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Regional Inequality and Convergence in Europe, 1995–2005

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[Abstract] The paper presents new results on within-country regional inequality in per capita income for 36 countries during 1995-2005; focusing on Europe but with some non-European countries included for comparison. In 23 of the 36 countries there was a significant increase in regional inequality during the period, and in only three cases there was a reduction. Regional inequality increased in all countries of Central and Eastern Europe, while for most Western European countries there was little change. For the EU-27 as a whole, there was a modest increase in within-country regional inequality, but convergence across countries. The latter effect was quantitatively more important, so on the whole there was income convergence in the EU-27, especially after 2000. Regional inequality is particularly important for some large middle-income countries such as China, Russia and Mexico. In such countries there may however be considerable price differences across regions, and the use of common price deflators for the whole country may lead to a biased assessment of regional inequality.

Keywords: Income distribution, regional inequality, economic growth and convergence, European integration.

JEL codes: R12, O18.

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1. Introduction*

In the EU-15, there was income convergence between countries, and modest changes in inequality between regions within countries (see e.g. Combes and Overman 2005, Cappelen et al. 1999, and also Ben David 1996). Faster growth in the relatively less prosperous countries such as Ireland and the new Mediterranean members (Greece, Portugal, Spain) contributed to country convergence in income levels, while intra-national regional inequality changed only modestly.

In this paper, we examine whether this characterisation of income inequality between countries and regions in Europe also applies to the most recent decade; a period of dramatic change in the economic geography of Europe. Since the fall of the iron curtain, the map of Europe has changed due to transition, increased east-west economic integration and recently the enlargement of the EU to encompass 27 members. The purpose of this paper is to provide comprehensive and updated evidence on the development of domestic regional inequality in Europe during this last decade. In the light of EU enlargement and the transformation of Europe, a main focus is on the countries of Central and Eastern Europe (CEA), but other countries, within as well as outside Europe, are also analysed in order to provide a comparative perspective.

Following a steadily growing amount of research and documentation, it has become a widespread belief that regional disparities in CEE are *large and increasing*. EU enlargement toward south and east may have contributed to income convergence across countries, but at the same time, disparities within some countries have increased. Earlier studies on regional inequality in Europe include Römisch (2001, covering nine CEE countries during 1993-98), Förster et al. (2003, covering four CEE countries in selected years between 1991 and 1999), and Landesmann and Römisch (2006, covering EU-27 during 1995-2002). These studies confirm increases in inter-regional inequality in CEE countries over the years studied, but also that the magnitude of this increase varied considerably across countries. The variability of results and fast changes over time suggests that it makes sense to have a closer look as well as to provide new systematic evidence. In the paper, we also want to assess the relative importance of within-country regional disparities; are these more or less important than income inequality across European countries, or other forms of domestic inequality?

Studying the change in regional inequality in CEE countries can be undertaken with data on these countries only. In order to conclude whether regional inequality in these countries is comparatively large, however, we need results for other countries as well. In the paper, we therefore include new evidence in inter-regional inequality not only for Western Europe, but also for some non-European countries. Hence the study presents a com-

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prehensive and international comparative perspective on regional inequality. To our knowledge, it is the most comprehensive study of regional inequality to date, in terms of country coverage.

Regional income inequality may also be considered as a component of overall domestic income inequality; along with (and partly overlapping with) rural-urban and class-based income divides. While e.g. the World Bank (2000) overwhelmingly documents the increase in inter-personal income inequality in most CEE countries, the relationship between regional and inter-personal income inequality has not been fully examined. According to Kanbur and Venables (2007), some studies undertaken suggest as a "typical" outcome that inter-regional disparities may account for around ¼ of total domestic inequality. In the paper, we examine this relationship and find that there is great variation across countries.

The main purpose of the paper is to provide new evidence on regional inequality rather than to explain it. We nevertheless provide a preliminary examination of some aspects. For the CEE countries, a recurring theme is that a major part of the increase in inter-regional inequality was accounted for by the growth of capital regions. Brülhart and Koenig (2006) found, for five CEE countries, that capital region concentration dominated the hypotheses based on the "new economic geography". In the paper, we therefore check to what extent the increase in regional inequality is driven by growth in the capital regions. A second issue concerns price differences across regions: Most data on regional income does not adjust for price differences across regions. If there are widely different inflation rates across regions, nominal income figures may be misleading. In the paper, we experiment with regional price deflators for Russia in order to check the importance of different price trends.

The paper proceeds as follows: In section 2, we describe data and the methodology used. In section 3, we examine the relative importance of international versus domestic regional inequality in the EU-27, and the overall extent of income convergence. In section 4, we examine changes in domestic regional inequality in a number of countries, in order to assess whether it is true that regional inequality in the CEE countries is "large and increasing". In section 5, it is shown that standard panel regression techniques may not be appropriate in the analysis of EU-wide regional convergence since the relatively poor regions grow faster at the EU-wide level, but they grow slower at the at the country level, at least for the poorer countries. In section 6, the relative importance of regional disparities in the context of overall domestic income inequality is analysed. In section 7, we shed light on the role of capital regions for regional inequality. In section 8, we use data on Russia in order to assess the importance of different price trends across regions. Some concluding comments are provided in Section 9.

2. Data and methodology

Given the purpose of analysing regional and between-country inequality using comprehensive and comparative international data, the analysis covers 36 countries:

- EU-27: Regional income data from Eurostat's Regio database cover 23 countries (Denmark is missing, and Cyprus, Luxembourg and Malta have limited regional subdivisions).
- Other Western European countries: Norway is included.[1]
- Eastern Neighbourhood and applicant countries: Croatia, Russia, Turkey and Ukraine.
- Non-European countries included for comparison: USA, Canada, Mexico, China, Japan, South Korea, Australia.

Table A1 in the Appendix describes data sources. The main data source, covering the EU and some OECD countries, is the Regio database of Eurostat. For Russia, Ukraine and China, data from national statistical agencies are applied.

For the EU-27, Turkey and Norway, regional data are available at different classification levels, according to the so-called NUTS nomenclature (Nomenclature of Territorial Units for Statistics, see Eurostat 2007). When we use regional averages for income, the level of inequality depends on the classification; the more detailed is the classification, the more inequality there is. For the EU-27 and Norway, we therefore present results at different classification levels in order to check how results are affected by classification. While we have more or less complete data for income and population at the country level, there are more missing data at the more detailed levels. For example, less than half of Poland is covered at the more detailed NUTS3 level. Table 1 gives an overview of data coverage for the EU-27.

Table 1: Data coverage, regional data for EU-27 for 1995-2005

	Number of countries or regions in EU-27[2]	Average population 2005	Period	% of EU-27 income covered by data	% of EU-27 population covered by data	Number of units used in analysis
Country level	27	18155	1995-97	98.4-98.6	100	25-27
			1998-2005	100	100	
NUTS1	97	5053	1995-97	97.9-98.6	100	96
			1998-2005	100	100	
NUTS2	271	1809	1995-97	97.4-98.0	98.5	259-264
			1998-2005	99.5	98.5-99.6	
NUTS3	1303	376	1995-97	94.1-94.9	91.3	1178-1219
			1998-2005	96.3-96.5	90.1-92.2	

For the calculation of income inequality indexes, we need annual data for population and income. We use GDP data, and since we also compare different countries we need data in purchasing power parities (PPP). Such

[1] Switzerland and Liechtenstein are included in some country comparisons, but regional income and population data for the former are not available in the Regio database.

[2] The figures apply from 2008. Before that, the numbers were 95, 268 and 1284 at the NUTS 1, 2 and 3 levels, respectively.

data are missing for Bulgaria in 1995 and Romania in 1995-97, so even at the country level and the NUTS1 level, some data are missing.

- At the NUTS2 level, data are missing for the two mentioned countries/years and for Denmark in most years. On the whole, data coverage is nevertheless good at the NUTS2 level; covering more than 97% of the total for all years during the period studied.
- At the NUTS3 level, more data are missing and the coverage drops to 90-92% of the total EU population. The main omission is Poland, where NUTS3 data cover less than half of the regions, including some of the economically most important regions. In our NUTS3 calculations, all data for Poland are therefore deleted.

For some calculations, we want a fully consistent time series with constant data coverage over time. In other cases, we allow minor variations in the number of regions covered. The number of regions covered by the analysis therefore varies slightly, as shown in the column to the far right.

For the EU-27, we report regional inequality at various levels, depending on country size: For larger countries (France, Germany, Spain, UK, Poland) we even report NUTS1 calculations, while at the other end we find Cyprus and Luxembourg which have no regional subdivision even at the NUTS3 level. For these as well as Malta (two regions at the NUTS3 level) we naturally do not report any inequality calculations at the country level. Some of the other small EU countries (the Baltic countries, Ireland and Slovenia) only have 1-2 units at the NUTS2 level, so for these we only report NUTS3 calculations.

For non-EU countries, data coverage in terms of years varies across countries. Table A2 in the Appendix shows the years covered by the data and the number of regions in each case. 12 non-EU countries are covered. Observe that the size of regions in terms of population varies considerably across countries: For example in China, the average population of provinces is 43 millions; i.e. much larger than average country size within the EU-27. Hence it may not be appropriate to compare calculations for China with indexes for other countries based on more disaggregated data.

In Section 5, we illustrate some challenges involved when using growth regressions in the analysis of convergence. If such regressions are weighted by population, one may obtain similar results at the country level as those based on inequality measures such as Gini or Theil coefficients. For the analysis of EU-wide convergence, the heterogeneity of outcomes at a country level represents a problem for using standard panel regression techniques. Using inequality measures, this heterogeneity may be examined more easily and transparently. This is one reason why the analysis here is based on standard inequality measures.

In Appendix Table B, we report more than 600 Gini coefficients for regional inequality at the country level. These indexes are population-weighted, so large and populous regions have more influence. A given Gini coefficient can be obtained by means of different underlying distributions. In Diagram 1, we illustrate two hypothetical cases.

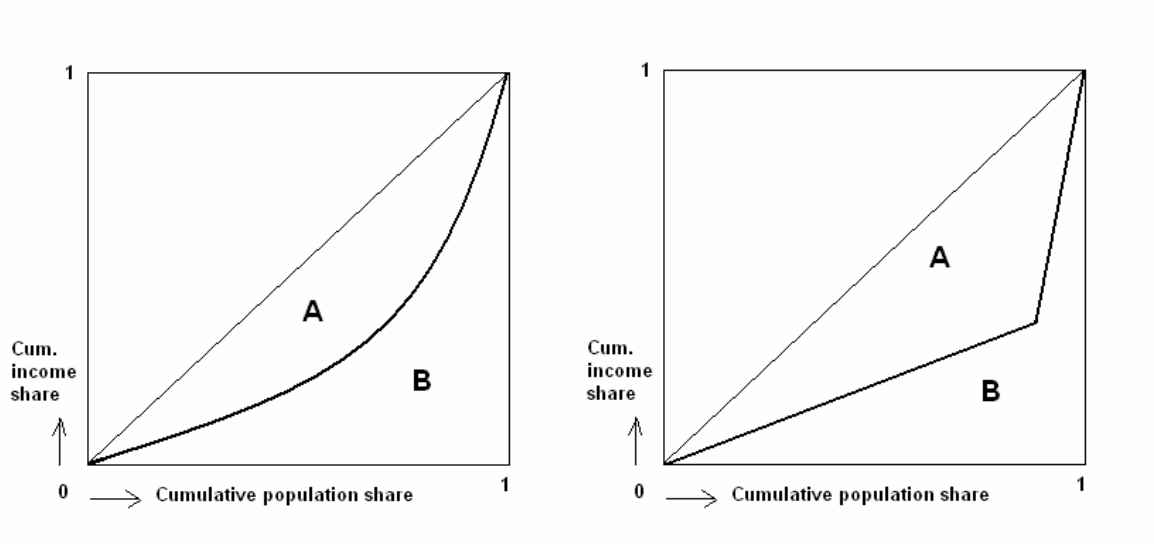


Diagram 1: Distributions underlying the Gini coefficient

In the diagrams, the regions are ranked by income levels (income per capita) and the two axes measure the cumulative shares of population (horizontally) and total income (vertically). Due to the ranking of regions by income level, the resulting solid *Lorenz curves* (the smooth curve to the left, the kinked curve to the right) become gradually steeper as we move from left to right. The ratio between the areas A/(A+B) is the Gini coefficient. If all regions had the same income per capita, the Lorenz curve would coincide with the diagonal and the Gini would be zero.

Diagram 1 illustrates that similar value for the Gini can be obtained with quite different underlying distributions. In the case to the left, there is a distribution with income levels gradually increasing across regions. In the right hand case, most regions are equally poor and a large section of the Lorenz curve is a straight line, but one or a few regions to the right have a large share of the income. In our sample, Russia is somewhere between the illustrated situations, with modest income gaps between the majority of regions but a few far ahead of the others. If e.g. regional inequality increases mainly because a few regions grow faster (e.g. capital regions) we will get closer to the right hand side illustration.

The Gini coefficient has many plausible properties and it is easy to interpret; hence we "follow the crowd" in the literature by using it for the calculation of within-country inequality. For a review of methodological issues, see e.g. Cowell (2000). When we compare within-country regional inequality with inequality across countries, the Gini coefficient nevertheless has the shortcoming that it is not decomposable or additive so that we can say that "regional inequality constitutes x% of total inequality". For that purpose we therefore use the Theil index, which is indeed decomposable so that such statements can be underpinned. The decomposed Theil index can be written as:

$$T = T_{Across\ countries} + T_{Regional} + T_{Personal} = \sum_{c} s_c \ln\left(\frac{y_c}{y_{eu}}\right) + \sum_{r} s_r \ln\left(\frac{y_r}{y_c}\right) + \sum_{p} s_p \ln\left(\frac{y_p}{y_r}\right)$$

Here the Theil index T is decomposed into three terms; (i) between countries, (ii) between regions within countries, and (iii) between persons within regions. The s terms represent shares of total income (in our calculations this is for EU-27) for countries, regions and persons, respectively. y_{eu}, y_c and y_r represent, respectively, average income per capita for all regions and countries taken together (all EU), individual countries, and individual regions, and y_p is the income of each person. In our case we have no data for individual income, so we neglect the inter-personal income component and assume (implicitly) that all persons have income equal to the region average. Then the last term is zero and disappears so we have:

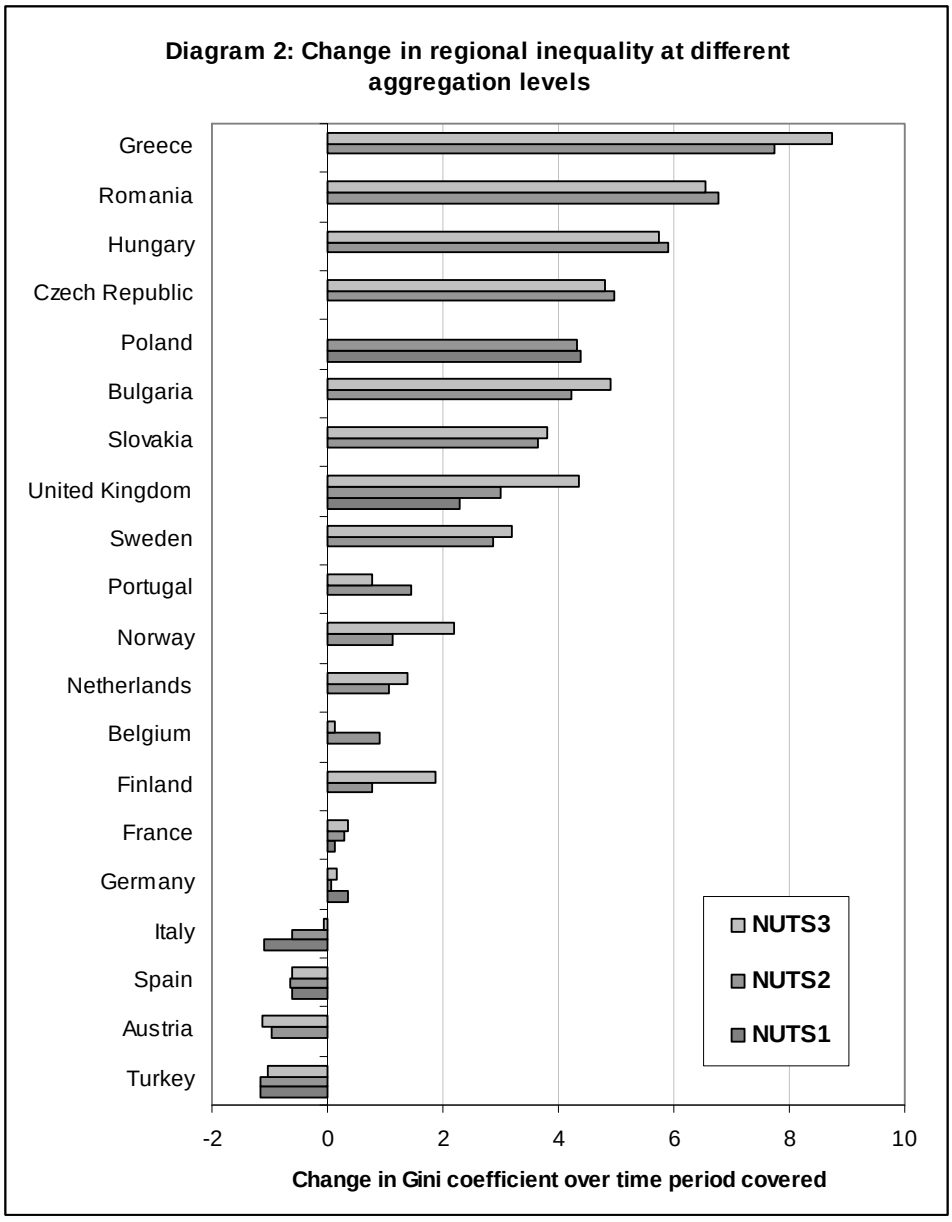
$$T = T_{Across\ countries} + T_{Regional} = \sum_c s_c \ln\left(\frac{y_c}{y_{eu}}\right) + \sum_r s_r \ln\left(\frac{y_r}{y_c}\right)$$

which is the formula used.

For the EU countries, we use PPP data where income is adjusted for price level differences across countries. At the national level, for the calculation of within-country inequality, it does not matter whether we use PPP income data or data based on nominal exchange rates or current prices, as long as it is a proportional scaling of the income for all regions. Similarly, it does not matter for country-level calculations whether we use fixed or current prices as long as the scaling for all regions is the same. We do not currently have regional PPP data available. This is a potential measurement error that we shall revert to later; if inflation rates differ across regions, income should be adjusted for this and non-adjusted data may be misleading. For some countries, this may be a serious issue and some caution should thus be exercised when interpreting results based on common deflators for all regions within a country.

As expected, we observe from Appendix B that more disaggregated data give higher Gini coefficients. The gap varies, however, very much across countries. For example, the level of regional inequality in France is more than doubled when we pass from NUTS2 to NUTS3. For Sweden, on the other hand, the gap is very small. We do not examine the reasons why this varies so much; it may potentially be related to specific institutional characteristics of the regional classification of each country.

What is useful to observe, however, is that the *change* in inequality over time is often very similar at different aggregation levels. This is shown in Diagram 2, where the percentage point change in the Gini is reported at different NUTS classifications for each country. The time period covered is mainly 1995-2005, or in a few cases shorter (as seen from Appendix Tables A and B).



From Diagram 2 it is evident that changes in regional inequality measured at different NUTS levels are closely correlated; In fact the correlation between results at NUTS2 and NUTS3 is at 0.98.[3] Hence even if the reported *level* of inequality is significantly affected by classification, the *change* in this level is fairly similar across classifications. This indicates that changes in regional inequality are driven mainly by growth differences across "major" regions within each country, and that more "localised" regional variation plays a less important role. A practical implication is that results at the NUTS2 level, where we have better data coverage than for NUTS3, should give a fairly reliable picture of changes in inequality. We will revert to the country-level results later, after examining the relative role of inequality across and within countries.

[3] Results for NUTS1 are reported only for 7 cases so the number of observations is small, but also here the correlation is high, in the range 0.94 (with NUTS3) and 0.99 (with NUTS2).

Observe that inequality measures are generally insensitive to changes in the ranking of countries: Say, for example, that in a country there is growth in the west and stagnation in the east because some regions are closer to the EU markets. This may correspond to large changes for individual regions but inequality measures such as the Gini or Theil indexes could be unaffected. Hence our methods do not capture all types of spatial changes in inequality. In Melchior (2008), methodologies for analysing such spatial aspects of regional inequality are developed.

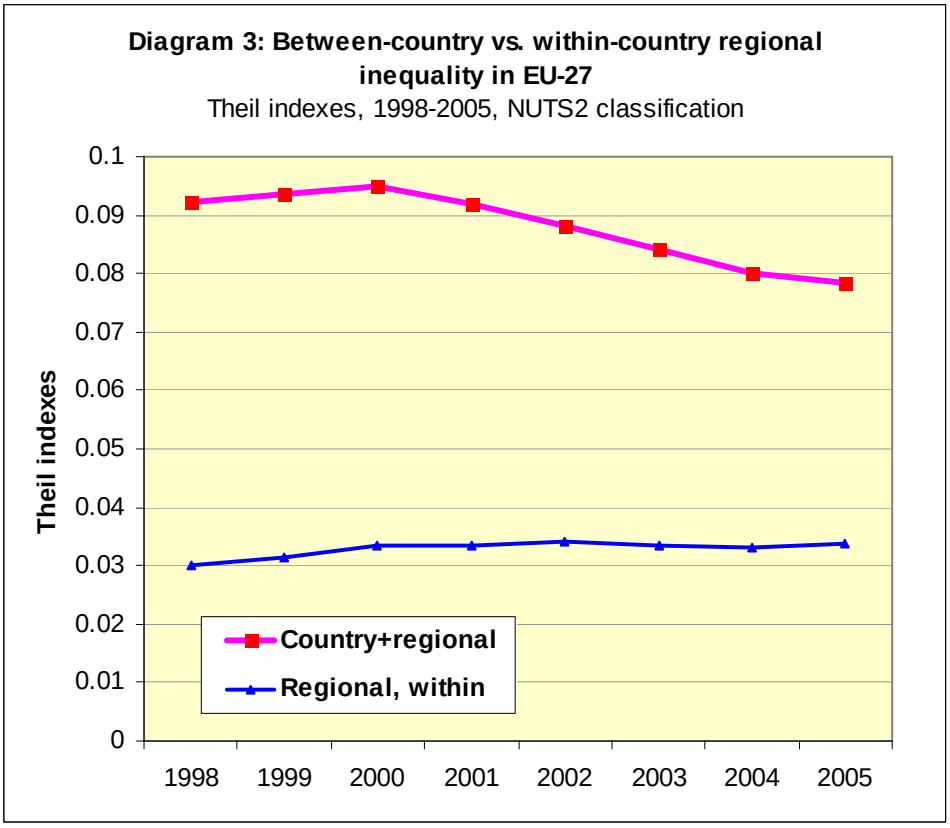
3. The relative importance of between-country and within-country inequality in the EU

As noted in the introduction, a core issue is whether there has been income convergence in Europe as a whole, and the role played by regional disparities in this context. In order to address these issues, we report in Appendix Table C Theil indexes for the EU-27, and Gini coefficients for the EU-15, EU-27 and EEA (the European Economic Area).[4]

Diagram 3 shows Theil indexes for EU-27 during the period 1998-2005. 1995-1997 is not included since Romania is missing for these years and we want to have a consistent time series with the highest possible data coverage.

Diagram 3: Between-country vs. within-country regional inequality in EU-27

Theil indexes, 1998-2005, NUTS2 classification



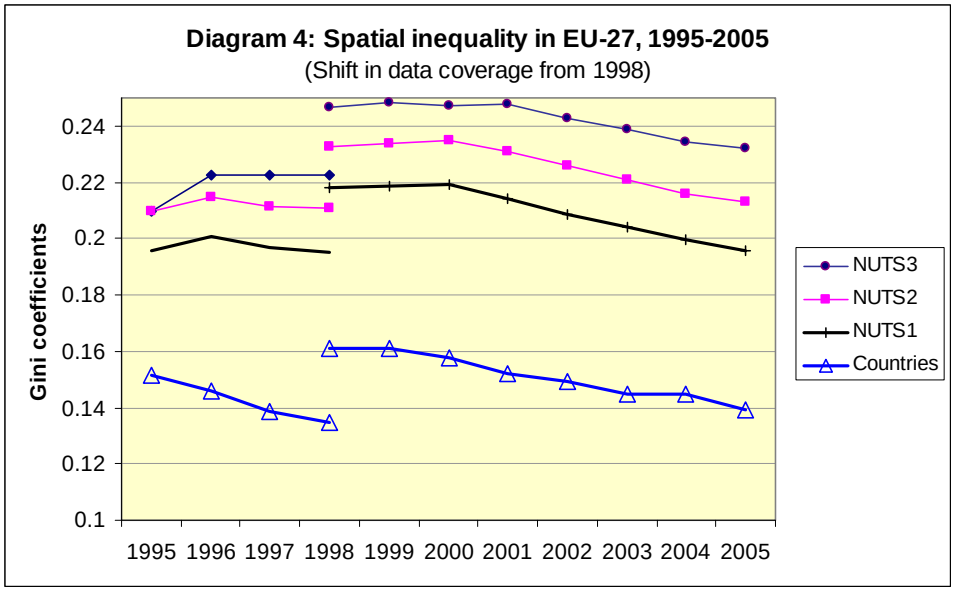
The lower curve shows that for the EU-27, the within-country inter-regional component of inequality has increased slightly but not dramatically.

[4] At the NUTS2 and NUTS3 level, we only have data for Norway so the results for EU-27 and EEA at these levels are very similar.

The upper curve, which includes between-country inequality, falls considerably after the year 2000 and this shows that convergence across countries clearly outweighs the modest increase in within-country regional inequality. Hence for the EU-27, the trend is qualitatively similar to the pattern observed for EU-15 in the preceding decade: There is on the whole convergence, and this is driven by the between-country changes.

Theil indexes at the NUTS3 level show a very similar pattern. In this case, the share of within-country regional inequality is higher, and at the end of the period it is clearly higher then the between-country component. In 2005, the share of regional inequality in the total of regional+country-level inequality in the EU-27 was 43% at the NUTS2 level, and 64% at the NUTS3 level. Hence evaluated at the NUTS3 level, within-country regional inequality is now clearly more important than inequality across countries. This provides another motivation for addressing regional disparities. In the policy context, one might say that formerly, differences across countries were the most important for European convergence; from 2005 onward regional inequalities are at least as important.

The Gini index is not decomposable but we may obtain qualitatively similar information by comparing Ginis calculated at different levels of regional classification. This is shown in Diagram 4.



Here we also show calculations for 1995-98 excluding Romania and with some variability in data coverage, e.g. more data missing for 1995. Hence the trends for the curves with regional sub-division to the left may not be reliable. The lowest curve, at the country level, should however be reliable and suggest a fall in inequality across countries also in the period 1995-98. The curves to the right are more or less parallel, indicating that the fall in overall inequality is driven by the between-country component; as also confirmed by the Theil index calculations.

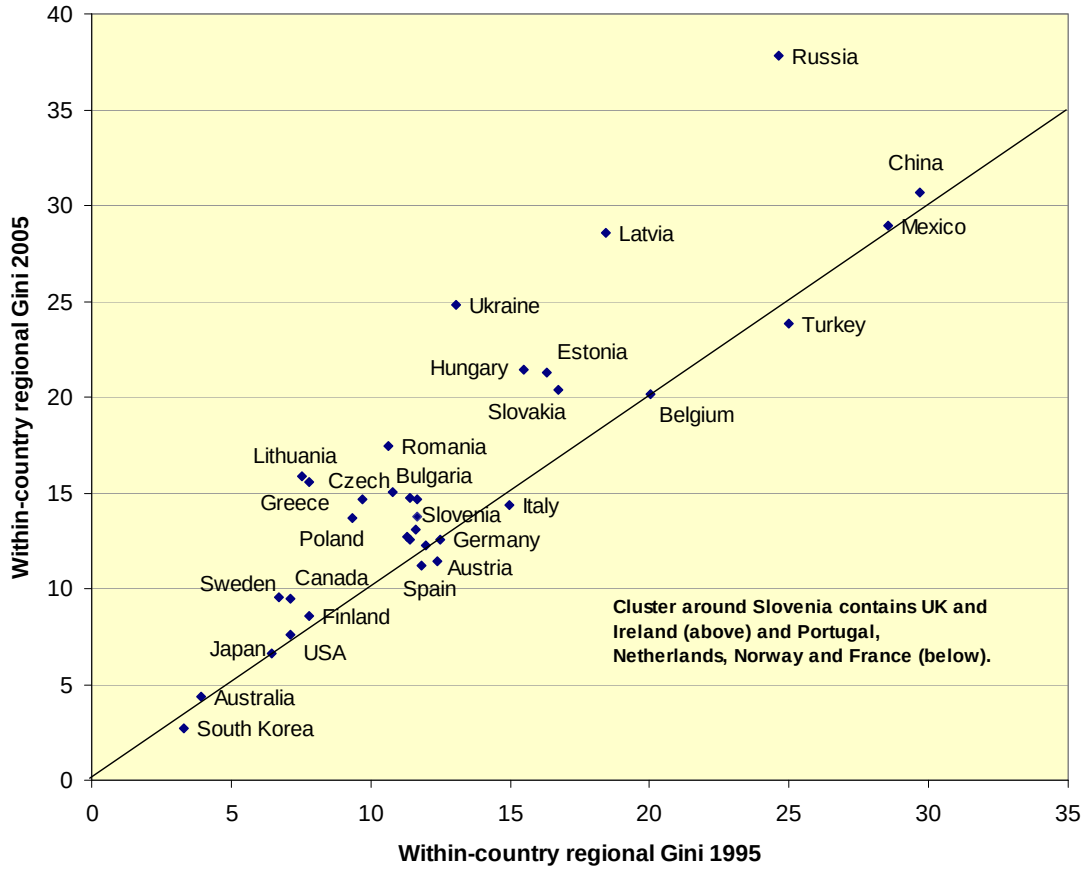
In 2005, the country-level Gini for the EU-27 was at 14%, while this measure for the EU-15 was at only 5%. Hence in the old EU, inequal-

ity across countries is now modest.[5] Wider European integration has in a sense added more between-country inequality, but from 2000 there has been a substantial reduction in this component as well.

4. Trends in within-country regional inequality

Diagram 3 showed, on the whole, a slight increase in within-country regional inequality in the EU-27. Is this driven by higher regional inequality in CEE countries? In order to answer this question, we shall examine more closely the results in Appendix Table B on regional inequality at the national level. In Diagram 5, we show the Gini coefficients for 1995 and 2005 (or the closest available years) for all the 36 countries covered in Appendix table B.

Diagram 5: Regional inequality: Change in Gini coefficients from 1995 to 2005
(Note: Shorter time period for some countries, see note in text.)



On the horizontal axis we show the Gini for 1995, and on the vertical axis the Gini for 2005. If a data point is at the 45º line, there was no change in the Gini. If it is above the line, there was an increase over time, and the vertical distance from the line measures the magnitude of this. By this measure, we observe that for all the CEE countries included, there was an increase. Except for Greece, all the "top countries" in terms of increasing

[5] More details on the pattern of inequality in EU-15 are available in Appendix C.

regional inequality are CEE countries. The only deviation from this is Slovenia, which is closer to the 45º line and observed a more modest increase.

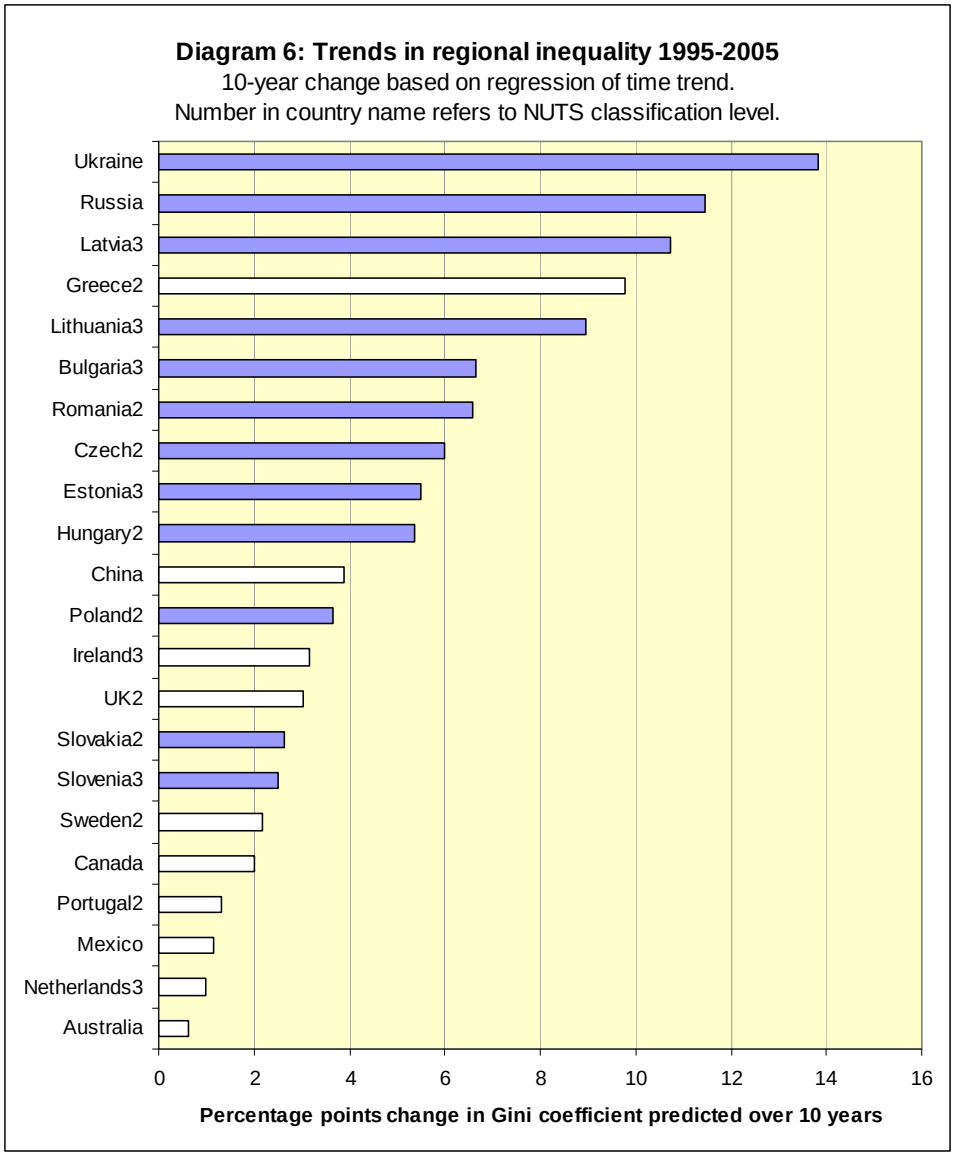
In our calculations, we have included a number of non-EU countries for comparison and we see that none of these are able to compete with CEE in terms of rising Ginis. This applies even for China, where it is well known that growth during the last decade has been higher in the coastal regions.[6] Hence the results indeed confirm that from an international comparative perspective, the rise in within-country regional inequality in the CEE countries covered here has been particularly large during the last decade.

Diagram 5 shows the simple change in Ginis over time but this is not fully representative for the change since some years are missing for a few countries. There may also be fluctuations over time so that the simple difference between the first and last year Ginis may not be representative for the trend. In order to correct for this, we regress the Ginis on a time trend variable and use the regression results to assess the trend change over time. The results are presented in Appendix Table D.

The regressions show a statistically significant trend towards higher inequality in 23 out of 36 countries, a reduction in three cases only (Austria, Turkey and Italy[7]), and ambiguous or non-significant changes in 10 cases. We show the magnitude of changes by using the predicted change over 10 years, according to the regression estimates. This is shown in Diagram 6, for the (selection of) countries with the largest predicted increase in the Gini. Observe that numbers (2 or 3) in the country names refer to NUTS levels; e.g. "Latvia3" says that the result for Latvia is based on data at the NUTS3 classification. In the diagram, CEE countries are shown in darker colour.

[6] The comparison with China is not fully "fair" since there was a considerable increase in inter-provincial inequality in China during 1990-95. If we had included this, China would also have shown a sharper increase in the Gini.

[7] For Italy, this applies only at the NUTS1 and NUTS2 levels.

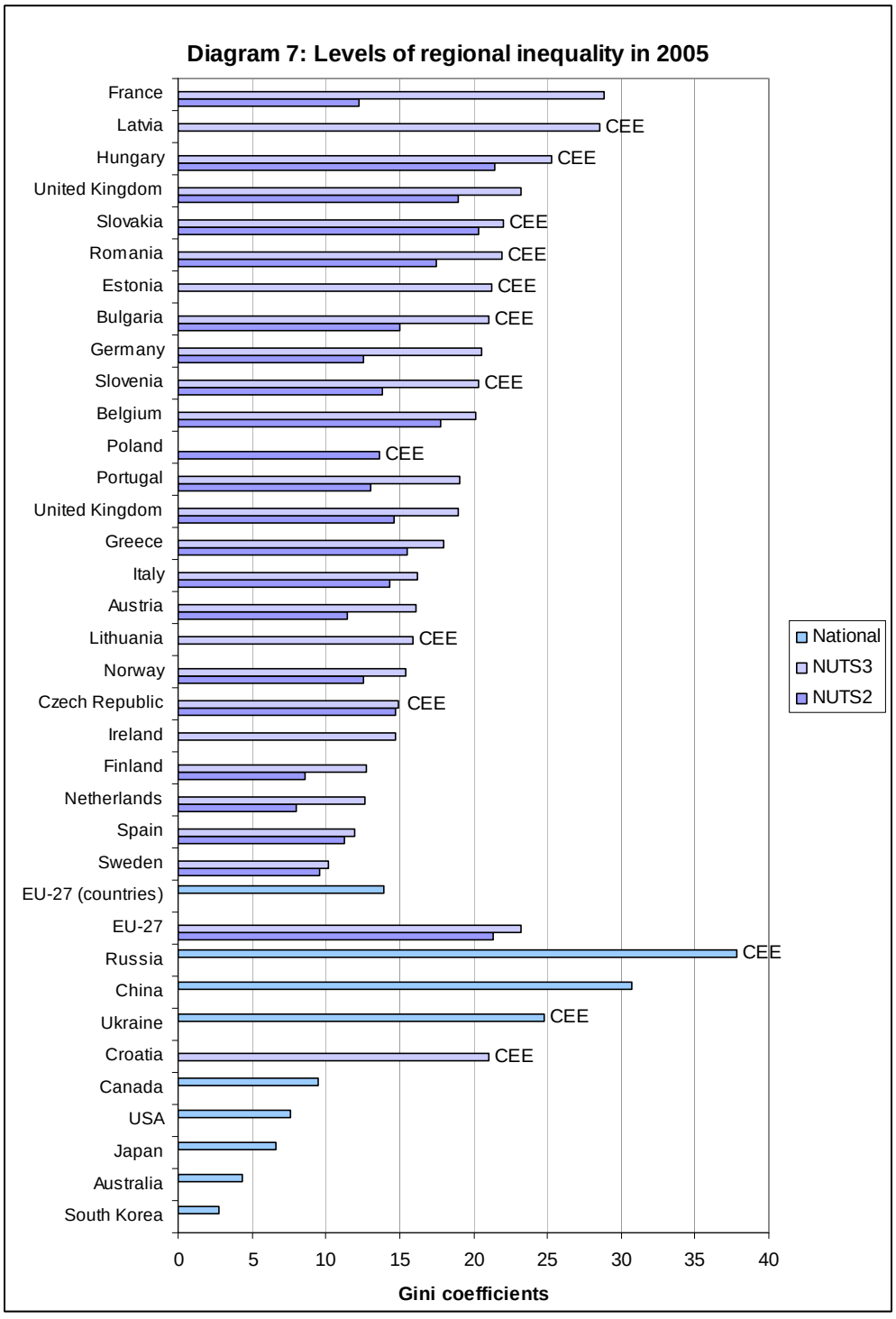


Unsurprisingly, CEE countries dominate the ranking: among the top 10 countries 9 are CEE, and the remaining ones (Poland, Slovenia, Slovakia) [8] follow among the next 6, so 12 out of the top 16 are CEE. On the top, we find important Eastern neighbours of the EU-27, namely Ukraine and Russia. In sections 6 and 7, we examine further some aspects that are relevant for these countries. In particular, there is uncertainty about price changes at the regional level in Russia and there is therefore some uncertainty about the results shown above.

While the *increase* in regional inequality is a common feature for the CEEs, their *levels* still differ considerably. As seen from Diagram 5, these levels differ substantially across countries; ranging from 3% (South Korea) to 38% (Russia) in 2005. For the western European countries, a typical level seems to be a Gini of 10-15%, with Belgium as an outlier with 18-20% (depending on whether NUTS2 or NUTS3 data are used). In Diagram 7, we show the levels of inequality in 2005 for the countries with

[8] For Croatia, the time series is very short so the time trend is not statistically significant even if there was an increase in the Gini.

data for that year. On top there are the EEA countries (23 EU countries plus Norway); in the middle we include Ginis for the EU-27 as a whole, and at the bottom there are other countries for comparison.



When interpreting the table it has to be recalled that levels depend on aggregation levels, and we therefore show results with different classifications. For example, China and the EU-27 as a whole may not be so different if EU results at NUT2 or NUTS3 are applied, but the appropriate classification for the EU in this case could be the country level, and the gap

between EU-27 and China is then much larger. Even at a given classification level, Appendix Table B shows that the average size of regions varies a lot. These classifications are heavily influenced by national institutional characteristics, and strict comparability across nations cannot be guaranteed.

With these caveats in mind, we observe that CEE countries are more dispersed on this ranking of levels, compared to the earlier ranking of changes. Some CEE countries still have levels of regional inequality close to the European "typical" level (Poland, Slovenia, Czech Republic, Lithuania). Among new CEE members, Hungary and Latvia stand out with clearly above-average regional disparities. And on the whole, it is clear that the new CEE members of the EU are disproportionately clustered in the upper half of the EU/EEA ranking.

Outside the EU, we find Russia and Ukraine on top, with levels comparable to China (and Mexico, if we consider data for earlier years). Croatia follows not far behind. So also here, CEE countries are above average. For Russia, Latvia and Ukraine, the levels as well as the increase over time are exceptionally high from an international comparative perspective.

5. Inequality measures versus growth regression analysis of European convergence

In the analysis of regional as well as national convergence, growth regression is an alternative method frequently applied (see e.g. Barro and Sala-i-Martin 1995). In principle, our Ginis and the regressions should measure the same phenomena and they should therefore be correlated. This is indeed the case, but not perfectly and there are some differences.

In order to examine this, we run growth regressions for the EU-27 as a whole, and for 23 of the individual EU-27 countries (plus Norway). We run standard growth regressions of the form

$$\ln(y_{i1}/y_{i0}) = a + b*\ln(y_{i0}) + u_i$$

Where y_{i1} and y_{i0} are income per capita levels in the first and last year for each region, respectively, u_i is the residual[9], and a and b are parameters to be estimated. A negative sign for b indicates so-called β convergence (ibid.); i.e. that initially poorer regions grew faster. A positive b indicates divergence. For a discussion, see Barro and Sala-i-Martin (1995, 384). For simplicity here we use the first and last year observations only; i.e. 1995 and 2005 for most countries and 1998/2005 for Romania. We use NUTS3 data except for Poland where we only have NUTS2. Observe that while the average number of observations is 57, this varies between 5 and 414 and in four cases, the number of observations is less than 10. In these cases, the reliability of the regressions is evidently limited.

[9] The regressions here are made in order to illustrate methodological issues and we do not undertake a full examination of possible violations of the assumption that residuals are normally and independently distributed. Hence we neglect e.g. spatial dependencies.

For reasons that will soon become evident, we run four types of regressions; (i) ordinary OLS, (ii) weighted least squares, (iii) robust regression, and (iv) robust regression with weighting. Given that our Gini coefficients as well as Theil indexes are population-weighted, we run regressions where we use population as weights. In addition, outliers affect the results in some cases so we also run robust regressions; unweighted and weighted. In Appendix Table E, we report the b estimates. Table 2 shows how the the regression results for the 24 countries are correlated with the change in our Ginis. Since the regressions use data for the first and last years only, we also measure the change in the Gini between these two periods.

Table 2: Correlation between change in Ginis and parameter estimates for convergence at the country level
23 EU countries + Norway, 24 observations
Pearson correlation coefficients, with P values in brackets

	Ordinary OLS	Weighted least squares	Robust regression	Robust regression, weighted
Ratio Gini last/first year	0.54 (0.0063)	0.90 (<0.0001)	0.50 (0.0128)	0.95 (<0.0001)
Note: For regression results, see Appendix Table E.				

Using ordinary OLS estimates, there is a positive correlation (0.54), but not very high. The other columns demonstrate why: The main reason is that ordinary OLS is unweighted; when weighting is introduced the correlation jumps to 0.90. Handling outliers increases the correlation even further; to a maximum of 0.95 when we use the estimates from robust, weighted regressions. Weighting is clearly more important than outliers. For some countries, the results change dramatically between regressions: In Greece, for example (see Appendix Table E), OLS regressions suggest strong convergence whereas robust, weighted regressions show strong divergence (in line with the Ginis).

Hence at the country-level, the results show that convergence regressions and inequality indexes can give virtually identical results, but this depends crucially on whether calculations are weighted or not. As seen from Appendix Table E, the robust, weighted regressions indicate divergence in the majority of cases. In 16 out of the 23 countries, there was a significant and positive b estimate, in line with our earlier results.

At the overall EU level, the matter is somewhat more complicated. In Appendix E, we also show, for illustrative purposes, convergence regressions for the 24 countries combined (EU-23 +Norway). These results indicate convergence in the EEA, in line with our results based on Theil indexes. The problem with this common regression is however that the heterogeneity within countries is not taken into account. For this reason, residuals for each country will be correlated with the income levels of its regions, so standard assumptions about residuals will be violated.

Given that CEE countries are poorer that Western European countries, it is already implicitly clear from the results above that in the EU-27 or EEA,

- regional inequality increased more in poor countries
- regional inequality increased more in countries with faster growth.

Hence the trends in regional inequality are related to income levels and growth. The correlations in Table 3 show this more precisely:

Table 3: Correlations between income level, growth, Ginis and regression results for 23 EU countries + Norway

	Growth rate in income per capita	Gini trend	Parameter b	
			OLS	Robust, weighted
Initial income per capita (y_0)	-0.58 (0.0027)	-0.69 (0.0002)	-0.52 (0.0088)	-0.61 (0.0016)
Growth rate in income per capita		0.57 (0.0034)	0.69 (0.0002)	0.63 (0.0010)
Note: P values in brackets. N=24.				

Hence the poorer is the country, the higher is growth and the higher is the increase in regional inequality. The latter applies whether we use Ginis or estimates from growth regressions.

But from the EU-level regressions as well as the analysis in Section 3, we have seen that at the European level, the correlations are the opposite: The poor grow faster. This point matters for regression analysis of convergence: It implies that the "within-group" (i.e. for each country) slopes vary across countries, and especially for many of the poorer counties the sign of the slope is opposite to the one that applies to the whole sample.

The implication of this is that standard panel regression techniques using fixed or random effects are not directly applicable, since they assume that the constant term varies across regions or countries, but the slope is the same for all. Hence in convergence growth regressions, one might use techniques where variable slopes as well as intercepts are allowed. Some experimentation with such regressions indicates that estimates on overall EU convergence are sensitive to the set of dummies included. This is one reason why we base our analysis of EU convergence on the Theil indexes, as undertaken in Section 3, and leave further work on EU-level regional convergence regressions as a task for future research.

6. The role of regional disparities in total domestic inequality

In all the calculations undertaken so far, the implicit assumption has been that all persons within a region have the same income. Within each region, however, income inequality exists due to urban rural disparities and class-based income differences. In order to provide a full account of income inequality, we would have to include all inter-personal inequality. This would however require a completely different type of data.

The difference is not only about aggregation, but also the income concept: Using GDP rather than data for household or personal income or consumption, we deliberately include more since the wealth of regions

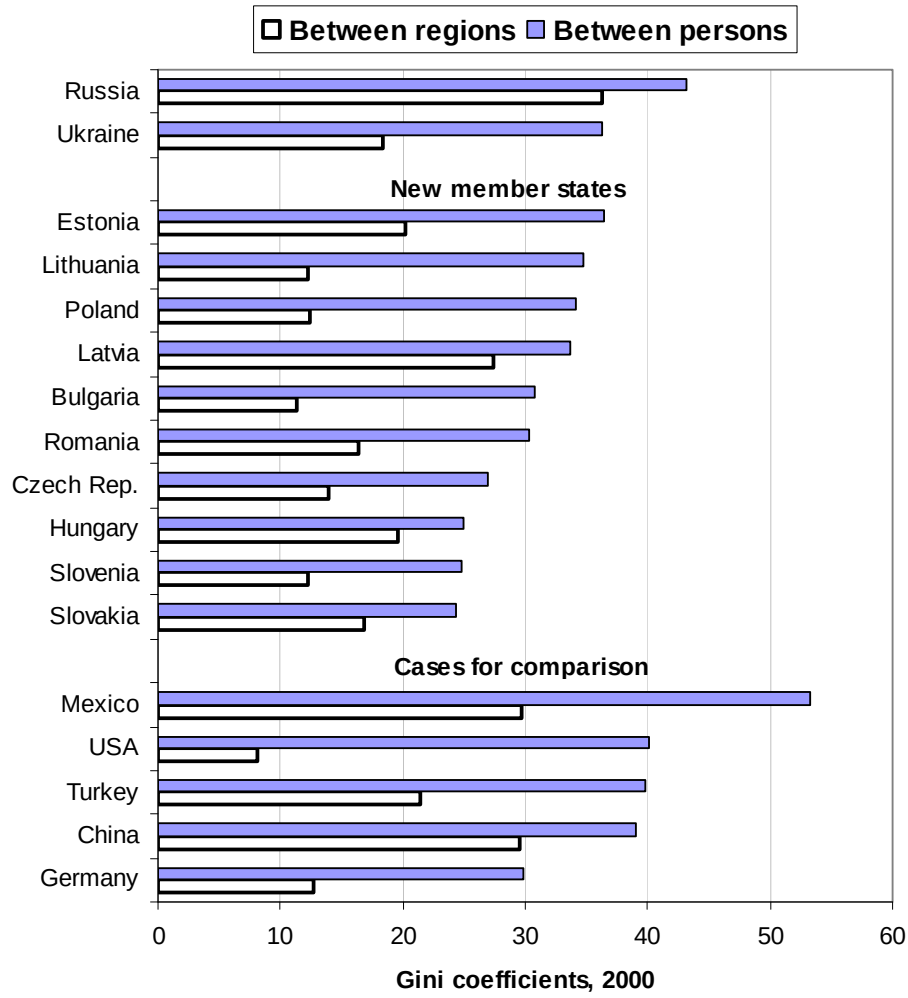
does not only depend on personal consumption but also on public consumption and investment. Hence one should not conclude that the ideal thing would be to use household consumption data, and that our macro-approach is a matter of limited data.

Nevertheless, it is clearly of interest to consider the role of regional disparities in overall domestic inequality. This is especially true for CEE countries since there has also been a fast increase in total inter-personal inequality in many CEE countries. The World Bank (2000, Chapter 4) provided documentation until the late 1990s.

Given the incompatibility of regional GDP data and household consumption data, we shall approach these issues in a roundabout way: by comparing measures of regional inequality with measures of inter-personal income inequality. For inter-personal inequality, it is well known that results crucially depend on data and methodology and even for the same country and year, one may find estimates that vary widely (see e.g. Atkinson and Brandolini 2001). For this reason, it is important to use quality-checked data. We use the UNU-WIDER (2008) database, which is more up-to-date than other similar databases, and where results are classified according to quality. We choose the years 2000-2001 in order to obtain the best possible data coverage, both for our own regional results and the inter-personal Gini coefficients where data coverage is more limited for later years. In Appendix Table F, the data used in the following analysis are presented.

In Diagram 8, we compare the two sets of inequality measures for selected countries. Recall that they are based on different income concepts and in spite of using quality-checked Ginis for inter-personal income inequality we cannot guarantee full comparability across countries. The material here should therefore be considered as a crude check only regarding the role of regional disparities in overall country-level inequality. Recall also that Ginis are not decomposable so we cannot from Ginis say anything about the "share" of regional inequality in total inequality. What we do is to compare the ranking in the two cases, in order to shed some light on the relative role of regional gaps.

Diagram 8: Regional vs. personal income inequality. Gini coefficients, 2000.



Rankings differ considerably across countries for the two measures. This is reflected in a correlation coefficient of 0.56. Hence there is a correspondence, but it is far from perfect. As illustrated by the case of the USA, high income inequality may be combined with modest regional inequality. On the other hand, we find cases such as Mexico, China and Russia where both types of inequality measures are high, and intermediate cases such as Turkey and Ukraine, where inter-personal inequality is high and regional inequality intermediate. From our earlier discussion, we have seen that Ukraine is approaching the top also for regional gaps.[10]

Among CEE EU members, we observe that regional inequality is particularly important, in relative terms, for Latvia and Hungary. For Hungary, this is well known from other studies (see Förster et al. 2003, 3), due to the dominant position of the capital region. Also for Russia and

[10] Milanovic (2005) calculates population-weighted regional Ginis for 2000 also for India (18.7), Brazil (28.0) and Indonesia (19.9). Hence Brazil is also in the "top league" with respect to regional inequality.

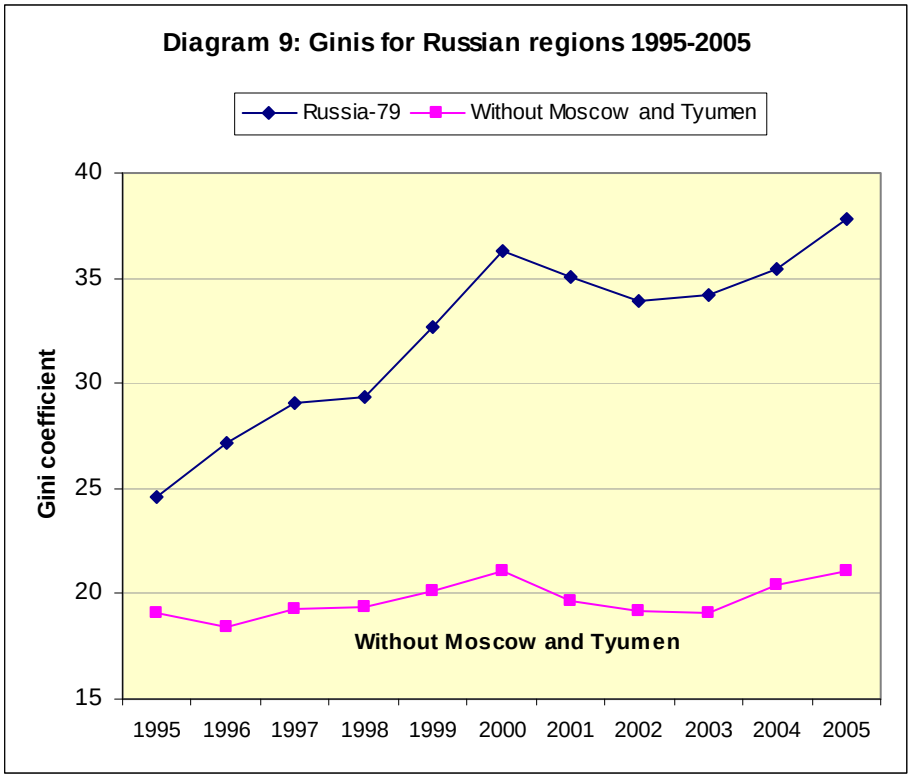
Ukraine, we shall show in Section 7 that capital regions play an important role in inter-regional inequality.

From the graph, one could also get the impression that the relative importance of inter-regional disparities is not ¼ as suggested by Kanbur and Venables (2007) but rather 30-40%. Such a conclusion can however not be drawn here since the two indexes have been constructed from different data. If we had personal income data for the regions, we could calculate inequality indexes that are decomposable and additive (such as the Theil index) and express exactly how large is the share of inter-regional inequality in the total. Using data from the Luxembourg Income Study (for household disposable income), Förster et al. (2003, 11) calculated Theil indexes and found that inter-regional inequality accounted for a mere 10% of domestic inequality in Russia in 1995. This shows that different income concepts render different results and that we should be cautious when comparing indexes based on different data. Diagram 8 may indicate that gaps in regional GDP are larger than regional gaps in disposable household income. More research is however needed in order to draw firm conclusions.[11]

7. The role of capital regions in regional inequality

As already noted, one issue for Russia is whether increased regional inequality is mainly driven by a few regions. It is well known that growth has been faster in the capital region, and some regions have also experienced fast growth because of oil and gas resources and prices. For example, the Tyumen region in 2005 had average nominal GDP per capita almost 6 times the Russian average. As an illustration of the impact of these two regions alone (i.e. Moscow and Tyumen), we calculate Ginis also without them. This is shown in Diagram 9.

[11] For some CIS countries, income-based Ginis show larger inequality than consumption-based calculations (World Bank 2000, 144). Hence a detailed examination of data and methodology is important to sort out how different measures are related.



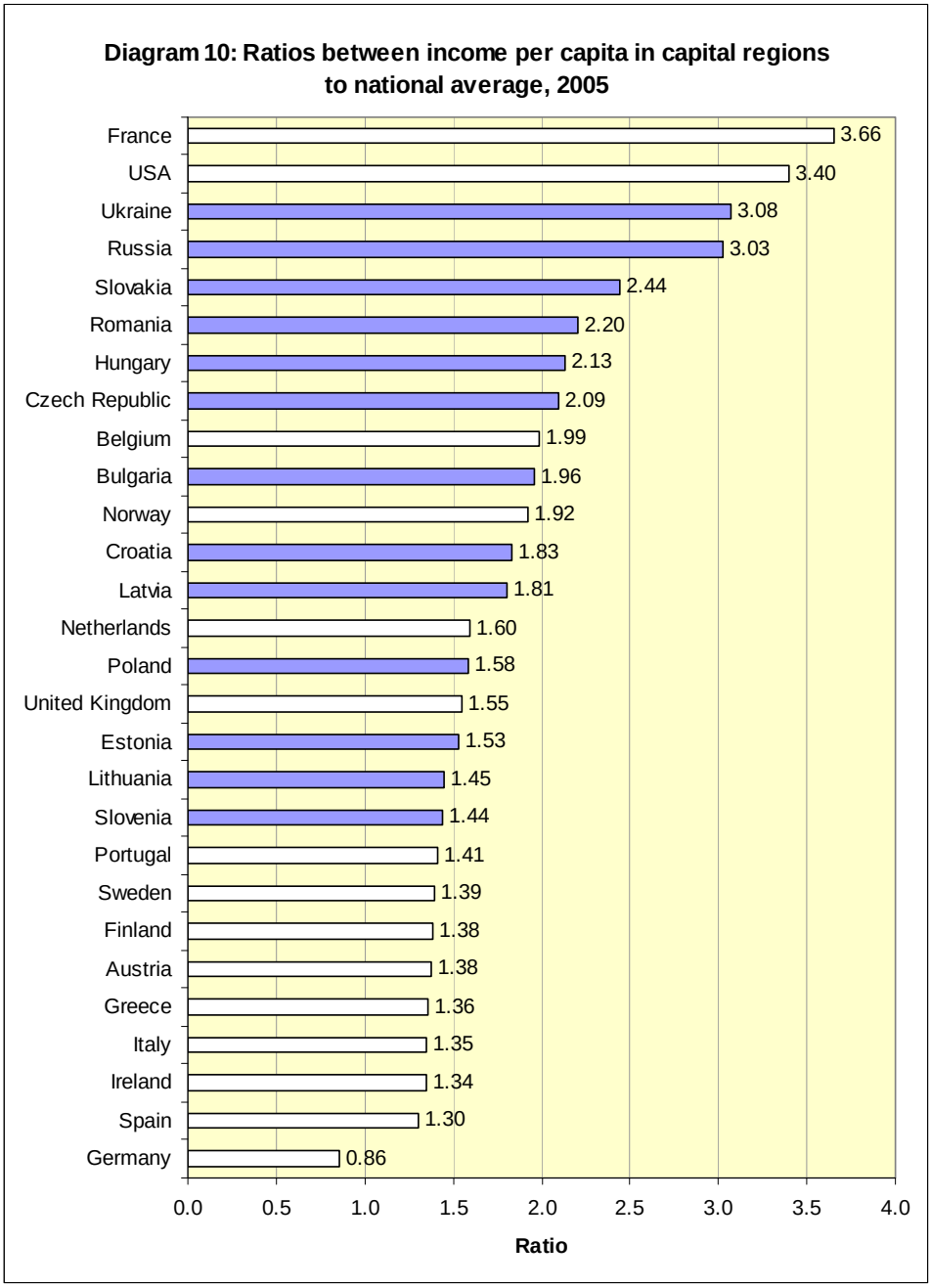
The curve on top is based on our results presented earlier. At the bottom, Ginis for Russia without Moscow and Tyumen are presented, showing little change in inequality. Hence for Russia, most of the change is driven by these two regions.

It has been observed that strong growth in capital regions has been an important feature in some CEE countries. Landesmann and Römisch (2006, 6) find that except for Romania, most of the increase in inter-regional inequality in CEE EU member countries until 2002 was due to capital regions. This was 100% true for the Czech Republic, Slovakia and Bulgaria, while in Poland and Hungary, some increase in regional disparity took place in 1995-2002 also when capital regions were left out of the analysis.

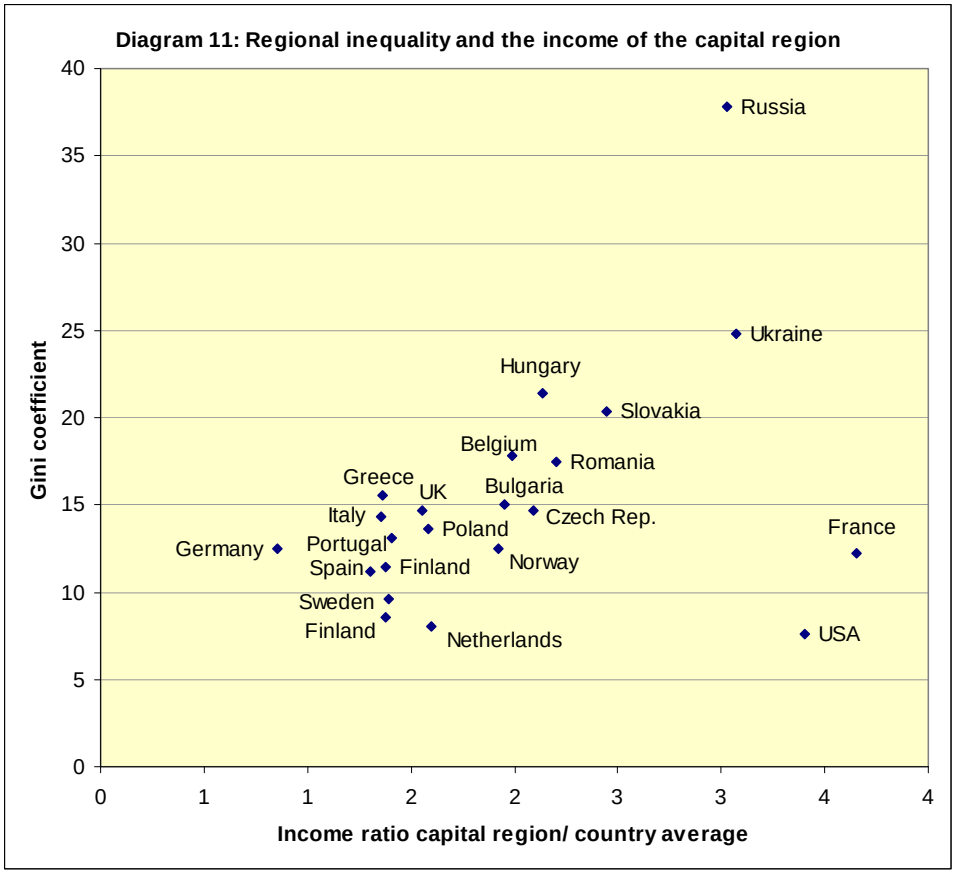
There is however nothing "abnormal" about this; it is a standard aspect of regional inequality that capital regions grow faster. Faster growth in capital regions is not an explanation, but a feature of inequality. There may be different reasons why this happens. For example, in Melchior (2008) we describe a hub-and-spoke pattern where capitals act as transport or services hubs and this may provide a mechanism by which income gaps may increase.

In the following, we add another simple test on the role of capital regions, in order to shed light on the issue: We calculate the ratio between income per capita in capital regions and the respective national averages. For this purpose, we generally use the most detailed definition of capital regions, except for Poland where NUT3 data are missing. The "narrowness" of capital regions may vary across countries and for that reasons there is also here a question about comparability. For example, we shall observe that France has a very high ratio, which may partly be because the capital region is here narrowly delineated; if surrounding areas had been

included, the figure would drop. With this reservation in mind, the comparison is still of some value. The results are shown in Diagram 10, with CEE countries in darker colour.



Hence France and USA top the ranking but except for this, the upper part of the ranking is dominated by CEE countries. If we plot this income ratio against the regional Ginis, we see even clearer that France and the USA are outliers but except for that, there is a rather clear correspondence between the two. This is presented in Diagram 11, using Ginis at the NUTS2 level.

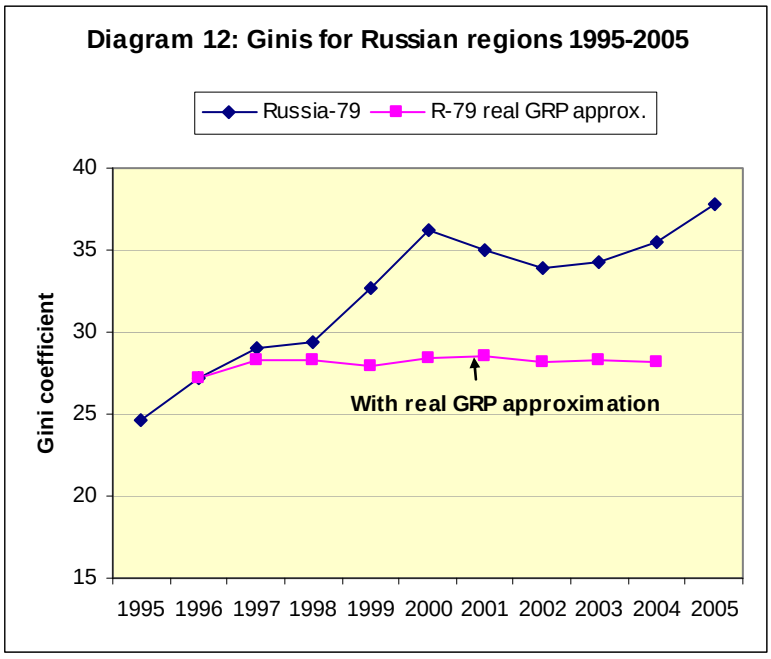


At the NUTS2 level, the correlation coefficient between the two is 0.41, at the NUTS3 level 0.61. If we drop the two outliers (France and the USA), the correlation increases to 0.82 at the NUTS2 level (while it remains 0.61 for NUTS3). This correlation is another indication to the effect that higher income in capital regions is indeed a normal feature of regional inequality. For Russia as well as Ukraine, it is evident that higher income in capital regions is an important component of their high regional inequality.

8. A note on regional PPPs

In this paper, calculations have relied on income data based on national deflators rather than region-specific ones. As noted, this creates potentially a bias if price changes vary across regions. For small and rich Western European countries such as Norway or Denmark or Belgium, with a developed commercial infrastructure, we would expect that inter-regional price differences are present but modest. The situation may be completely different in large middle-income countries such as e.g. India, China, Turkey or Russia. The less developed is the infrastructure, the more fragmented is a country, and if infrastructure is correlated with income, this should be a larger problem in poorer countries. Developing countries may also have less modernised regions with more poverty; with different consumption baskets compared to major cities. Hence (as a hypothesis) low income combined with large country size renders it more likely that price differences across regions are more important.

An interesting case in question is Russia. If prices as well as inflation rates have been lower in peripheral regions, the result could be that inter-regional inequality is over-estimated with the use of nominal income data, and it is also possible that the change over time is exaggerated due to different inflation rates. For Russia, Gluschenko (2006) has demonstrated the problems and limitations with currently available price deflators for regions. According to Gluschenko, the regional consumer price index for Russia is not a plausible alternative for deflation of regional GRP. Data for Russia, however (but not Ukraine), include an index of change in real GRP from 1996 to 2004, and we assume this has been constructed using some broader GRP deflator.[12] As a first approximation to the price issue, we therefore use nominal GRP values for 1996 and calculate the change to 2004 using the real GRP index. Diagram 12 shows the result.



Hence according to the real GRP approximation, there was not much change in inequality. This is however just a first crude test and further research for Russia as well as for other nations is necessary in order to address the price issue properly. The purpose here has been to raise the issue and make clear that for some countries, research on the price issue may be necessary if we are to draw firm conclusions about real income inequality.

9. Concluding comments

Compared to earlier research, this paper has examined regional inequality with a data set extended to more recent years and to more countries. We have shown that within-country regional income differences have remained stable in most of Western Europe but increased in Central and Eastern European countries; in some cases considerably. For the EU-27 as

[12] It has so far been impossible to obtain more information about this; in spite of some efforts.

a whole, income convergence across countries has however been quantitatively more significant than the rise in domestic regional inequality so on the whole, there has clearly been convergence – especially after 2000. The reduction in inequality across countries also implies that from this point onward, domestic regional inequality is quantitatively more important than inequality across countries.

Our comparative study of regional inequality in 36 countries suggests that such inequality is particularly important for some medium-sized to large middle income countries, such as Russia, China, Mexico and Ukraine. Based on other studies (Milanovic 2005) we could also add Brazil. For such countries, price differences across regions may however also be important and there is a risk that nominal income data causes an exaggeration of inequality levels. Our preliminary evidence for Russia suggests that more research should be done in order to correct for price differences across regions.

The purpose of this paper has been to provide an updated a comprehensive assessment of regional inequality in Europe and beyond. We have also shown how changes in inequality are related to income levels and growth rates, and addressed some methodological issues that are relevant in future work in the field. However the task of explaining the reasons for levels and changes in inequality has been left for further research.

Given that an increase in regional inequality has occurred in a number of countries at the same time as globalisation and wider European integration, there could be a temptation to jump to premature conclusions about causality: Regional inequality is *caused* by globalisation or integration. This is however far from clear, and specific research is needed to explain the rise in regional inequality.[13] One possibility is that increased regional inequality is a temporary "Kuznets-like" phenomenon where some regions grow first, and others catch up at a later stage. Another possibility, however, is that inequalities are more permanent due to agglomeration mechanisms, technology gaps or other forces. More research should be undertaken to address such issues.

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[13] In a companion paper (Melchior 2008), we ask how EU enlargement could affect regional disparities in CEE countries and a preliminary empirical check does not provide any support for the hypothesis that east-west European integration has promoted higher regional inequality.

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Appendix Table A1: Data sources	
Eurostat Regio database, available at http://epp.eurostat.ec.europa.eu	EU-27, Croatia, Turkey, USA, Canada, Mexico, Japan, South Korea, Australia.
National statistical agencies used for:	Norway, supplementary data Russia, Ukraine, China
World Bank: World Development Indicators 2007	Supplementary population data for some countries

Appendix Table A2: Data coverage for domestic regional inequality beyond EU-27

Country	Classifi-cation	Years	Number of regions	Average po-pulation of regions 2001
Australia	National	1990-2006	8	2426
Canada	National	1990-2006	12	2585
China	National	1995-2006	30	43044
Croatia	NUTS3	2001-2005	21	211
Japan	National	1990-2005	10	12731
South Korea	National	1990-2005	7	6765
Mexico	National	1993-2004	32	3116
Norway	NUTS2	1995 and 1997-2005	7	645
	NUTS3		19	238
Russia	National	1995-2005	79	1802
Turkey	NUTS1	1995-2001	12	5697
	NUTS2		26	2629
	NUTS3		81	844
Ukraine	National	1996-2005	26	1846
USA	National	1997-2006	51	5593

Appendix Table B: Gini coefficients (population-weighted) for inter-regional inequality within selected countries														
Country	**NUTS**	**N used**	**Avg. Pop.**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Austria	2	9	894	12.38	12.57	12.15	11.88	11.85	11.61	11.96	11.99	11.73	11.48	11.42
	3	35	230	17.18	17.37	17.06	16.85	16.74	16.59	16.78	16.72	16.64	16.35	16.06
Belgium	2	11	935	16.91	17.11	17.17	16.83	17.33	17.50	17.53	17.72	17.43	17.54	17.80
	3	42	239	20.02	20.12	20.09	19.94	20.16	20.05	20.11	20.17	19.74	19.95	20.15
Bulgaria	2	6	1319		10.81	10.57	10.60	12.87	11.31	12.22	13.77	13.71	14.55	15.03
	3	28	283		16.12	13.86	15.16	17.32	17.31	18.50	19.38	18.88	19.54	21.01
Czech Republic	2	8	1278	9.72	9.76	10.38	11.98	13.13	13.89	14.71	15.18	15.12	14.51	14.70
	3	14	731	10.10	10.08	10.95	12.52	13.35	14.16	14.89	15.36	15.33	14.74	14.92
Germany	1	16	5146	10.38	10.34	10.34	10.49	10.64	10.79	11.03	10.87	10.76	10.68	10.72
	2	39	2111	12.47	12.40	12.39	12.57	12.70	12.77	12.98	12.74	12.62	12.45	12.52
	3	415	192	20.35	20.43	20.57	20.77	20.67	20.63	20.78	20.47	20.53	20.40	20.51
Estonia	3	5	273		16.31	18.19	19.45	19.12	20.13	20.48	20.93	21.28	22.63	21.27
Spain	1	7	5817	10.65	10.85	11.11	11.55	11.80	11.77	11.62	11.22	10.70	10.39	10.03
	2	19	2143	11.84	12.08	12.32	12.69	12.98	12.96	12.80	12.38	11.86	11.56	11.21
	3	49	778	12.56	12.87	13.15	13.55	13.88	13.80	13.62	13.25	12.68	12.34	11.94
Finland	2	5	1038	7.82	8.43	8.55	9.47	9.82	9.61	9.74	9.34	8.46	8.58	8.59
	3	20	259	10.89	11.52	11.70	13.08	13.95	13.97	14.10	13.63	12.43	12.45	12.76
France	1	8	7432	11.08	11.23	11.37	11.11	11.76	11.77	11.53	11.66	11.72	11.20	11.20
	2	22	2702	11.97	12.17	12.22	11.98	12.65	12.87	12.65	12.68	12.74	12.31	12.24
	3	96	619	28.47	28.79	28.69	29.76	28.49	29.02	30.20	29.87	29.11	26.66	28.82
Greece	2	13	842	7.79	7.26	6.90	6.55	6.51	12.09	12.56	13.56	13.70	14.40	15.53
	3	51	215	9.22	9.67	9.58	9.58	9.57	14.26	15.04	15.89	16.18	16.70	17.95
Croatia	3	21	211							20.37	19.66	20.61	20.79	21.00
Hungary	2	7	1455	15.51	16.61	17.57	17.65	19.05	19.65	19.86	21.01	20.30	20.02	21.41
	3	20	509	19.56	20.77	21.52	21.87	22.95		23.25	24.39	23.82	23.71	25.29
Ireland	3	8	480	11.43	11.72	13.01	13.68	13.12	13.18	13.17	14.65	14.73	14.46	14.73
Italy	1	5	11396	13.71	13.82	13.64	13.59	13.33	13.44	13.25	13.13	13.14	12.99	12.61
	2	21	2713	14.98	15.13	14.83	14.80	14.46	15.18	14.92	14.86	14.75	14.72	14.35
	3	99	559	16.30	16.37	16.16	16.24	16.16	16.88	16.96	16.60	16.45	16.65	16.23

Appendix Table B: Gini coefficients (population-weighted) for inter-regional inequality within selected countries														
Country	**NUTS**	**N used**	**Avg. Pop.**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Lithuania	3	10	348	7.53	7.53	9.56	10.63	11.74	12.30	13.45	14.93	15.10	15.00	15.87
Latvia	3	6	393		18.45	20.65	24.44	26.61	27.45	25.76	28.98	27.52	29.98	28.54
Netherlands	2	12	1337	6.96	7.54	7.65	7.69	7.95	8.05	7.45	7.81	7.64	7.83	8.02
	3	38	394	11.29	11.73	11.74	11.95	11.95	12.25	11.57	12.04	12.06	12.46	12.69
Norway	2	7	645	11.38		12.71	13.54	13.71	13.54	12.77	12.50	11.70	12.05	12.53
	3	19	238	13.27		14.68	15.70	16.23	15.62	15.56	14.38	14.36	14.75	15.45
Poland	1	6	7650	6.61	7.66	8.18	8.88	9.95	9.78	10.34	10.03	10.24	10.23	10.99
	2	16	2391	9.34	10.68	10.91	11.44	12.49	12.38	13.05	12.84	12.92	13.01	13.66
Portugal	2	7	1470	11.62	11.57	12.38	12.74	11.66	12.54	12.09	12.57	12.87	13.03	13.06
	3	30	343	18.35	18.06	18.65	18.85	18.01	18.79	18.38	18.49	18.76	18.97	19.11
Romania	2	8	2801				10.65	13.24	16.38	16.62	16.73	15.46	15.35	17.44
	3	42	534				15.36	16.52	19.94	19.73	21.09	19.42	18.77	21.92
Sweden	2	8	1112	6.70	7.22	8.30	8.73	9.51	9.31	9.04	8.90	8.93	9.14	9.58
	3	21	424	6.99	7.75	9.10	9.52	10.33	10.13	9.73	9.50	9.48	9.73	10.17
Slovenia	3	12	166	11.64	11.62	11.58	11.55	12.34	12.22	12.61	12.76	13.72	13.54	13.78
Slovakia	2	4	1076	16.71	16.13	16.43	16.28	16.49	16.89	16.36	16.82	17.40	17.89	20.36
	3	8	672	18.24	17.83	18.19	18.24	18.32	18.64	18.48	18.63	19.06	19.42	22.06
Turkey	1	12	5697	22.22	22.31	22.48	21.78	21.46	21.43	21.06				
	2	26	2629	24.98	24.78	24.83	23.86	23.71	23.91	23.81				
	3	81	844	26.91	26.54	26.82	25.72	25.58	25.70	25.86				
United Kingdom	1	12	4926	8.17	8.42	8.82	9.33	9.70	9.98	9.84	10.10	10.23	10.31	10.46
	2	35	1664	11.65	12.00	12.82	13.43	13.86	14.42	14.34	14.58	14.62	14.51	14.66
	3	126	462	14.62	14.82	16.76	17.38	18.08	18.72	18.86	19.14	19.16	18.99	18.96
Canada		12	2585	7.13	7.41	7.86	7.25	7.36	8.59	8.44	7.65	8.22	8.59	9.49
USA		51	5593			7.14	7.31	7.63	8.16	8.06	7.65	7.47	7.55	7.60
Mexico		32	3116	28.54	28.31	28.66	28.93	29.08	29.66	29.12	29.79	29.49	28.98	
Japan		10	12731	6.46	6.30	6.50	6.46	6.55	6.61	6.48	6.48	6.50	6.48	6.60
Korea		7	6765	3.32	2.60	1.87	2.82	3.24	3.10	3.43	3.29	3.07	2.96	2.73
Australia		8	2426	3.91	4.19	4.12	3.98	3.91	4.57	4.77	4.55	4.82	4.40	4.33

Appendix Table B: Gini coefficients (population-weighted) for inter-regional inequality within selected countries														
Country	**NUTS**	**N used**	**Avg. Pop.**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Russia		79	1802	24.63	27.14	29.08	29.36	32.64	36.27	35.05	33.93	34.21	35.44	37.79
Ukraine		26	1846		13.06	15.47	16.35	17.40	18.43	22.69	22.87	23.52	24.84	24.83
China		30	43044	29.70	29.80	30.10	30.50	31.00	29.60	31.20	31.50	31.90	32.10	30.70

Appendix Table C: Inequality between and within countries in the EU, including Theil indexes with decomposition

Area analysed	Classification	Inequality index		Year											
				1995	1996	1997	1998a	1998b	1999	2000	2001	2002	2003	2004	2005
EU-27	Country	Theil	Total					0.0615	0.0614	0.0610	0.0577	0.0535	0.0499	0.0468	0.0440
EU-27	NUTS2	Theil	Within					0.0302	0.0316	0.0335	0.0335	0.0340	0.0336	0.0329	0.0339
			Between					0.0621	0.0620	0.0616	0.0583	0.0541	0.0505	0.0472	0.0444
			Total					0.0923	0.0936	0.0951	0.0918	0.0880	0.0841	0.0802	0.0784
EU-27	NUTS3	Theil	Within					0.0566	0.0585	0.0614	0.0614	0.0616	0.0605	0.0598	0.0609
			Between					0.0500	0.0506	0.0501	0.0463	0.0424	0.0390	0.0368	0.0342
			Total					0.1066	0.1091	0.1116	0.1077	0.1040	0.0996	0.0966	0.0951
EU-27	Country	Gini		15.12	14.61	13.87	13.47	16.11	16.09	15.76	15.18	14.92	14.50	14.45	13.91
	NUTS1			19.59	20.09	19.69	19.53	21.80	21.87	21.93	21.44	20.87	20.43	19.97	19.56
	NUTS2			20.97	21.49	21.16	21.06	23.28	23.39	23.51	23.11	22.58	22.11	21.61	21.30
	NUTS3			21.00	22.23	22.23	22.27	24.66	24.83	24.70	24.78	24.26	23.86	23.46	23.23
EU-15	Country	Gini		6.65	6.25	5.53		5.19	5.22	4.82	4.41	4.67	4.68	5.25	4.97
	NUTS1			13.63	13.51	13.23		13.19	13.32	13.42	13.13	12.94	12.91	12.89	12.75
	NUTS2			15.17	15.09	14.89		14.91	15.07	15.26	15.04	14.86	14.76	14.68	14.59
	NUTS3			18.24	18.27	18.35		18.46	18.60	18.89	18.80	18.55	18.49	18.44	18.34
EEA	Country	Gini		15.24	14.79	14.12	13.66	16.24	16.24	16.05	15.42	15.12	14.71	14.71	14.31
	NUTS1			19.51	20.03	19.66	19.45	21.68	21.76	21.92	21.39	20.82	20.38	19.99	19.69
	NUTS2			20.92	21.48	21.18	21.05	23.25	23.38	23.59	23.18	22.62	22.17	21.72	21.52

Note: Calculations for 1998a and earlier are excluding Malta and Romania, while calculations for 1998b and later are including these.

Appendix Table D: Regression of time trends for Gini coefficients					
Country	**NUTS level**	**Estimate**	**t value**	**P value**	**Adj. R^2**
Austria	2	-0.092	-4.92	0.0008	0.70
	3	-0.102	-6.86	<.0001	0.82
Belgium	2	0.081	4.96	0.0008	0.70
	3	-0.006	-0.47	0.6468	-0.08
Bulgaria	2	0.515	6.98	0.0001	0.84
	3	0.665	6.60	0.0002	0.83
Czech Republic	2	0.601	6.86	<.0001	0.82
	3	0.574	6.87	<.0001	0.82
Germany	1	0.050	3.17	0.0114	0.47
	2	0.016	0.92	0.3824	-0.02
	3	0.001	0.07	0.9481	-0.11
Estonia	3	0.549	6.75	0.0001	0.83
Spain	1	-0.064	-1.15	0.2811	0.03
	2	-0.067	-1.23	0.2498	0.05
	3	-0.068	-1.14	0.2828	0.03
Finland	2	0.035	0.53	0.6075	-0.08
	3	0.150	1.54	0.1582	0.12
France	1	0.022	0.83	0.4276	-0.03
	2	0.045	1.57	0.1511	0.13
	3	-0.033	-0.35	0.7371	-0.10
Greece	2	0.979	6.35	0.0001	0.80
	3	0.997	8.50	<.0001	0.88
Croatia	3	0.239	1.86	0.1602	0.38
Hungary	2	0.535	8.41	<.0001	0.87
	3	0.479	8.69	<.0001	0.89
Ireland	3	0.315	6.34	0.0001	0.80
Italy	1	-0.103	-9.78	<.0001	0.90
	2	-0.040	-1.89	0.0917	0.20
	3	0.029	1.08	0.3087	0.02
Lithuania	3	0.896	14.54	<.0001	0.95
Latvia	3	1.072	5.12	0.0009	0.74
Netherlands	2	0.056	2.24	0.0519	0.29
	3	0.097	4.14	0.0025	0.62
Norway	2	-0.029	-0.34	0.7443	-0.11
	3	0.061	0.65	0.5341	-0.07
Poland	1	0.373	6.92	<.0001	0.82
	2	0.366	7.55	<.0001	0.85
Portugal	2	0.131	3.74	0.0046	0.57
	3	0.068	2.40	0.0399	0.32
Romania	2	0.660	2.53	0.0446	0.44
	3	0.677	2.82	0.0304	0.50
Sweden	2	0.217	3.71	0.0048	0.56
	3	0.221	3.00	0.0149	0.45
Slovenia	3	0.250	8.88	<.0001	0.89
Slovakia	2	0.265	3.18	0.0112	0.48
	3	0.263	3.45	0.0072	0.52
Turkey	1	-0.224	-4.91	0.0044	0.79
	2	-0.227	-3.98	0.0105	0.71
	3	-0.216	-3.14	0.0256	0.60

Appendix Table D: Regression of time trends for Gini coefficients					
Country	**NUTS level**	**Estimate**	**t value**	**P value**	**Adj. R^2**
United Kingdom	1	0.226	9.40	<.0001	0.90
	2	0.302	6.67	<.0001	0.81
	3	0.453	5.79	0.0003	0.76
Canada		0.201	5.13	0.0004	0.70
USA		0.030	0.85	0.4184	-0.03
Mexico		0.115	2.96	0.0182	0.46
Japan		0.013	1.82	0.1028	0.19
South Korea		0.030	0.69	0.5080	-0.06
Australia		0.064	3.03	0.0127	0.43
Russia		1.145	6.58	0.0001	0.81
Ukraine		1.382	12.37	<.0001	0.94
China		0.198	3.35	0.0085	0.51

Appendix Table E: Growth convergence regressions, results for the convergence parameter b													
Country	**OLS**			**Weigthed least squares**			**Robust regression**			**Robust, weighted regression**			**Obs.**
	b est.	P value	Adj. R^2	b est.	P value	Adj. R^2	b est.	P value	R^2	b est.	P value	R^2	
Austria	-0.06	0.2104	0.02	-0.06	0.0510	0.08	-0.09	0.0364	0.09	-0.08	0.0099	0.13	35
Belgium	0.07	0.1033	0.04	0.00	0.9185	-0.02	0.07	0.1400	0.05	0.00	0.9828	0.00	42
Bulgaria	-0.10	0.5324	-0.02	0.15	0.1909	0.03	-0.18	0.2646	0.01	0.20	0.0717	0.11	28
Czech Republic	0.38	0.0098	0.39	0.37	0.0027	0.50	0.44	<.0001	0.23	0.41	<.0001	0.22	14
Germany	-0.07	<.0001	0.06	-0.05	0.0004	0.03	-0.07	<.0001	0.05	-0.04	0.0017	0.02	414
Estonia	0.36	0.0854	0.57	0.33	0.0438	0.72	0.36	<.0001	0.50	0.31	0.0249	0.74	5
Spain	-0.08	0.0238	0.08	-0.07	0.0110	0.11	-0.07	0.0406	0.07	-0.07	0.0155	0.12	49
Finland	-0.05	0.6474	-0.04	0.12	0.1214	0.08	-0.10	0.2921	0.05	0.12	0.1324	0.13	20
France	0.00	0.9636	-0.01	0.03	0.0382	0.03	-0.01	0.7785	0.00	0.03	0.0709	0.03	96
Greece	-0.22	0.0651	0.05	0.32	0.0678	0.05	-0.23	0.0505	0.07	0.66	0.0004	0.11	51
Hungary	0.21	0.1558	0.06	0.23	0.0301	0.19	0.24	0.0349	0.14	0.31	<.0001	0.38	20
Ireland	0.23	0.279	0.06	0.27	0.1631	0.18	0.17	0.0002	0.26	0.20	<.0001	0.46	8
Italy	-0.09	<.0001	0.14	-0.04	0.0622	0.03	-0.08	0.0001	0.10	-0.04	0.0348	0.04	99
Lithuania	0.63	0.0318	0.39	0.89	0.0105	0.53	0.62	0.0183	0.40	0.90	0.0026	0.55	10
Latvia	0.39	0.2433	0.15	0.56	0.0813	0.47	0.41	0.1781	0.27	0.73	<.0001	0.65	6
Netherlands	0.03	0.6718	-0.02	0.09	0.0643	0.07	0.03	0.5663	0.01	0.09	0.0691	0.09	38
Norway	0.08	0.3495	0.00	0.07	0.2312	0.03	0.08	0.3940	0.05	0.07	0.2657	0.08	19
Poland	0.24	0.1278	0.10	0.34	0.0408	0.21	-0.02	0.8787	0.00	0.32	0.0595	0.11	16
Portugal	-0.07	0.3463	0.00	-0.03	0.6143	-0.03	-0.12	0.0935	0.07	-0.02	0.7444	0.00	30
Romania	0.30	0.0244	0.10	0.45	0.0003	0.27	0.32	0.0296	0.10	0.47	<.0001	0.25	42
Sweden	0.20	0.1625	0.05	0.34	0.0002	0.51	0.25	0.0951	0.05	0.35	<.0001	0.52	21
Slovenia	0.18	0.1461	0.12	0.17	0.0429	0.28	0.16	0.1789	0.16	0.15	0.0819	0.27	122
Slovakia	0.18	0.0315	0.49	0.18	0.0347	0.48	0.18	0.0167	0.45	0.17	0.0162	0.46	8
United Kingdom	0.09	0.0505	0.02	0.12	0.0018	0.07	0.09	0.0667	0.03	0.12	0.0043	0.07	126
EU23+Norway	-0.16	<.0001	0.23	-0.16	<.0001	0.24	-0.16	<.0001	0.18	-0.15	<.0001	0.19	1209
Note: For weighted regressions, population 2000 has been used as weights (2001 for Hungary).													

Appendix Table F: Data for comparing regional and inter-personal income inequality at the country level.					
Country	**NUTS level**	**Regional inequality**		**Inter-personal income inequality, Gini coefficients**	
		2000	**2001**	**2000**	**2001**
Austria	2	11.61	11.96	23.7	23.7
	3	16.59	16.78		
Belgium	2	17.50	17.53	29.6	29.3
	3	20.05	20.11		
Bulgaria	2	11.31	12.22	30.8	31.4
	3	17.31	18.50		
Czech Republic	2	13.89	14.71	27.0	27.2
	3	14.16	14.89		
Germany	1	10.79	11.03	29.8	30.1
	2	12.77	12.98		
	3	20.63	20.78		
Estonia	3	20.13	20.48	36.4	35.4
Spain	1	11.77	11.62	32.6	32.5
	2	12.96	12.80		
	3	13.80	13.62		
Finland	2	9.61	9.74	28.8	27.9
	3	13.97	14.10		
France	1	11.77	11.53	28.2	27.6
	2	12.87	12.65		
	3	29.02	30.20		
Greece	2	12.09	12.56	32.3	32.3
	3	14.26	15.04		
Hungary	2	19.65	19.86	25.0	25.7
	3		23.25		
Ireland	3	13.18	13.17	30.1	28.9
Italy	1	13.44	13.25	33.4	29.2
	2	15.18	14.92		
	3	16.88	16.96		
Lithuania	3	12.30	13.45	34.7	34.5
Latvia	3	27.45	25.76	33.7	33.2
Netherlands	2	8.05	7.45	25.5	25.8
	3	12.25	11.57		
Norway	2	13.54	12.77	28.8	26.5
	3	15.62	15.56		
Poland	1	9.78	10.34	34.2	34.0
	2	12.38	13.05		
Portugal	2	12.54	12.09	34.7	37.1
	3	18.79	18.38		
Romania	2	16.38	16.62	30.3	35.3
	3	19.94	19.73		
Sweden	2	9.31	9.04	29.2	26.1
	3	10.13	9.73		
Slovenia	3	12.22	12.61	24.8	24.5
Slovakia	2	16.89	16.36	24.3	26.2
	3	18.64	18.48		

Appendix Table F: Data for comparing regional and inter-personal income inequality at the country level.					
Country	**NUTS level**	**Regional inequality**		**Inter-personal income inequality, Gini coefficients**	
		2000	**2001**	**2000**	**2001**
Table E, continued:					
Turkey	1	21.43	21.06	39.8	n.a.
	2	23.91	23.81		
	3	25.70	25.86		
United Kingdom	1	9.98	9.84	31.5	30.8
	2	14.42	14.34		
	3	18.72	18.86		
Canada		8.59	8.44	32.4	n.a.
USA		8.16	8.06	40.1	n.a.
Mexico		29.66	29.12	53.2	50.9
Australia		4.57	4.77	31.0	31.1
Russia		36.27	35.05	43.2	42.2
Ukraine		18.43	22.69	36.3	36.4
China		29.60	31.20	39.0	44.8
Note: Results for regional inequality are from own calculations, se Appendix B. Results for inter-personal inequality sre from the UNU-WIDER inequality database (UNU-WIDER 2008), see http://www.wider.unu.edu/research/Database/en_GB/database/					