DEVELOPMENT AND REGIONAL DISPARITIES

Testing the Williamson-curve hypothesis in the European Union

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Abstract

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 at early stages of development, peak at middle-income stages, but diminish again as a country becomes rich. However, which is more important, I point out that there are considerable factors which influence disparities more than national income. Among these country-specific factors, (earlier) EU-membership has an outstanding role, being responsible for more than half of the differences in regional disparities between the member states. I identify factors which are connected to EU-membership and are candidates of possible driving forces behind disparities: the transition in the new member states, the Economic and Monetary Union, the resources of the Structural and Cohesion Funds and effective institutions.

Introduction

According to the European Commission, in every fourth region of the enlarged EU, GDP per capita is below 75% of the EU average, thus they are eligible for the Convergence objective of the Structural Funds of the EU (EC 2006). These "Convergence regions" are characterized by low levels of GDP and employment; their share in EU's total GDP is only 12.5%, compared to their 35% share in EU's total population. However, the same situation can be observed within particular countries of the EU. Besides rich regions, there are regions lagging behind, where economic welfare is lower than the average of the country. We can think of especially the new member states of the Union. In Hungary, the central region has a GDP per capita level slightly above the EU average, while the poorest regions has only slightly more than 40% average. The similar can be observed in the Czech Republic, while in Slovakia, the Bratislava region is three times as rich as the poorest one. Bulgaria as the current poorest member of the EU 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 list of research on convergence of countries within the EU, this above observation often seems to be neglected. The most frequently emphasized aspect of convergence is that poorer *countries* of the EU must somehow catch up with the more developed ones. Lately, as data availability became better, researchers also have started to focus on the convergence of regions, this meaning whether poorer regions as a group are able to converge to richer ones. However, little attention was paid on within-country disparities and their development. Taking a look at these, many questions arise. Are these regional disparities a characteristic of the anyway poorer countries, or is it common in the EU? Is this difference related purely to the income differences of the countries, or is there also a difference between the old and a new member states? If the poorer countries are concerned

about their faster convergence to the richer ones, does not this influence their regional disparities?

The aim and thus the contribution of my paper is to examine hitherto neglected relationship between within-country regional disparities and development. I study whether differences in development level can explain the differences in regional disparities, or whether there is something else which effects inequalities. As regional GDP data are more reliable and available now, it is possible to carry out the research for the whole enlarged EU, including not only the new member states which joined in 2004, but also Romania and Bulgaria. Previous research was not able to examine such a vide variation in the data, thus it had only a limited use. Besides, I not only make a simple cross-country analysis, as a part of the studies examining disparities, but I use panel data for the period between 1995 and 2004. This way I extend the research into two directions. On the one hand, a particular country itself is developing over time, and I observe how disparities evolve in line with development, thus I am not constrained to generalize the results of a pure cross-country analysis. On the other hand, I examine also the relationship between the speed of development and disparities, which is not possible if one picks up only a point in time.

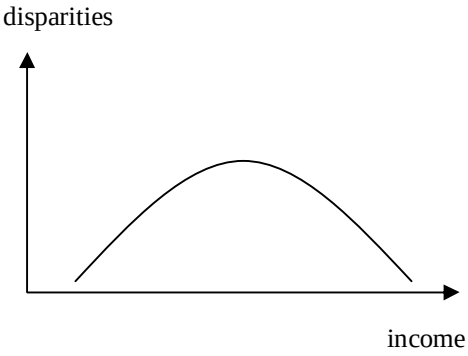
The remaining part of the paper is structured as follows. Chapter 1 provides a review of the relevant theoretical and empirical literature. Chapter 2 compares two simulations of the evolution of regional disparities within a country group. Chapter 3 provides descriptive statistics of regional differences and their change for the examined EU countries. Chapter 4 estimates different panel data models in order to detect the relationship between national development and within-country regional inequalities as well as the relationship between the speed of growth of countries and the (speed of change of) inequalities. Chapter 5 discusses the results in the sense that it suggests possible driving forces behind the findings of the previous Chapters. The final Chapter concludes.

1. 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 the convergence of regions within a country. However, Myrdal (1957) and other post-Keynesians thought, growth is a spatially cumulative process, which is likely to increase regional inequalities.

Williamson (1965) took up Kuznets's hypothesis which describes the relationship between income inequalities among households and the development level of the examined country [1]. Williamson claims that similarly to the Kuznets-curve, national development creates increasing regional disparities in early stages of development, while later on, national development leads to regional convergence. This results in an inverted U-shaped curve as depicted in Figure 1.

Figure 1: The Williamson-curve



Source: Williamson (1965)

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

The main argument behind Williamson's finding is that there are a few growth pole regions in a catching-up country where capital and skilled workers are concentrating. As a consequence of faster rise in productivity, faster growth of these regions 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 I mentioned, there is only a few empirical research devoted to this issue and applied for the European Union. Among the few are Davies and Hullet (2002), who examine the four cohesion countries (Greece, Portugal, Spain and Ireland)[2] as less developed, while Germany, the UK and Italy as more developed countries between the period 1980 and 1999. They find some evidence of the ascending side of the Williamson-curve, as catching up is driven by a few growth poles while 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. They find that institutional aspects, for instance degree of emphasis placed on proactive regional policy are deterministic in reduction of disparities in later stages of development.

Petrakos, Rodrigez-Pose and Rovolis (2003) include eight EU countries into their study (France, UK, Italy, Portugal, Spain, Belgium, Greece, and Netherland) and examine the period between 1981 and 1997 using spatial econometric analysis. Their results show that ceteris paribus, faster growth in GDP results in higher increase in regional inequalities. Besides, higher levels of GDP go together with lower levels of disparities. They also find that regional disparities at national and EU level exhibit pro-cyclical behavior in the short run, increasing in periods of expansion and decreasing in periods of slow growth. Meanwhile,

[2] Ireland was also considered as a cohesion country before its economic boom, since it was entitled for receiving grants from EU's cohesion funds.

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 United Kingdom), taking the period between 1989 and 1999 and using spatial econometrics. They focus on within-EU disparities by dividing the European Union into core and periphery regions, the former including regions to be found in more developed countries, while the latter including regions in less developed countries. They find significant convergence among the periphery regions, although they cannot obtain the same among regions belonging to the core. They say that EU structural funds have positively benefited to the targeted regions, however, spillover effects through the impact of the funds are present only in core regions. The reason of this might be that core regions are generally smaller and better connected with each other through trade and transport networks.

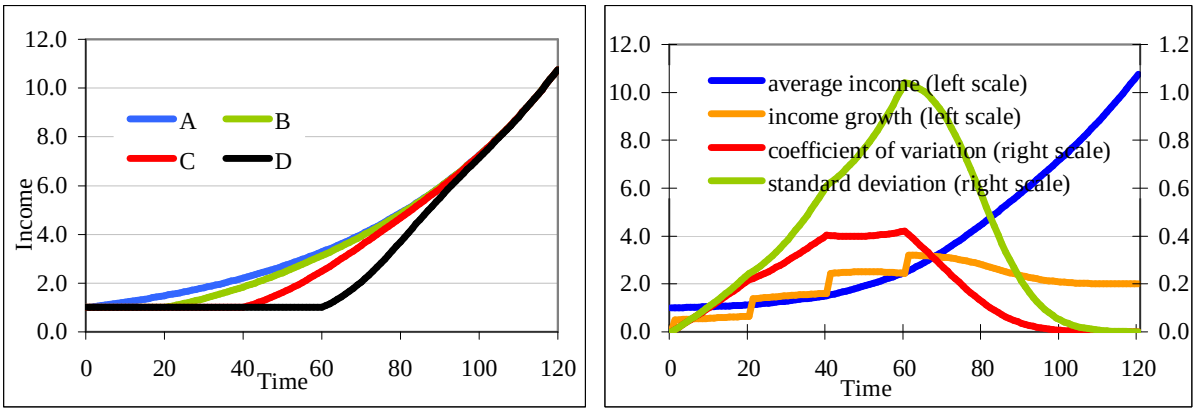
Finally, Brasili and Gutierrez (2004) extend their study to 15 EU countries, examining the period between 1980 and 1999. They use both distribution dynamics and panel data analysis to have a wider look at the topic. They attain considerable evidence of convergence: the distribution analysis shows that per capita income level of poorer countries tends to converge towards the mean. They find no evidence of 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-level regions.

2. The relationship between development and disparities

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

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

Figure 2: Simulation of disparities 1



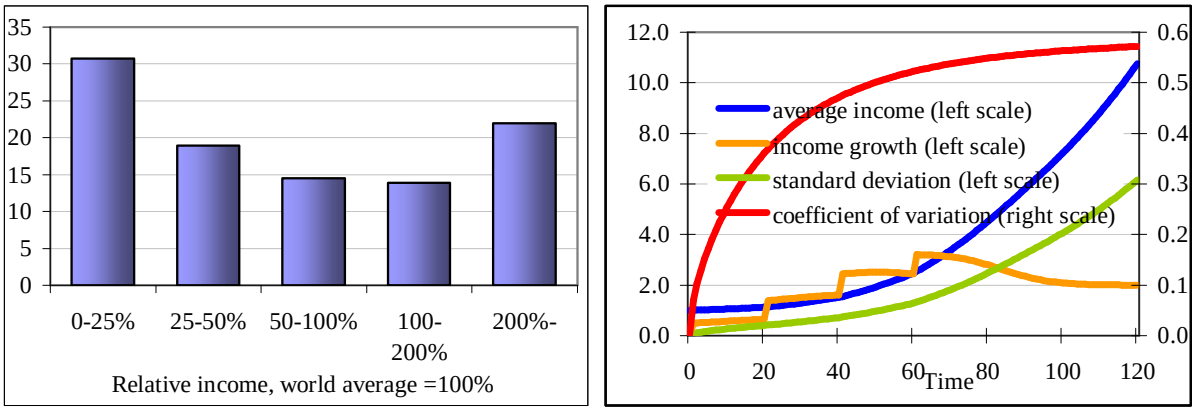
Source: own calculations based on Lucas (2000)

As Figure 2 demonstrates, at time 120, each catching-up region will reach the income level of region A (actually, the gap is almost zero already at time 100). If we take either the coefficient of variation or the standard deviation of GDP per capita levels as a measure of regional inequality, the right hand side figure shows that disparities start to increase fast, as the privileged region begins to grow. Inequalities will slightly diminish only after average income of the country reaches about 2.5 (this happens at year 60), and after the growth rate of

the whole country reaches 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 to the European Union. More developed countries indeed grow at a slower pace and we have the intuition that they face 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 moves from a 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 there are some countries moving from the middle towards either end. It can be shown that this results in "twin-peaks", i.e. there will be several rich and poor countries and less mid-income countries. If we take 100 equally developed countries at time zero, in 100 years the distribution of income will look like in Figure 3.

Figure 3: Simulation of disparities 2



Source: own calculations based on Quah(1993)

From this empirical result, we can deduce the evolution of disparities. In order to draw the figure similar to Figure 2, I took over the average income growth rates from the Lucas-simulation, thus average income and income growth (the red and orange lines on the right figure) are the same as before. The reason is that the original Quah paper is an empirical investigation of cross-country income levels, where he did not generate growth rate. If Quah's

hypothesis prevails, the standard deviation of incomes grows continuously in the second simulation, while the path of coefficient of variation shows a logarithmic pattern: it increases fast first by development, but then stabilizes and remains high even at high a development level. This level of inequality is also higher than the peak of disparities in the Lucas-simulation.

Summarizing the two simulations, the Lucas model suggests that convergence of regions indeed occurs. The first increasing regional disparities will diminish as other regions also start to develop and they do it faster than the early developing ones. However, the Quah-based model initially assumes the existence of "twin-peaks" with a permanently poor and a permanently rich group of regions and from this it follows that disparities remain permanently high. From the Lucas-model, the estimation of a quadratic regression follows, but from the Quah-model, a search for a logarithmic relationship might be more fruitful. I will estimate both functional forms in Chapter 5; however, I will pay more attention on the quadratic form. One reason is that this one is more flexible than the monotonic logarithmic functional from, the other is that the log-function assumes the existence of twin-peaks – which is not evident to show in my sample.

3. Data analysis

In this section I provide the descriptive statistics regarding the examined regions. I use data on nineteen countries out of the twenty seven of the European Union[3]. The reason is that the basis of inequality measure is NUTS-2 regions[4] of the EU, and in the other eight countries of the Union, the country itself equals a NUTS-2 region. Thus, no regional differences can be observed at this level. GDP per capita data at NUTS-2 level are currently available for the period 1995 – 2004; the source is Eurostat, the statistical office of the EU. I also use data for some of the New Member States (including Bulgaria and Romania). However, they were not members of the EU between 1995 and 2003: the Czech Republic, Hungary, Slovakia and Poland became members in May 2004, and Bulgaria and Romania in January 2007. The previous enlargement happened in January 1995, taking in Austria, Finland and Sweden. I assume that the EU-membership has an affect both on the development and on regional inequalities. For the old EU-members, the regional policy tools of the EU (cohesion and structural funds) were available even before the examined period, while the new member states have just started to experience pre-accession and cohesion funds.

3.1. Within EU disparities

In 1995, GDP per capita (measured in purchasing power parities) of 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 to between a minimum of EUR 5,070 and a maximum of EUR 65,100. Data for Romania are available only from 2000, thus this latter observation is valid for 276 regions with the somewhat downward distorting effect of the Romanian regions. The standard deviation also grew continuously

[3] The countries are: Belgium, Bulgaria, Czech Republic, Germany, Greece, Spain, France, Ireland, Italy, Hungary, the Netherlands, Austria, Poland, Portugal, Romania, Slovakia, Finland, Sweden, the United Kingdom.
[4] About the classification of the EU-regions see:
http://ec.europa.eu/comm/eurostat/ramon/nuts/introduction_regions_en.html

during this period, which suggests the divergence of regions in terms of σ-convergence[5]. However, estimating the standard non-linear equation for absolute β-convergence[6] results in a β of 1.3% per year. This means poorer regions managed to catch up to richer ones. This seems somewhat controversial; 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 one will tend to generate the latter, although it is possible for initially poor countries/regions to grow faster than initially rich ones without the cross sectional dispersion fall over time[7].

Table 1: Descriptive statistics of incomes in EU

	1995			2004		
	Whole sample	"Old" EU	"New" EU	Whole sample	"Old" EU	"New" EU
Mean	14447	16049	6978	20797	23290	11007
Median	15180	15846	6198	21534	22714	9811
Maximum	37617	37617	17866	65138	65138	33784
Minimum	3858	7836	3858	5070	11714	5070
St.Dev.	5375	4389	2749	7832	6354	5165
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	1018.56	156.15
(probability)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	267	217	46	276	217	55

Source: Eurostat, own calculations

It is also interesting to take a look at the evolution of the distribution of income during the period (6th to 8th rows of Table 1). Taking all the regions, the distribution is non-normal and has a long right tail, which means there are some regions with very high income, while most of the regions have middle-income. From 1995 to 2004, the distribution became more "peaky" (the kurtosis increased) and the right tail became longer (the skewness also increased). This suggests that average-income regions managed to gain more wealth, while

[5] σ-convergence occurs when the standard deviation of income levels of a country/region group is decreasing over time.

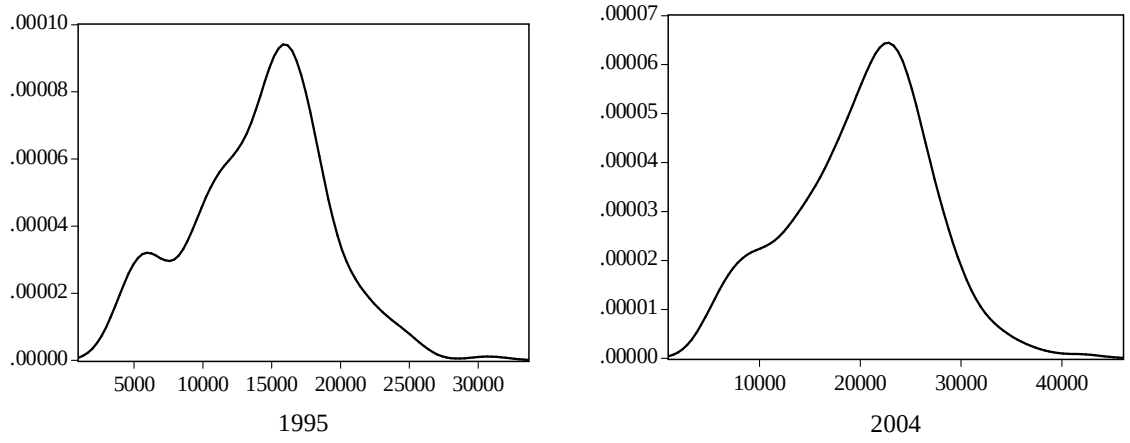
[6] The absolute β-convergence hypothesis says that less developed countries/regions are growing faster only because they are poorer.

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

some mid-income regions joined the high-income ones, which 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 containing the capital of a particular country. When I exclude these regions, the distribution becomes normal (highly supported by the Jarque-Bera test). Towards 2004, the normality is slightly less observable as the now negative skewness decreases further while the kurtosis falls below 3. The fact that the capital regions are the most developed, while in the other regions, income was distributed normally, does not depend on whether a country was a member of the EU or not. Splitting the sample according to EU-membership results in the same differences in distributions. Of course there are large income differences among EU and earlier non-EU (new-EU) members: an average old EU region is more than double as rich as an average new-EU region; however, the difference has been decreasing a bit over the examined period. It is worth to take a look at the distribution graphs on Figure 4 when excluding the capital. While in 1995, there seems some evidence of "twin-peaks" - i.e. regions being divided into two groups, "old" and new" EU regions -, this is disappearing by 2004. This suggests that the assumption of the log-function might not be fulfilled.

Figure 4: Density functions of income distribution



Source: own calculations based on Eurostat

It can also be seen from the data that differences between the capital and the other regions in the country are larger in the new EU member states than in the old members.

Between 1995 and 2004, almost all the nineteen examined countries experienced a continuous growth in their GDP per capita levels (again, measured in purchasing power parities). The fastest average growth was registered in Ireland, 7.9% per year, while GDP per capita in Romania, Hungary, Slovakia and Poland - i.e. in the new members - also grew by more than 6% (by 4.6% in Bulgaria and 4.8% in the Czech Republic). The less developed old members, Greece and Spain, also experienced an expansion above average; however Portugal's performance was rather sluggish. Out of the more developed members, the UK's 5.2% average growth might be surprising, while the other countries performed under the average, with France, Germany and Italy being the slowest developing countries.

3.2. Within country disparities

In the rest of the paper, I use 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:

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

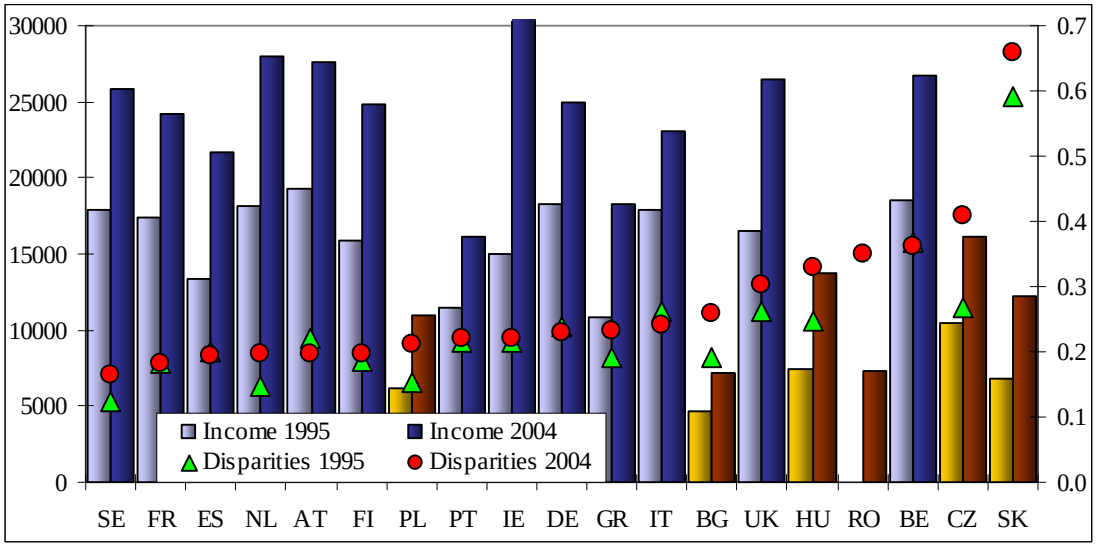
where inc_{rt} denotes GDP per capita in region r of country i. This equation is sort of a population weighted coefficient of variation and standard deviation, since I take the squares of the deviations of the individual regional GDP per capita levels from the country's GDP per capita level, instead of using the mean of the regional GDP per capita, $\overline{inc_{rt}}$. The idea behind using this type of measure is that in countries where the population is relatively bigger in the main region or in other centers, the production process might be enormously concentrated there, also by historical reasons. This might depress other regions significantly and inequalities are even higher. When compared to the "normal" coefficient of variation, the

above measure produces larger values for disparities when the main region is significantly larger in terms of population than the others. This is the case in France, where the population of Ile de France and Bassin-Parisien gives one third of the population of France. There is not much difference between the measures when there are more large "poles" (most noticeably in England: London, Manchester, Leeds; or in Germany: Stuttgart, München, Düsseldorf, etc.). Finally, measure (1) gives smaller values when the main region is only slightly larger than others or regions have a rather equal size.

Taking the latest available data, which are for the year 2004, within country regional inequalities are outstandingly high in Slovakia, and are above average in the Czech Republic, Belgium, Romania, Hungary, and in the UK. Disparities are about average in Bulgaria, while they are lower in the remaining countries. Sweden has the lowest disparities (see Table A.2 in the Appendix).

I illustrate the above data on Figure 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 Figure 5 is that the *rise* in inequalities was higher in the least developed countries. Rather it can be noticed that the change (and even the level) is higher in those countries which are said to develop faster, or which are the new member states of the EU. (On Figure 5 I denoted the old members by blue, new members by yellow and red.)

Figure 5: Incomes and disparities in 1995 and in 2004



Source: Eurostat, own calculations

This observation raises the question: does not faster growth/convergence of the country drive the rise in regional disparities, rather than the development level of the country? Or is it somehow the EU membership? I answer these questions in the next Chapter.

4. Methodology and results

In this Chapter I introduce the methodology I use. Then I estimate the relationship between disparities and the level of income, as well as the relationship between disparities and income growth.

4.1. Methodology

Williamson originally applied his examination to the development path of a country. However, 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 different in the examined countries, a comparison at an arbitrarily chosen time would result in biased estimates. Thus it seems logical to combine time- and cross-series analysis and use panel data.

Thus, I use a panel data regression model with unobserved effect of the general form:

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

where i denotes country observation and t denotes time, while a_i (also called as heterogeneity effect) contains observable or unobservable (but yet unobserved) country-specific, but time-invariant factors effecting disparities. ε_{it} is the idiosyncratic error, which represents unobserved factors that change over time and effect 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 is more efficient, because its estimators have much smaller variances than the fixed effect estimators. However, if we think 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-s 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:

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

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, inc_{it}^2 is its square. It is likely that there are factors effecting regional disparities, which are specific for individual countries, but do not change over time, at least not over the examined period. These factors are represented by a_i. If the Williamson curve hypothesis holds, β_2 is smaller than zero, which indicates a reverse U-shaped curve. I also expect β_0 and β_1 to be strictly greater than zero. The first one assumes that there is an initial level of inequality: a country being very-very poor also has some regional disparities. The second one assumes that I am able to observe not only the descending part of the curve.

By the same logic, it can be assumed that there are factors which affect regional disparities; these change over time, but they affect each country equally. The most likely one of such factors can be globalization. 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 b_t represents the vector of the period dummies[8].

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

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

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[9]. Thus I use White period standard errors and covariance, which are robust for serial correlation.

As I presented in Chapter 3, a logarithmic relationship between disparities and development also might be detected, however it is more rigid than the quadratic from. 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. Thus on Figure 6, only that part of inequalities appears which cannot be connected to country-specific factors. It seems that from about EUR 20-24,000, inequalities indeed start to decrease. However, as an alternative of the Williamson hypothesis, I estimate the logarithmic relationship of the form

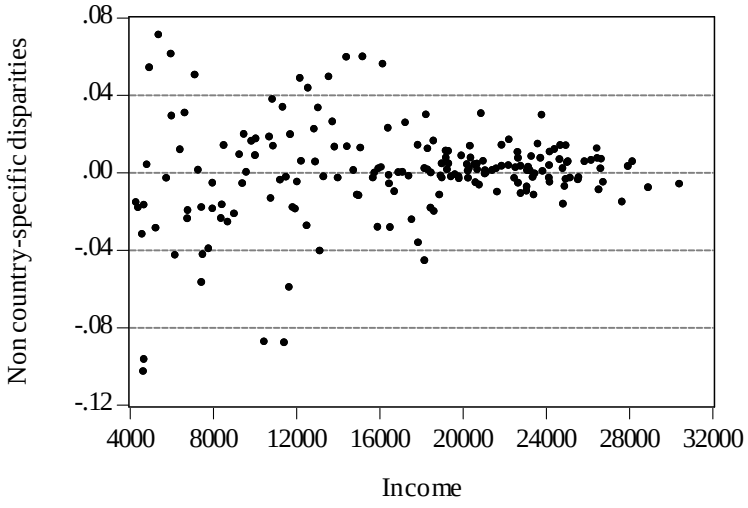
$$ineq_{it} = \beta_0 + \beta_1 \log inc_{it} + a_i + \varepsilon_{it}, \tag{6}$$

where the new variable is loginc_{it}, which is the natural logarithm of the GDP per capita level of country *i* at time *t*.

[8] Because of using unbalanced panel data (observations are missing in some years), using fixed cross-sectional and random period effects at the same time is not feasible.

[9] The Levin, Lin & Chu; the Im-Pesaran & Shin as well as the ADF-Fisher tests 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 rejects the null that there is no unit root. Specification of these tests is described in Eviews (2004).

Figure 6



Source: own calculations, Eurostat

Finally, as Figure 5 suggests, it might be the case that faster growing countries experience larger or faster increasing inequalities. This intuition also can be drawn from the two simulations in Section 4. In the Lucas-type of 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 income is accelerating, while the graph of inequalities becomes flatter when income growth is decelerating. Here the simple correlation is 0.87. For that reason I also estimate the relationship between income growth and both *change in* and *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 dlog*(*$ineq_{it}$*)* and dlog*(*inc_{it}*)* is the change in the logarithm of the corresponding variable, using 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 b_t-s, the time dummies.

4.2. 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 squared are highly significant. The coefficient on income is positive, while its squared is negative, indicating an inversed U-shaped relationship between disparities and development.

Table 2: Income and disparities

	Quadratic form		Log-form	
Dependent variable: *cov*	Model (I) Cross-section dummies	Model (II) Cross-section and time dummies	Model (III) Cross-section dummies	Model (IV) Cross-section and time dummies
constant	0.011	0.081	-0.534	-0.935
	(0.808)	(0.316)	(0.011)	(0.157)
inc	2.58E-05	2.02E-05	-	-
	(0.000)	(0.002)	-	-
inc^2	-5.67E-10	-4.94E-10	-	-
	(0.000)	(0.000)	-	-
log(inc)	-	-	0.082	0.124
	-	-	(0.000)	(0.071)
nms	-	-	-	-
	-	-	-	-
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: own calculations.
Marginal significance level (p-value) using White period standard errors in parenthesis

The results show that regional inequalities within a country grow until the country reaches an income level of about EUR 22,800 per capita[10], and then they start to diminish. This is about the EU-25 average (the whole EU excluding Romania and Bulgaria) or the development level of Italy in 2004. The estimated maximum of disparities is 0.305, being equal to the disparities in the UK in 2004.

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

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

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

Model (II) also uses period fixed effects. The results only slightly change; 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, suing period fixed effects does not have an outstanding value.

The log-regression using cross-country dummies (Model (III)) gives significant results as well. A one percentage higher income results in higher regional disparities of 0.0082 in the former case, or simply: a country having 50% higher income per capita than another is expected to face by about 0.4 higher regional disparities. (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, the result is significant only at 10% and the fit does not improve. For Model (III) and Model (IV), redundant fixed effects test results the same as before: cross-section fixed effect are useful and have strong explanatory power; however, 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 did 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 level of Ireland at the end of the examined period).

It is also interesting to observe the estimated cross-section dummies (Table A.2): they are all positive in case of the new member states (and Belgium), while they are negative in case of the old EU. 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 in case of Romania, Bulgaria, Slovakia, the Czech Republic, Hungary and Poland and takes the value 0 otherwise. It is true that Slovakia, the Czech Republic, Hungary and Poland became members in May 2004, and they have been eligible for the Structural Funds from January 2004 on, however, they are still new member states, having considerably less experience in using the EU funds than old members states. 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 which model's coefficients I use.

Table 3: Income and disparities

Dependent variable: *country dummies*	Quadratic form		Log-form	
	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

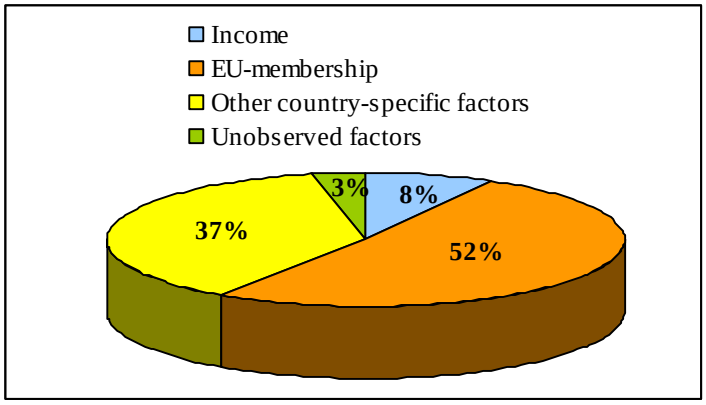
Source: own calculations.
Marginal significance level (p-value) using White heteroskedastic robust standard errors in parenthesis

Table 3 presents the above estimations. In all of the 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 disparities than the old members. The R^2 tells that the new or old membership explains more than 50% of the variations in disparities after controlling for income levels.

It is also visible in Figure 6 that if we take Model (I) as a baseline model, and decompose the variance in disparities according to the previous estimations, more than half of the total variation is captured by the 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.

Figure 7: Decomposition of the variance in disparities



Source: own calculations

4.3. Growth and disparities

I estimated four additional models stemming from equation (7) and (8). Model (V) and (VII) use cross-country dummies only and Model (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-s 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)
nms	-	-	-	-
	-	-	-	-
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: own calculations.
Marginal significance level (p-value) using White period standard errors in parenthesis

In spite that in Model (VI) the coefficient on growth is significant, we have to handle this result cautiously. If I estimate equation (7) first, the coefficient on growth is not significant, and the R^2 is below 0.03. Then I include period fixed effects, which again results in insignificant estimator on growth, and the adjusted R^2 decreases below zero. 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 rather time and country-specific factors which 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. One percentage point higher growth increases disparities by 0.2, which means, a country with 2% growth has disparities 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 upward biased. What we can say is that the speed of growth might have only a very minor role in explaining within-country regional disparities.

5. Discussion

As the results of the previous chapters show, it is rather the ascending side of the Williamson-curve, which is supported in case of the EU, while the link between growth and disparities is very weak. New and old EU member states can be distinguished in two ways: (a) the new member states can be placed on the earlier part ascending side, while the old members are on the part where the curve becomes flat, and (b) the new member states face higher disparities, even when accounting for differences in development levels. The evidence on the ascending side of the Williamson curve is in line with the mentioned study by Davies and Hullet (2002).

Before, differences between two or more groups of regions were examined for example on basis of core and periphery regions, but 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 EU membership that matters. The new member states were not yet members during the examined period. Now that they are all members, the EU must face the fact that they experience higher regional disparities, and have to think about what factors might cause these differences between the old and new members. I emphasize four possibilities here.

i) The transition

The new member states examined here are all post-communist countries and went through the transition process in the nineties. This factor alone must have resulted in a considerable jump in disparities. On the one hand, in most of the countries significant poles of heavy industry have deteriorated (e.g. in the region Northern-Hungary) and as a result, unemployment increased dramatically, while income fell back. On the other hand, with the break up of the Soviet Union and the Council for Mutual Economic Assistance, these countries lost their external markets. Looking at both consequences, the recovery was easier for the central region as well as for those being closer to the western markets. When the

liberalization and privatization process started, foreign direct investments preferred the areas where production and transportation infrastructure was in a better shape (central region) or which were closer to the western markets. This resulted in the central regions to rise fast and mostly the eastern regions to lag behind.

ii) The European economic area

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

However, after meeting the Maastricht criteria and becoming a member of the Eurozone, the other beneficial effect of the single currency / single market could prevail. 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. It is also supposed that regional variations in labor costs

become more transparent, which should help to focus attention on underlying differences in productivity, a major cause of differences in regional competitiveness (EC 2002).

iii) The role of Structural and Cohesion Funds

There is no doubt that the EU's Structural and Cohesion Funds provide an opportunity the indigent regions to catch up. These sources have been available for the old member states for quite a long period now, and as the report of the European Commission notes, between 1988 and 1998, 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 (EC, 2002). A number of regions, in particular in Ireland, the East-German regions and Lisbon, have performed better than the average. In the case of other regions eligible for sources from the Structural Funds, also employment and unemployment moved in a more favorable direction than in the rest of the Union. Over the period 1989 to 1999, structural intervention had a significant effect in Greece and Portugal, the effect was smaller in Ireland and Spain, the Structural and Cohesion Funds forming a smaller proportion of GDP there. The EC (2002) also notes that the Funds also increase the lagging regions competitiveness and productivity and so help to expand income over the long-term. Structural intervention handles 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 enterprises, research and development, innovative capacity, education systems. The old member states apparently have an advantage in knowing how to use these Funds successfully; however, the Funds are open now for the new members as well. It is up to them, how fast the learning process will be.

iv) Institutions of regional policy

Successful regional policy is not only a matter of available economic resources, but also efficient institutions, administrative background and decentralized decision-making procedure

play significant role (Getimis, 2003; Davies – Hullet, 2002). As many studies pointed out, new member states (former accession countries) are characterized by weak institution building and limited administrative capacity despite the implementation of concrete steps to decentralization, compared to the old members. In the latter, efficient institutional structures at all levels of governance (European, national, regional, local) can help in the effective use of the Structural Funds (Bailey - De Propris, 2002; Marcu, 2002). In the new member states, the process of institutional restructuring has not been finished yet and it is contradictory. The 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.

Among others, Heinelt (1996) and Benz – Eberlein (1999) study the relationship between decentralized, multi-level governance and the Structural Funds. They show that there are differences with regard to the political influence of the State government vis-à-vis the sub-national level in programming, implementation, monitoring and evaluation of European regional policy. In unitary states such as Greece, Ireland and France, national government dominated the whole procedure in the nineties: from the negotiation with the Commission to the programming and implementation of regional development plans and operational programs. Sub-national authorities had only limited political influence, however, 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 examined period, compared to the mid-nineties (however, inequalities diminished in Ireland in the past few years). As a contrast to unitary and centralistic states, in federal states (e.g. Germany, Austria) or in regionalized countries (e.g. Spain) sub-national institutions had a very substantial role in the planning and implementation process. In all the three countries, disparities are lower now than they were in the mid-nineties, and Austria managed to decrease inequalities the most

among the EU-countries. The case of Italy is also interesting, where disparities were also continuously diminishing. In Italy, central government plays an important role in both planning and implementation of regional programs, although some regions, especially those with experience in innovative regional development plans, have succeeded in influencing these processes.

6. 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 at early stages of development, peak at middle-income stages, but diminish again as a country becomes wealthy. However, which is more important, I pointed out that there are considerable factors which influence disparities more than national income. Among these country-specific factors, (earlier) EU-membership has an outstanding role, being responsible for more than half of the differences in regional disparities between the member states. I argue that there are four main factors which are connected to EU-membership and are candidates of possible driving forces behind disparities. The *transition* in the new member states completely had changed their previous economic structure and some regions recovered faster than others. The *Economic and Monetary Union,* which the old member states joined in the end of the nineties, made them learn fiscal prudence, provides a more transparent market ad increases competition, not only among states, but also among regions. In the old member states, the substantial resources of the *Structural and Cohesion Funds* have been available since the eighties. Which is more important, they learned how to take advantage of these Funds and how to built *effective institutions* which might also allow for more decentralized regional planning.

For the new member states, the implication of the above is, that disparities will not decrease just because the country is caching up to the more developed part of the EU. Development policies must not extensively focus on the country as a whole, but have to take into account of the preferences and abilities of their peripheral regions as well. Also it is not enough to make resources available for these regions; they must be taught how to communicate with the planning and decision making bodies and how too use these sources 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: own calculations

Table A. 2: The 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
UK	-0.006	0.009	0.004	-0.009

Source: own calculations

Table A. 3: GDP per capita in purchasing power parities

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	19320	20362	21000	21882	23225	24959	25158	25545	26535	27666
Belgium	18478	19006	19837	20626	21424	23167	24158	25025	25581	26759
Bulgaria	4694	4411	4313	4609	4837	5261	5773	6020	6657	7134
Czech Republic	10474	11428	11676	11835	12252	12875	13571	14411	15202	16171
Germany	18325	19018	19645	20319	21087	22210	22666	23107	24188	24903
Spain	13315	14006	14757	15773	17113	18322	19214	20261	20800	21658
Finland	15930	16733	18470	19947	20899	22674	23810	24416	23367	24834
France	17420	18168	19259	20265	21076	22535	23466	23838	23155	24146
Greece	10790	11239	11966	12518	13137	14458	15095	16428	17257	18245
Hungary	7454	7806	8401	9022	9608	10713	11722	12576	13067	13751
Ireland	15006	16468	18953	20704	22644	25071	26481	28165	28909	30414
Italy	17852	18613	19339	20398	21136	22494	23076	23426	22796	23095
Netherlands	18167	19189	20574	21626	22795	24665	26182	26673	26630	27946
Poland	6194	6784	7456	7994	8522	9283	9495	9862	10080	10908
Portugal	11520	12051	12919	13854	14935	15969	16458	16916	15693	16086
Romania				4656	4702	4948	5397	5988	6434	7301
Sweden	17867	18633	19448	20215	21880	23620	23744	24195	24821	25865
Slovakia	6808	7516	7989	8444	8716	9419	10031	10866	11362	12196
UK	16527	17563	18887	19815	20716	22230	23306	24705	24974	26456
EU-27	14581	15310	16127	16874	17696	18944	19668	20353	20596	21503

Source: own 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
UK	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: own calculations