e.g. Germany, Austria) or regionalized countries (e.g. Spain) subnational institutions had a very substantial role in the planning and implementation process. In these three countries, disparities are lower now than they were in the mid-1990s. Austria managed to decrease inequalities the most among the EU countries. The case of Italy, where disparities have also continuously diminished, is also interesting: The central

government plays an important role in both the planning and implementation of regional programs, but some regions – especially those experienced in making innovative regional development plans, have succeeded in influencing these processes.

7 Conclusions

In this paper I examined the relationship between within-country regional disparities and the development of nations in the enlarged EU. I found evidence on the Williamson curve hypothesis, which says that disparities are lower in the early stages of development, peak in the middle-income stages, but diminish again as a country becomes wealthy. What is more important, however, I point out that some factors have a considerably stronger influence on disparities than national income. Among these country-specific factors, the date of EU accession plays an outstanding role, being responsible for more than one-half of the differences in regional disparities between the EU Member States. I argue that four main factors connected to EU membership are possible driving forces behind the disparities. The *transition process* in the new Member States completely changed their economic structure, and some regions recovered faster than others. *Economic and Monetary Union* was established in the old Member States in the end-1990s, making them observe fiscal prudence, making the markets more transparent and increasing competition, not only among the states, but also among the regions. In the old Member States, the substantial resources of the EU's *Structural and Cohesion Funds* have been available since the 1980s. What is more important, they have learned how to use these funds efficiently and how to build *effective institutions* which might also allow for more decentralized regional planning.

For the new EU Member States, the above implies that disparities will not decrease just because a country is catching up to the more developed EU countries. Development policies must not focus extensively on the country as a whole, but have to take into account the preferences and possibilities of their peripheral regions as well. Also it is not enough to make resources available to these regions; they must be taught how to communicate with the planning and decision-making bodies and how to use these funds efficiently.

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Appendix

Table A.1

Correlations between the Examined Variables

	Disparities	Income	Growth	NMS
Disparities	1.000	−0.316	0.163	0.500
Income	−0.316	1.000	−0.247	−0.824
Growth	0.163	−0.247	1.000	0.212
NMS	0.500	−0.824	0.212	1.000

Source: Author's calculations.

Table A.2

Estimated Cross-sectional Dummies

	Model (I)	Model (II)	Model (III)	Model (IV)
Austria	−0.089	−0.069	−0.084	−0.102
Belgium	0.068	0.085	0.076	0.061
Bulgaria	0.075	0.032	0.035	0.079
Czech Republic	0.106	0.095	0.108	0.116
Germany	−0.063	−0.047	−0.050	−0.064
Spain	−0.081	−0.077	−0.067	−0.072
Finland	−0.085	−0.071	−0.074	−0.086
France	−0.115	−0.100	−0.102	−0.115
Greece	−0.055	−0.061	−0.048	−0.044
Hungary	0.088	0.067	0.077	0.094
Ireland	−0.063	−0.045	−0.066	−0.083
Italy	−0.052	−0.037	−0.038	−0.051
Netherlands	−0.105	−0.086	−0.102	−0.119
Poland	0.006	−0.021	−0.015	0.010
Portugal	−0.048	−0.053	−0.039	−0.036
Romania	0.212	0.167	0.173	0.219
Sweden	−0.140	−0.124	−0.130	−0.144
Slovakia	0.410	0.385	0.392	0.414
U.K.	−0.006	0.009	0.004	−0.009

Source: Author's calculations.

Table A.3

GDP per Capita in Purchasing Power Parities

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	19,320	20,362	21,000	21,882	23,225	24,959	25,158	25,545	26,535	27,666
Belgium	18,478	19,006	19,837	20,626	21,424	23,167	24,158	25,025	25,581	26,759
Bulgaria	4,694	4,411	4,313	4,609	4,837	5,261	5,773	6,020	6,657	7,134
Czech Republic	10,474	11,428	11,676	11,835	12,252	12,875	13,571	14,411	15,202	16,171
Germany	18,325	19,018	19,645	20,319	21,087	22,210	22,666	23,107	24,188	24,903
Spain	13,315	14,006	14,757	15,773	17,113	18,322	19,214	20,261	20,800	21,658
Finland	15,930	16,733	18,470	19,947	20,899	22,674	23,810	24,416	23,367	24,834
France	17,420	18,168	19,259	20,265	21,076	22,535	23,466	23,838	23,155	24,146
Greece	10,790	11,239	11,966	12,518	13,137	14,458	15,095	16,428	17,257	18,245
Hungary	7,454	7,806	8,401	9,022	9,608	10,713	11,722	12,576	13,067	13,751
Ireland	15,006	16,468	18,953	20,704	22,644	25,071	26,481	28,165	28,909	30,414
Italy	17,852	18,613	19,339	20,398	21,136	22,494	23,076	23,426	22,796	23,095
Netherlands	18,167	19,189	20,574	21,626	22,795	24,665	26,182	26,673	26,630	27,946
Poland	6,194	6,784	7,456	7,994	8,522	9,283	9,495	9,862	10,080	10,908
Portugal	11,520	12,051	12,919	13,854	14,935	15,969	16,458	16,916	15,693	16,086
Romania				4,656	4,702	4,948	5,397	5,988	6,434	7,301
Sweden	17,867	18,633	19,448	20,215	21,880	23,620	23,744	24,195	24,821	25,865
Slovakia	6,808	7,516	7,989	8,444	8,716	9,419	10,031	10,866	11,362	12,196
U.K.	16,527	17,563	18,887	19,815	20,716	22,230	23,306	24,705	24,974	26,456
EU-27	14,581	15,310	16,127	16,874	17,696	18,944	19,668	20,353	20,596	21,503

Source: Author's calculations.

Table A.4

The Calculated Regional Inequalities

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average
Austria	0.222	0.225	0.217	0.214	0.212	0.207	0.208	0.207	0.202	0.196	0.211
Belgium	0.367	0.372	0.364	0.362	0.368	0.369	0.371	0.372	0.365	0.362	0.367
Bulgaria	0.191	0.189	0.192	0.176	0.211	0.179	0.204	0.237	0.238	0.258	0.207
Czech Republic	0.267	0.266	0.295	0.336	0.360	0.377	0.403	0.414	0.414	0.410	0.354
Germany	0.240	0.235	0.237	0.240	0.239	0.242	0.246	0.239	0.233	0.231	0.238
Spain	0.201	0.200	0.204	0.203	0.203	0.215	0.211	0.204	0.197	0.193	0.203
Finland	0.184	0.202	0.194	0.221	0.243	0.207	0.242	0.224	0.209	0.196	0.212
France	0.183	0.187	0.186	0.182	0.184	0.188	0.185	0.186	0.188	0.182	0.185
Greece	0.191	0.200	0.185	0.176	0.163	0.217	0.217	0.227	0.230	0.234	0.204
Hungary	0.246	0.264	0.279	0.282	0.303	0.322	0.323	0.347	0.336	0.329	0.303
Ireland	0.214	0.220	0.224	0.231	0.237	0.232	0.233	0.232	0.218	0.220	0.226
Italy	0.263	0.265	0.254	0.257	0.249	0.246	0.239	0.237	0.238	0.242	0.249
Netherlands	0.147	0.204	0.197	0.195	0.196	0.199	0.199	0.199	0.194	0.196	0.193
Poland	0.154	0.173	0.179	0.192	0.211	0.206	0.217	0.213	0.215	0.211	0.197
Portugal	0.215	0.212	0.223	0.230	0.205	0.219	0.216	0.217	0.214	0.220	0.217
Romania				0.247	0.253	0.404	0.421	0.411	0.361	0.351	0.350
Sweden	0.124	0.140	0.158	0.164	0.174	0.175	0.167	0.170	0.162	0.165	0.160
Slovakia	0.591	0.568	0.592	0.594	0.585	0.605	0.619	0.648	0.644	0.659	0.611
U.K.	0.263	0.267	0.280	0.289	0.293	0.308	0.300	0.305	0.305	0.304	0.292
Average	0.237	0.244	0.248	0.252	0.257	0.269	0.275	0.278	0.272	0.271	0.261

Source: Author's calculations.