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THE SPATIAL STRUCTURE OF INCOME INEQUALITY IN THE ENLARGED EU

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This study examines how personal disposable income is distributed across regions, countries and larger geographical areas in the EU25 and how this distribution changed during the second half of the 1990s. Moreover, it assesses the "statistical" effect resulting from the enlargement of the European Union, and therefore the community of people for which inequality is measured. A three-level spatial decomposition of the overall personal inequality in the EU reveals that a fifth of its amount is attributed to the east–west income gap and that intra-regional inequality accounts for three quarters. The study detects a convergence of both average national income levels and within-country personal income inequality. Inequality is rising primarily in the Scandinavian social-democratic welfare states and decreasing in the Mediterranean countries of the EU15. In Eastern Central Europe, the rapid growth of inequality which had been observable during the first years of transition has come to an end.

1. Introduction

In the first decade of the new millennium, the European Union (EU) faces a double challenge. On the one hand, it is struggling for a democratization of its institutions of decision making, as foreseen in the draft constitution agreed upon by the Member States' governments in Rome 2004. On the other hand, it has enlarged its territory by integrating 12 new countries, mostly in Central and Eastern Europe—ten in 2004 and two others in 2007[1]—for which average income per capita is considerably lower than for the original EU15. Too high income inequality is commonly considered as a threat for social cohesiveness and democracy in a community. Durkheim (1992, pp. 446–8) develops the thought that inequalities, which prevail between persons for reasons which they cannot be held responsible for, tend to destroy ("organic") solidarity and promote anomic behavior by those who are worse off. Boix (2004, pp. 1–4) shows in a simple model framework that the two objectives, integration of a relatively poor group of people and full participation of citizens in decision-making, counteract each other when the members of the richer and incumbent part of the community are unwilling to share their material resources with the newcomers. Distributional conflicts indeed

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[1]This study focuses on the enlargement in 2004 in which the following ten countries joined the EU: the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Slovakia, Slovenia and Poland. They will be referred to as the Accession Countries (AC10). The countries which formed the EU before that enlargement will be referred to as the EU15, and both country groups together as the EU25.

played a significant role in the debates about the reform of the European Structural Funds (ESF) in the light of enlargement and on the modification of the voting rules in the Council of the EU.

Being aware of the risk of tensions caused by unequal distribution of income throughout the regions, the European Community agreed on measures to support regions lagging behind in their economic development even in the early phases of its existence. At the Lisbon Summit in 2000, the Member States also voiced their concern about *individuals* who are excluded from the wealth generated in European society and declared the fight against poverty and social exclusion as a central element of modernizing the European Social Model. However, unlike support given to the regions, the EU does not implement any direct measures to redistribute income on the level of individuals. The formulation and implementation of social policy has remained the sole responsibility of the national governments. This emphasis on the nation state is reflected in the Laeken indicators introduced in the scope of the Lisbon strategy to monitor success in the fight against poverty and social exclusion (cf. Atkinson, 2003).

At present, the Laeken indicators include measures of relative poverty and income inequality, including the Gini coefficient, which are calculated separately for each country. Eurostat derives the figure for the EU25 as the population-weighted average of the national estimates (Eurostat, 2008). This method produces different results than when inequality is measured jointly for the entire population of the EU, because inequality between countries is not taken into account. The country-specific approach has also been followed in many previous studies on income inequality in the EU (see Section 2). However, in an independent report on the Laeken indicators it has been proposed to introduce a new indicator which reports poverty as the share of people whose income falls short of an EU wide poverty line to be defined as 60 percent of the median income of the entire EU (Atkinson *et al.*, 2005, pp. 113–15). This indicator would constitute the first official measure of EU-wide inequality. Some research has already been carried out to analyze poverty (Kangas and Ritakallio, 2004; Förster, 2005) and inequality (Atkinson, 1996; Beblo and Knaus, 2001; Boix, 2004; Morrisson and Murtin, 2004; Brandolini 2007) in a pan-European approach.

But country-wise measurement of inequality and relative poverty is often justified with reference to the theory of relative deprivation. This theory rests on the assumption that a person's well-being is primarily determined by their position relative to the other members of their community, rather than by the absolute value of the resources at their disposal. People form their perception of being or not being deprived on the basis of comparison with others (Runciman, 1966); the community creates expectations on one's way of life, and the resources required to comply with them differ between richer and poorer communities (Townsend, 1979); in richer countries a higher income is needed to uphold a life of dignity and participate in also society for other reasons (Sen, 1983). In this light, deprivation becomes a matter of socialization. Although EU citizens appear to still feel rooted in their national and regional environments (Keating, 1998; Edwards, 2000; Castells, 2002), there is also strong evidence for patterns of international socialization among the inhabitants of the EU. Kaelble (2005) observes a convergence of the social conditions in which Europeans live. Niedermayer (1995) and Delhey

(2005) show that trust, the key determinant of a sense of community according to Karl Deutsch, is on the rise between inhabitants of different countries. Since 1996 a modestly larger number of respondents reported that they see themselves as being European citizens in the near future, at least complementarily to being citizens of their country (Berger-Schmitt, 2002, pp. 4ff.; Eurobarometer, 2005, pp. 94–6). More and more people are therefore comparing their situation with that of people living abroad. Hence the perceptions of what is an acceptable way of life can be expected to converge throughout the countries. According to Delhey and Kohler's (2006) analysis, cross-national comparisons are already having a significant impact on reported well-being in Europe if inhabitants of the reference country are richer than the respondents themselves. Other studies show that the Member States' relative income position in the EU is an important determinant for individuals' perceived deprivation and economic strain. This applies to the EU15 (Whelan *et al.*, 2001, pp. 364–9) and, to an even larger extent, to the accession countries (Russel and Whelan, 2004; Förster, 2005, pp. 37–41; Fahey, 2007). Hence a pure country-wise measurement of inequality appears to become increasingly obsolete, as it tells us little about how parts of the evolving European society feel unfairly deprived.

The primary goal of this paper is to investigate the extent of income inequality in the EU25, treating the inhabitants of all Member States as a common whole. A spatial decomposition allows us to analyze the statistical effect on inequality caused by the enlargement round of 2004, and to assess the role of regional cohesion and social policies in lowering it. Another goal is to understand the evolution of the spatial pattern of inequality. Inequality will be analyzed at two points in time, in the middle and at the end of the 1990s, and contrasted with the main changes which took place in the economic and institutional environment. The following section reviews the empirical findings of previous studies. Section 3 describes the methodology applied in analysis of the study at hand. The results are presented and discussed in Section 4. Section 5 concludes.

2. Evidence from Previous Studies

The development of the regional and national average income levels, measured in terms of the GDP per capita adjusted by purchasing power parities (PPP), is documented in the Cohesion Reports of the European Commission (2001, 2004). As a general trend, the differences in the national average GDP per capita across the EU15 countries diminished in the course of the 1990s. But large income differences in the average GDP levels persist between the EU15 and the new Member States. With the exception of Cyprus, none of the countries which joined the Union in May 2004 was more prosperous than the poorest EU15 country in 2002. Thus, in 2004 the regional disparities throughout the EU grew considerably as a consequence of the "statistical effect" of the enlargement. Indeed the gap between the GDP per capita in the least prosperous Member State and the EU average increased from less than 30 percent before enlargement to more than 60 percent after enlargement (European Commission, 2004, pp. ix, 10–12). However, the income gap between the AC10 and the EU15 has become smaller over time. From 1995 to 2003 the difference between the average GDP per capita in the new

Member States and the EU25 average decreased from 54 to 48 percent of the EU25 level. Nevertheless, in 2003 the average GDP per capita in the AC10 was still not even half as high as in the EU15 (cf. Hoffmeister, 2006).

With respect to within-country income inequality, studies by Atkinson *et al.* (1995), Gottschalk and Smeeding (1997), Smeeding (2000) and Beblo and Knaus (2001) reveal that in the mid 1990s the ordering of EU15 countries was highly stratified by the type of welfare state. Income was most equally distributed in the Scandinavian countries. More inequality could be found in western central Europe, and inequality was highest in the liberal and Mediterranean countries.[2] Smeeding (2000) reports rising inequality of income in almost all investigated Member States of the EU15 between the late 1980s and mid 1990s. Inequality only declined in Luxembourg during this time. In the AC10, inequality grew in all countries investigated by Milanovic (1999), although different paths of development can be observed: Slovenia, Hungary, Latvia and Poland entered the period of economic transition with comparatively low inequality at the end of the 1980s. Until the mid 1990s, the Gini coefficient of disposable income increased dramatically in Latvia (by 44 percent) and Poland (by 42 percent), whereas in Slovenia (13 percent) and Hungary (11 percent) the growth of inequality was not as high (Milanovic 1999).

Up to now, few studies have analyzed income inequality across persons jointly for different Member States, which may be attributable to the scarcity of internationally harmonized microdata. Atkinson (1996, pp. 25ff.) makes an attempt, based on data of the Luxembourg Income Study (LIS, 2008), which he calls "at best a prototype" of the estimation of EU inequality. He divides the population of 12 EU15 countries and Norway and Switzerland into 20 or 40 groups per country, with reference to their disposable income. He then aggregates these groups across all countries and calculates decile shares and decile ratios. A similar approach is followed by Morrisson and Murtin (2004), who derive common European inequality measures from the decile and vintile shares in countries' total disposable income. Quantile-wise aggregated income data also forms the basis of the "World Income Distribution Dataset," prepared by Milanovic (2002) on the basis of a variety of different data sources, which has been employed by Boix (2004, pp. 7ff.) for the calculation of Gini coefficients of the EU using different demarcations of EU territory. The Gini coefficient of 0.380 turns out to be 0.037 points higher when calculated for the EU25 instead of EU15.

The supranational measurement of inequality based on secondary datasets like the World Income Distribution Dataset has been criticized, as the aggregates which they provide do not rely on harmonized source data. Atkinson and Brandolini (2001) show that inequality indices for OECD countries calculated on that basis are only modestly correlated to indices derived from the ex-post harmonized microdata from the LIS. Heyns (2005, p. 174) finds albeit a higher yet far from perfect correlation between indices recorded in different secondary datasets. Moreover, the practice of calculating inequality indices from quantile distributions rests on the assumption of zero inequality within the quantiles and thereby produces a measurement error of a size which is difficult to assess.

[2]Headey and Muffels' (2003, pp. 35ff.) comparison of post-tax income distributions in Germany, The Netherlands and the United States between 1987 and 1996 confirms this relationship between inequality and the type of welfare state.

Beblo and Knaus (2001) and Brandolini (2007) derive supra-national inequality in the EU directly from household data. Beblo and Knaus calculate and decompose a Theil index calculated from the datasets of ten countries of the Eurozone included in the 1995 Round of the European Community Household Panel (ECHP). Transfers paid and received by households are not considered in the income measure, which makes comparison with other studies difficult. Brandolini matches the ECHP data of Round 2000, covering all EU15 countries, with LIS data from five AC10 with reference years between 1996 and 2000. Based on these data he calculates a Gini coefficient, Atkinson indices, quintile and decile ratios. The Gini coefficient rises from 0.294 to 0.328 when the baseline population is extended from the EU15 to the five AC10 included in the study.

To summarize, during the first half of the 1990s the income distribution became more unequal both in countries of the EU15 and AC10. Within the EU15, the countries' average income converged. Furthermore, the income gap between the east and west of the EU narrowed over the entire decade, though toward the end real GDP per capita was still less than half as high in the AC10 as in the EU15. The supra-national Gini coefficient increases between 0.03 and 0.04 points when the baseline population is extended from the EU15 to include the AC10.

The analysis below assesses inequality between inhabitants of EU Member States treated as a common whole, focusing on the second half of the 1990s. It differs from Atkinson (1996) and Beblo and Knaus (2001) in that it covers not only Member States of the EU15 but also the AC10. AC10 are indeed included in the studies of Boix (2004), Morrisson and Murtin (2004) and Brandolini (2007). However, Boix and Brandolini do not provide decompositions of inequality into within- and between-group components. Thus, their results do not enable us to infer to what extent inequality would reduce if between-group differences in average income were absent. By decomposing inequality on three geographic levels, the present analysis goes further than the decompositions presented by Morrisson and Murtin and Beblo and Knaus and thereby provides a more detailed picture of the spatial distribution of income. By computing the inequality measures directly from harmonized household-level microdata, the estimate of inequality is supposed to be more exact than those from the previous analyses.

3. Methodology

Levels of Spatial Decomposition

For assessing the actual and theoretical impact of regional cohesion and social policies in Europe, it appears relevant to decompose the personal inequality of income on the following geographic levels. The *first* comprises the EU15 and the AC10. The huge income gap between these two parts of Europe has been intensively discussed since the idea of enlargement was born. The *second* level is that of the nation states, which play the key role in the redistribution of income across their citizens. The national governments are not only assigned the responsibility for social policy in the EU but also initiate cross-regional financial transfers within their countries to a certain extent. Nation states are also the reference unit for the

allocation of resources from the Cohesion Fund. For the *third* level of decomposition, attention shall be given to the administrative territorial units below the national level, as they are the main recipients of resources allocated through the EU's and Member States' regional policies. The employed geographic division on the sub-national level is aimed to reflect the countries' administrative structure, along which cross-regional transfers are typically conducted. At the same time, the defined regions should be similar in terms of population size, because this size influences the calculated shares of within- and between-regional inequality. Commonly, the larger the regions are, the greater the measured within-regional component becomes relative to the between-regional component (Shorrocks and Wan, 2005).

Eurostat's Nomenclature of Territorial Units for Statistics (NUTS) takes both criteria just mentioned into account. It assigns priority to the institutional boundaries, while at the same time maximum and minimum thresholds of population size have been set up for each geographic hierarchy level. The NUTS2 classification is generally considered to correspond most closely with the framework which Member States use for their regional policy and is therefore recommended as the appropriate level for the investigation of "regional-national problems" (Eurostat, 2007). It is also applied for the identification of the regions eligible for support from the ESF. Unfortunately, many NUTS2 regions are too small to guarantee that the regional inequality measures derived from the available LIS data are representative for the population of the regions. For that reason, regional identifiers on the NUTS2 level are lacking in most datasets. As a second best solution, the analysis below is based on the next hierarchy level, NUTS1, in the third stage of the decomposition. According to Eurostat, the use of NUTS1 is especially recommended for studies on regional Community problems, such as "the effect of customs union and economic integration on areas at the next level down from national areas" (Eurostat, 2007). NUTS1 regions have been defined by Eurostat so as to ideally cover between 3 and 7 million people. However, there are exceptions to this rule as the administrative division is the main classification criterion.[3]

Data Sources

The LIS makes available data on private household income collected in large representative interview surveys in a variety of countries. It offers a unique opportunity for cross-country studies on personal income inequality. The analysis presented below is based on information reported by roughly 230 thousand households in 18 countries of the EU25. For this study, the household weights stored in the LIS database have been inflated so as to sum up to the population total of the NUTS1 region (in the survey round 1999/2000) or country (in round 1994/1995) as reported in Eurostat's New Cronos database. The EU15 is represented by all of its Member States except Portugal. Among the AC10, Cyprus, the Czech Republic, Latvia, Lithuania, Malta and Slovakia are missing. The 18

[3]Among the countries investigated in this study, the NUTS1 regions' average population size is especially large in Italy and Sweden. At the opposite end of the scale, small countries like Luxembourg, Estonia and Slovenia are composed of only one NUTS1 region with less than 3 million inhabitants.

countries of the LIS sample account for 93 percent of the total population of the EU25—98 percent of the inhabitants in the EU15 and 69 percent of the inhabitants in the AC10. Based on the surveyed information about the gross household income, tax payments, social security contributions and other deductions from income, the LIS has generated a harmonized measure of household disposable income.

Adjustment for Differences in Needs and Prices Levels

Taking into account differences in needs between households of different size, household disposable income, as generated by the LIS, has been transformed into equivalized disposable income (EDI) by dividing it by the square root of the household size. The resulting amount has been assigned to each person in the household. The needs of members of larger households are considered to be lower than those of others, because people commonly save costs when they share a common habitation.

The choice of the equivalence scale has an impact on the measured income inequality. Coulter *et al.* (1992, p. 1081) demonstrate that the relationship between the weight attached to additional persons in the household and the measured inequality is U-shaped. Inequality has a minimum somewhere between the equivalence scale values one and the number of persons in the household. Buhmann *et al.* (1988, pp. 128ff.) show that in EU15 countries this minimum is commonly reached when the household-size elasticity of the equivalence scale is between 0.25 and 0.72. The values of customary inequality measures in OECD countries differ considerably depending on the applied equivalence scale. In Brandolini's (2007) analysis, the measured Gini coefficient takes values between 0.357, when the equivalence scale equals the household size, and 0.328, when other common scales are applied.

If we expect an equivalence scale to accurately reflect the differences in the cost of living between persons living in different types of households, one might apply different scales in different countries. By contrast, if we expect it to reflect a social planner's subjective judgment about the persons' needs, it appears preferable to apply the same judgment in all investigated countries and define the equivalence scale universally. The application of the "square-root scale" chosen for this study, which implies a household-size elasticity of 0.5, should be understood as a subjective judgment. This judgment provides a good compromise between official equivalence scales used in many countries of the OECD, as Atkinson *et al.* (1995) show.

The household data analyzed below refer to different countries and different years. As income is intended to be employed as a measure of welfare, differences in the cost of living across time and space should be taken into account. For that purpose, the nominal EDI, which is expressed in local currency units at current prices, is deflated by the temporal price index of household final consumption expenditure (HFCE) and transformed into PPP for the year 2000 calculated by the PPP from Eurostat (2008) for that consumption aggregate.[4] One euro of

[4]The currencies of the Eurozone countries had to be divided by the convergence rate between local currency and the Euro, because the PPPs of these countries are based on the Euro.

PPP-adjusted income can be thought of as the cost of an average consumption basket equivalent to 1.06 Euros spent in Germany. The data of the geographic and temporal price deflators are given in Table A1 in the Appendix.

The method of adjustment for geographic and temporal differences in prices indeed leads to a certain degree of inaccuracy. First, as income deflators are only available at the level of countries, differences in the cost of living on the sub-national level are not seen in the analysis below. Commonly, prices are higher in richer regions. Accordingly, the true cross-regional and interpersonal inequality within countries can be expected to be modestly overstated by the results presented below. Second, the employed PPP and temporal price indices are biased by the Gerschenkron effect (Eurostat and OECD, 2006, pp. 130ff.). This effect arises from the fact that the price indices are calculated on the basis of weights reflecting fixed expenditure shares, while in reality households with different levels of standard of living consume goods in different proportions and relatively expensive goods are substituted with cheaper ones. Hill (2000) finds that the world's poorest countries' per-capita incomes are overestimated by up to 70 percent as a consequence of the Gerschenkron effect, if income is deflated by the PPP of the World Bank (see also Dowrick and Akmal, 2005). Eurostat applies a different method of aggregation of expenditure categories, called the EKS method, which is based on geometric weighting and which should lead to a weaker substitution bias, but the Gerschenkron effect cannot be completely avoided.

Comparison of Income across Countries

The difficulties in comparisons of household income across countries are not limited to the problem of accurate assessment of the cost of living. The surveys which provided the source data for the measurement of EDI apply different designs and measure income in different ways. Accordingly, although the data have been harmonized ex-post by the LIS, the extent of underreporting is likely to differ between the countries, and certain sources of income are included in the definition of income in some countries but not in others (Smeeding and Weinberg, 2001). By comparing the national averages of household income obtained from the LIS with the corresponding amount reported by external sources, Atkinson *et al.* (1995) find an under-reporting of the LIS data of between 7 and 23 percent in different countries.

The effect of measurement error on reported inequality within a country is difficult to be adjusted for, as better data on the income distribution within the countries are not available. By contrast, for the correction of between-country inequality, it is possible to make use of the National Accounts. Eurostat publishes the household net disposable income (HNDI) per capita of all EU25 countries as part of the European National Accounts. HNDI is derived by subtracting taxes, current transfers paid net of current transfers received, and fixed capital consumption from the gross national income (GNI) of the household sector. Indeed the microdata and National Accounts approaches to measurement of household income are rooted in different traditions and partly serve different purposes. While the emphasis of the microdata approach is on measurement of economic well-being and its distribution among individuals, the focus of the National Accounts

is on expressing the interrelationships between the various sectors of an economy, one of which is the household sector. Nevertheless, both approaches are meant to arrive at the measurement of more or less the same thing: the maximum amount which individuals can spend on consumption in a given period of time without reduction of their assets (Expert Group on Household Income Statistics, 2001, pp. 5ff., 16ff.).

It has become standard practice in the literature on world income inequality to merge household survey data with mean income levels from the National Accounts, although this practice has also been criticized (Brandolini, 2007, pp. 9–11). Below, the results obtained with these two methods will be compared by applying both mean EDI obtained from microdata and HNDI from the National Accounts for the assessment of between-country inequality. The Cohesion Reports of the EU analyze the relative differences between regions and countries with regard to their average GDP per capita. Many studies use gross national income (GNI) which differs only modestly from GDP.[5] The difference between GDP and HNDI, the largest part of which constitutes the income of the government sector, is commonly positively correlated to the average GDP and thus exerts a smoothening effect on the measured cross-national inequality (Brandolini, 2007, pp. 10ff.; Svennebye, 2008, p. 3). With the aim to investigate the size of that effect, both real HNDI and real GDP are employed in the analysis below. Their figures for 1995 and 2000 are presented in Table A2 in the Appendix.

Inequality Measurement

Theil's (1967) Generalized Entropy Indices are the only differentiable, symmetric and homogenous inequality measures that can be additively decomposed into subgroups (Bourguignon, 1979; Cowell, 1980; Shorrocks, 1980). One indicator belonging to this family is the Mean Logarithmic Deviation (MLD), which is defined as

$$D = \frac{1}{N}\sum_{i=1}^{N} \ln\left(\frac{\mu}{y_i}\right), \tag{1}$$

where y_i is the i-th person's income and μ is the mean income calculated over all N persons. The MLD satisfies the most common properties of inequality indices: scale invariance, the principle of diminishing transfers and zero normalization.[6,7] However, it is the only index of the Generalized Entropy family which leads to a path-independent decomposition (Shorrocks and Wan, 2005). Path-independency, as defined by Foster and Shneyerov (2000), implies that the within-component is unaffected by changes in the subgroups' average income levels. As a consequence,

[5]The difference between GDP and GNI is made up by net trading gains from changes in the terms of trade and net incomes received abroad.

[6]Scale invariance means that the measured inequality does not change if everybody's income is multiplied by the same factor, as is the case, for example, with inflation rates. The principle of diminishing transfers implies that inequality reduces whenever income is transferred from a richer to a poorer person, leaving their rank order unchanged. Zero-normalization requires that the inequality index is zero if all individuals earn the same amount of income.

[7]However, unlike most other inequality indices, the MLD is unbounded from above. It can take values greater than one if inequality is extraordinarily high.

if income is transferred from one subgroup to another in a way that the distribution of personal incomes relative to the subgroup means does not change in each subgroup, the within-component of the MLD remains the same. This property is particularly desirable for the present study to illustrate the potential effects of redistribution of income conducted at different geographic levels on the overall inequality. An income transfer of the type mentioned above can be thought of, for example, as a proportional tax levied on the members of one subgroup, the revenues of which are proportionally distributed among the members of another.

The path-independency of the MLD is due to the fact that the within-group component is derived by taking the purely *population*-weighted average of the MLD levels observed in each subgroup. Accordingly, if two regions are equal in population size but their average income is different, the MLD assigns a reduction of inequality within each of these regions equal importance. By contrast, in the Theil index, which has been employed, for example, by Beblo and Knaus (2001), the regions are represented with weights proportional to their *income shares*. The authors' choice has been driven by the intention to accentuate the "countries' economic standings in terms of political power within the European Monetary Union" rather than to "evaluate the effectiveness of distribution policies" (Beblo and Knaus, 2001, p. 307). The emphasis in the present study is on the second of the aforementioned research goals.

The MLD is less frequently applied as an inequality measure than the Gini coefficient. If the Gini coefficient is additively decomposed, it only falls entirely into within- and between-group components if the richest member of any poorer group is poorer than the poorest member of any richer group. In all other cases, there remains an "overlap component" which provides interesting information about the population's stratification (cf. Pyatt, 1976; Yitzhaki and Lerman, 1991; Lambert and Aronson, 1993; Yao and Liu, 1996). The primary focus of this study is not on stratification but on the relative importance of the inequalities occurring within and between regions. The complete decomposition of the MLD into within- and between-regional components enables exact specification of the amount of inequality which could be avoided if income levels within certain regions were fully equalized or all regional disparities removed. This applies to the Gini coefficient only in very specific circumstances which do not prevail in the EU.

Bourguignon (1979), Cowell (1980) and Shorrocks (1980) demonstrate how the MLD is decomposed into subgroups. For the analysis below, this decomposition is repeated three times on the different geographic levels outlined above. Let us assume that N Europeans are spread over K country groups (the EU15 and the AC10), each of which incorporates n_k persons. Each country group is composed of L_k countries with $n_{k,l}$ inhabitants living in the l-th country of the country group k. Furthermore, each country l in country group k is composed of $M_{k,l}$ regions with $n_{k,l,m}$ inhabitants in each of them. Then, the MLD given in equation (1) can be rewritten as

$$(2) \qquad D = \left[\sum_{k=1}^{K}\sum_{l=1}^{L_k}\sum_{m=1}^{M_{k,l}} \frac{n_{k,l,m}}{N} D_{k,l,m}\right] + \left[\sum_{k=1}^{K}\sum_{l=1}^{L_k} \frac{n_{k,l}}{N} D^{B}_{k,l}\right] + \left[\sum_{k=1}^{K} \frac{n_k}{N} D^{B}_{k}\right] + D^{B},$$

where D^B is the MLD which measures the inequality of the country groups' mean income levels (μ_k),

$$D^B = \sum_{k=1}^{K} \frac{n_k}{N} \ln\left(\frac{\mu}{\mu_k}\right), \tag{3}$$

D_k^B is the MLD which measures the inequality of the countries' mean income levels within country group k ($\mu_{k,l}$),

$$D_k^B = \sum_{l=1}^{L_k} \frac{n_{k,l}}{n_k} \ln\left(\frac{\mu_k}{\mu_{k,l}}\right), \tag{4}$$

$D_{k,l}^B$ is the MLD which measures the inequality of the regions' mean income levels within the l-th country of country group k ($\mu_{k,l,m}$),

$$D_{k,l}^B = \sum_{m=1}^{M_{k,l}} \frac{n_{k,l,m}}{n_{k,l}} \ln\left(\frac{\mu_{k,l}}{\mu_{k,l,m}}\right), \tag{5}$$

and $D_{k,l,m}$ is the MLD which measures the interpersonal inequality within the respective region,

$$D_{k,l,m} = \sum_{i=1}^{n_{k,l,m}} \frac{1}{n_{k,l,m}} \ln\left(\frac{\mu_{k,l,m}}{y_i}\right). \tag{6}$$

4. Results

Personal Inequality of the EU25

In 1999 and 2000, the total interpersonal inequality measured throughout the LIS sample amounted to 0.215 points of the Mean Logarithmic Deviation (MLD). It was composed of 0.165 MLD points average personal inequality within countries (accounting for 76.6 percent), 0.006 MLD points average between-country inequality within the EU15 and AC10 respectively (accounting for 2.8 percent), and 0.044 MLD points attributed to the income gap between these two groups of countries (accounting for 20.6 percent of the overall MLD). This decomposition is shown on the left-hand side of Table 1.

The MLD obtained on the basis of the LIS sample is likely to provide an inaccurate estimate of the MLD of the entire EU25, because seven Member States are missing, six of which are AC10. As a result, 98 percent of the population of EU15 but only 69 percent of the population in the AC10 are represented in it. In contrast, data on average HNDI per capita are available for all Member States of the EU25 from the European National Accounts. An estimate of between-country inequality on the basis of these data might produce more accurate results. They not only cover the entire set of countries but may also be viewed as more comparable across countries from a certain perspective (see Section 3). The between-country inequality in the entire LIS sample—obtained as the average of between-country

TABLE 1

INCOME INEQUALITY IN THE LIS COUNTRY SAMPLE 1999/2000[1]

Geographic Units		Pure LIS Data				With Imputed HNDI Per Capita			
				MLD[4]				MLD[4]	
Within	Between	Popul. Share (%)	Mean EDI (Euro)[2]	Abs.	Contr.[5] (%)	Popul. Share (%)	Mean HNDI (Euro)[3]	Abs.	Contr.[5] (%)
MS in EU15	Persons	87.6	16,863	0.1659	67.7	87.6	19,119	0.1659	70.6
AC10	Persons	12.6	6,060	0.1546	8.9	12.4	7,680	0.1546	9.3
All MS	*Persons*	*100.0*	*15,522*	*0.1645*	*76.6*	*100.0*	*17,699*	*0.1645*	*79.9*
EU15	MS	87.6	16,863	0.0066	2.7	87.6	19,119	0.0052	2.2
AC10 group	MS	12.4	6,060	0.0021	0.1	12.4	7,680	0.0066	0.4
EU15/AC10	*MS*	*100.0*	*15,522*	*0.0060*	*2.8*	*100.0*	*17,699*	*0.0054*	*2.6*
EU25	EU15-AC10	100.0	15,522	0.0442	20.6	100.0	17,699	0.0360	17.5
EU25	*Persons*	*100.0*	*15,522*	*0.2147*	*100.0*	*100.0*	*17,699*	*0.2059*	*100.0*
No. of observations		227,265				227,265			
Baseline population		417 Mio.				417 Mio.			

Notes:

[1]In Slovenia the reference year is 1997.

[2]Mean EDI, according to LIS, at 2000 prices and PPP-adjusted (EU25 = 1) using Eurostat's price indices for HFCE.

[3]Mean HNDI per capita, according to Eurostat's National Accounts, at 2000 prices and PPP-adjusted (EU25 = 1) using Eurostat's price indices for HFCE.

[4]Inequality of EDI between persons; inequality of HNDI between Member States and country groups.

[5]Contribution to total inequality, measured as the share of the population-weighted MLD in the total MLD.

MS = member states; AC10 = Accession Countries; EDI = equivalized disposable income; MLD = Mean Logarithmic Deviation; HNDI = household net disposable income.

Source: LIS; Eurostat, New Cronos.

inequality in the EU15 and AC10 plus the inequality between these country groups—amounts to 0.050 MLD points. If we replace the national average of EDI, inferred from microdata, by HNDI per capita according to the National Accounts, this component is reduced to 0.041 MLD points, i.e. by a sixth; the overall personal inequality is lowered by 4 percent (see the right-hand side of Table 1).

Having accepted HNDI per capita as an income aggregate well suited for the assessment of between-country inequality, this allows us to calculate an estimate of inequality in the entire EU25. For this, we extrapolate the within-country inequality, measured among the LIS population, to the total population of the EU15 and the group of AC10 respectively and calculate between-country inequality on the basis of all EU25 countries' HNDI per capita. The results are presented in the lower right panel of Table 2. Compared to the LIS sample with imputed HNDI, the within-country inequality is now modestly smaller as a result of the stronger population-weight given to the AC10. The measured between-country inequality has become greater in both parts of the EU. This effect was to be expected: firstly, the EU15 country with the lowest income per capita has been matched to the LIS sample; secondly, of the AC10 not included in the LIS sample, with the exception of the Czech Republic, some are poorer and the others richer than those included in the sample. Furthermore, surprisingly at first view, we observe the effect that the between-EU15–AC10 inequality has become greater although the average per

TABLE 2

DEVELOPMENT OF INCOME INEQUALITY IN THE EU25, 1999/2000

Geographic Units		Round 1 (1994/1995)[1]				Round 2 (1999/2000)			
		Popul. Share	Mean EDI	MLD		Popul. Share	Mean EDI	MLD	
Within	Between	(%)	(Euro)[3]	Abs.	Contr.[3] (%)	(%)	(Euro)[2]	Abs.	Contr.[3] (%)
Raw LIS data (without EE)									
MS (EU15)	Persons	87.7	15,188	0.1723	66.3	87.9	16,863	0.1659	68.2
AC10	Persons	12.3	5,216	0.1758	9.5	12.1	6,093	0.1527	8.7
MS (EU25)	*Persons*	*100.0*	*13,958*	*0.1728*	*75.8*	*100.0*	*15,557*	*0.1643*	*76.8*
EU15	MS	87.7	15,188	0.0065	2.5	87.9	16,863	0.0066	2.7
AC10 group	MS	12.3	5,216	0.0171	0.9	12.1	6,093	0.0076	0.4
EU25	*MS*	*100.0*	*13,958*	*0.0078*	*3.4*	*100.0*	*15,557*	*0.0067*	*3.1*
EU25	EU15-AC10	100.0	13,958	0.0474	20.8	100.0	15,557	0.0428	20.0
EU25	*Persons*	*100.0*	*13,958*	*0.2280*	*100.0*	*100.0*	*15,557*	*0.2138*	*100.0*
No. of observations			216,253				212,239		
Baseline population			412 Mio.				415 Mio.		
Extrapolated to EU25[4]									
MS (EU15)	Persons	83.2	16,779	0.1723	60.6	83.5	18,933	0.1659	64.0
AC10	Persons	16.8	6,488	0.1758	9.4	16.5	7,876	0.1546	11.8
MS (EU25)	*Persons*	*100.0*	*15,050*	*0.1729*	*74.9*	*100.0*	*17,105*	*0.1640*	*75.8*
EU15	MS	83.2	16,779	0.0100	2.7	83.5	18,933	0.0073	2.8
AC10 group	MS	16.8	6,488	0.0269	1.4	16.5	7,876	0.0162	1.2
EU25	*MS*	*100.0*	*15,050*	*0.0129*	*4.1*	*100.0*	*17,105*	*0.0088*	*4.1*
EU25	EU15-AC10	100.0	15,050	0.0509	21.0	100.0	17,105	0.0435	20.1
EU25	*Persons*	*100.0*	*15,050*	*0.2367*	*100.0*	*100.0*	*17,105*	*0.2162*	*100.0*
Baseline population			447 Mio.				450 Mio.		

Notes:
[1]In Slovenia the reference year is 1997.
[2]At 2000 prices and PPP-adjusted (EU25 = 1) using Eurostat's price indices for HFCE.
[3]MLD weighted by the population share.
[4]Mean EDI extrapolated to HNDI and population extrapolated to totals of the EU15 and AC10. For abbreviations, see Table 1.
Source: LIS; Eurostat, New Cronos.

capita income levels of the EU15 and the AC10 group have become more equal in response to the extension of the country sample. This effect is caused by the readjustment of population weights, as a result of which the group with low average income compared to the mean, notably the AC10, has grown.

The overall inequality of the EU25, measured on the basis of the extrapolated data, amounts to 0.216 MLD points. This is fairly close to the estimate obtained with the pure LIS sample (0.215 MLD points). However, this should neither be interpreted as a sign of a high representativeness of the LIS sample nor as a good fit between the income aggregates of the LIS and National Accounts. Rather, two inconsistencies between the micro- and macro-data outweigh each other. The inequality diminishes as aggregated EDI is replaced by HNDI per capita. But it rises again, as the sample of analyzed countries is extended to the entire EU25. Given these results, we should rely on the results achieved with the extrapolated data in order to derive an estimate of the inequality for the EU25 as a whole, because otherwise the results were not representative. We should be aware of the fact, however, that the results could be different if between-country inequality was

measured with EDI. The size of this deviation is not too large. In the test carried out with the LIS country sample it amounted to 4 percent of the personal MLD measured purely with EDI data. Which of the two estimates is more reasonable to apply cannot be decided here. The disputed question as to whether EDI or HNDI is the more accurate aggregate for measuring cross-national inequality has not yet been solved.

Comparing overall personal inequality in the EU15 with that of the EU25 allows us to quantify the statistical effect of the enlargement—under the assumption that this enlargement had already taken place by the year 2000. The inequality of the EU15, calculated on the basis of the extrapolated data, amounts to 0.173 (the sum of 0.166 and 0.007) MLD points, as compared to 0.216 MLD points inequality in the EU25. Thus, the enlargement made the inequality between persons rise by 25 percent. The statistical effect of enlargement on the Gini coefficient, derived by Boix (2004) and Brandolini (2007), was smaller. It amounted to only around 11 percent. This difference is not surprising, as the MLD reacts more sensitively than the Gini coefficient to changes taking place in the lower segments of the income distribution. Furthermore, we note that the MLD of the EU25 is higher than in all, except one, of its constituent Member States (see the eighth column of Table 3). The exception is represented by Estonia, which shows a within-country MLD of 0.224 points. The figures for the United Kingdom and the Mediterranean EU15 countries come fairly close to the amount of the EU25 as well. Greater inequality has been reported by other studies for some large countries, such as Russia in 1999 (0.33 MLD points), Canada in 1997 (0.31 MLD points), the Philippines in 1997 (0.30 MLD points), or Indonesia in 1993 (0.23 MLD points) (Shorrocks and Wan, 2005). Thus, an inequality of around 0.22 MLD points in the EU25 does not appear exceptionally high. However, the comparability of the results with those of other studies is rather limited due to differences in income measurement and survey design.

Development of Inequality over Time

How did income inequality within and between EU countries develop during the second half of the 1990s? Except for Estonia, we can investigate the distribution of EDI within all the 18 Member States included in the LIS sample at two points in time: in 1994/1995 and 1999/2000. For Slovenia, however, the reference year in the first round is 1997. The lower part of Table 1 shows how the inequality and its geographic composition evolved throughout the EU25. We observe a convergence on all geographic levels: the inequality within countries fell in both parts of Europe. In the AC10 the decline was so strong that the two country groups swapped places. In the mid 1990s, with an amount of 0.176 MLD points on average, the within-country inequality of the AC10 group had exceeded that of the EU15 gradually by to 0.004 points, but with an amount of 0.155 MLD points it was already 0.011 points smaller by the end of the decade.[8] During the same period of time, the between-country inequality fell in the EU15 modestly

[8]The difference in 1999/2000 would be even greater if Estonia was excluded from the sample, so that the same set of countries would be observed at both points in time; see the figures of within-country inequality in the upper part of Table 2.

TABLE 3
ROBUSTNESS OF MEASURED BETWEEN-COUNTRY INEQUALITY TO CHANGES IN THE INCOME AGGREGATE

	MLD						
	Between MS in EU15		Between AC10		Between EU15 and AC10 Group		
Income Aggregate	1995	2000	1995	2000	1995	2000	Divergence[1]
Nominal HNDI/HFCE price index	0.0100	0.0073	0.0269	0.0162	0.0509	0.0435	–0.597
Nominal HNDI/GDP price index	0.0067	0.0056	0.0245	0.0128	0.0452	0.0371	–0.563
Nominal GDP/GDP price index	0.0078	0.0062	0.0281	0.0158	0.0424	0.0347	–0.360

Notes:
[1]Correlation between the countries' per-capita income levels in round 1 and their average annual growth rate.
For abbreviations, see Table 1.
Source: Eurostat, New Cronos.

(from 0.010 to 0.007 MLD points) and more strongly among the AC10 (from 0.027 to 0.016 MLD points). In 1999/2000 it still remained higher in the latter group of countries. Finally, the income gap between the EU15 and the AC10 narrowed, from 0.051 to 0.043 points of the MLD. Altogether, the interpersonal inequality of the EU25 shrank from 0.237 to 0.216 MLD points. A similar convergence at all geographic levels can be observed by applying the pure non-extrapolated LIS data, with the exception that they do not indicate any fall of between-country inequality in the EU15 (see the upper part of Table 2).

Data on HNDI and the price index for HFCE are not always available in cross-national research on income inequality. Researchers often use real GDP or GNI as a substitute, or they may feel tempted to divide nominal HNDI by the GDP deflator. Let us check the robustness of the estimated between-country inequality to those modifications. For this, the calculations above are redone twice: firstly, after the (temporal and cross-national) HFCE price index, applied in the calculation of real HNDI, has been replaced by the GDP price index, and once again, after real HNDI has been replaced by real GDP (i.e. nominal GDP divided by the GDP price index). The results of these checks are presented in Table 3. They reveal the expected effect that between-country inequality commonly appears smaller with GDP than with HNDI data (with the exception of between-country inequality among AC10 around 1995). The measured between-country inequality also shrinks in response to replacing the HFCE by the GDP price index. Effects in the same direction on the EU25-wide Gini coefficient have been observed by Brandolini (2007, p. 27), after he had replaced HNDI by GNI or applied the GDP price index. Independently from those effects on the *levels* of measured inequality, it can be inferred from Table 3 that the *development* over time reveals similar trends with and without the modifications just described: the income gap between the east and west EU narrows, the between-country inequality falls in both parts of Europe, and this fall is more pronounced in the AC10 than in the EU15.

Let us now examine the personal inequality of each particular country in the middle and at the end of the last decade. The countries presented in Table 4 are sorted in ascending order of their personal inequality observed in 1994 or 1995. At that time, we could find the EU15 countries arranged according to the same

TABLE 4

DEVELOPMENT OF MEMBER STATES' WITHIN-COUNTRY INEQUALITY AND MEAN DISPOSABLE INCOME ACCORDING TO LIS DATA

	Round 1				Round 2				Annual Growth	
Country	Year	EDI (Euro)[1]	MLD	No. of Obs.	Year	EDI (Euro)[1]	MLD	No. of Obs.	EDI (%)	MLD (%)
Finland	1995	13,564	0.0818	9,257	2000	14,865	0.1112	10,419	1.8	6.3
Denmark	1995	17,158	0.0882	79,922	2000	18,582	0.0892	81,904	1.6	0.2
Luxembourg	1994	27,300	0.0906	1,813	2000	29,066	0.1094	2,418	1.1	3.2
Sweden	1995	13,354	0.1056	16,221	2000	15,829	0.1199	14,471	3.5	2.6
Slovenia	1997	10,382	0.1114	2,576	1999	10,503	0.1125	3,858	0.6	0.5
Belgium	1995	16,845	0.1290	2,627	2000	19,581	0.1845	2,359	3.1	7.4
Netherlands	1994	15,802	0.1342	5,134	1999	17,656	0.1358	4,968	2.2	0.2
Germany	1994	16,538	0.1356	6,367	2000	18,250	0.1280	10,979	1.7	–0.9
France	1995	16,011	0.1430	11,286	2000	16,483	0.1298	10,287	0.6	–1.9
Austria	1995	16,083	0.1459	19,248	2000	19,087	0.1175	2,344	3.5	–4.2
Poland	1995	4,746	0.1764	31,562	1999	5,963	0.1558	31,375	5.9	–3.0
Hungary	1994	5,981	0.1864	1,929	1999	5,718	0.1490	2,013	–0.9	–4.4
Ireland	1995	13,081	0.2011	2,824	2000	16,630	0.1856	2,447	4.9	–1.6
Italy	1995	13,561	0.2098	8,101	2000	14,365	0.2069	7,923	1.2	–0.3
UK	1995	16,125	0.2161	6,750	1999	18,442	0.2102	24,824	3.4	–0.7
Spain	1995	13,069	0.2254	5,861	2000	16,025	0.2068	4,755	4.2	–1.7
Greece	1995	10,193	0.2255	4,775	2000	11,295	0.2001	3,805	2.1	–2.4
Estonia	/	/	/	/	2000	4,841	0.2237	6,026	/	/
Divergence[2]									–0.163	–0.589

Notes:
[1]Mean EDI at 2000 prices, PPP-adjusted (EU25 = 1), using Eurostat's price indices for HFCE.
[2]Correlation between levels in round 1 and average annual growth rates.
For abbreviations, see Table 1.
Source: LIS.

clusters as identified in previous studies by Atkinson *et al.*, Smeeding, and Beblo and Knaus (see Section 2). The Scandinavian countries, with inequality between 0.08 and 0.10 MLD points, were located at the one end of the scale and the Mediterranean countries, with inequality between 0.21 and 0.23 MLD points, at the other. Between those groups lay the western central European countries, except Luxembourg, where the MLD ranged between 0.12 and 0.16 points. In Ireland and the United Kingdom the inequality was equally as high as in the Mediterranean Member States of the EU15, amounting to 0.20 and 0.22 MLD points respectively. The three AC10, for which LIS data are available, did not form a cluster of their own. Instead, the LIS data confirm Milanovic's findings of a still comparatively low inequality in Slovenia and higher inequality in Poland in the mid 1990s (see Section 3). However, the evidence that Hungary showed a more unequal distribution of income than Poland stands contrary to Milanovic's results.

During the second half of the decade, the inequality increased considerably in all Scandinavian countries, especially in Finland, and fell in all observed Mediterranean ones. As a result, the stratum of Scandinavia overlapped with that of western central Europe—Sweden now revealed more inequality than Austria—and the Mediterranean countries moved closer to the latter. The United Kingdom dropped to the lowest rank among the observed EU15 countries, although the inequality decreased there as well. In the AC10 the rapid rise of inequality

observed by Milanovic at the beginning of the decade obviously came to an end. The MLD of Hungary fell on average by more than 4 percent each year, the MLD of Poland by 3 percent, while the MLD of Slovenia remained constant. All in all, we observe a convergence of interpersonal inequality throughout the countries. The average annual growth rate of the MLD (last column of the table) correlates to the initial MLD value (fourth column) by a factor of –0.589.

The growth of national average EDI levels is also negatively, although modestly, correlated to their levels in 1994/1995 (by a factor of –0.163), which corresponds to finding of a reduction of between-country inequality throughout the LIS sample presented above. The strength of that correlation increases considerably (to –0.597) once the country means of EDI are replaced by HNDI per capita. This can be seen from the eighth column of Table 3. The absolute value of the correlation coefficient diminishes modestly if the GDP price index is employed and falls more strongly if real HNDI is replaced by real GDP.

Decomposition of Inequality on the Level of NUTS1 Regions

So far, the inequality observed between persons in the EU25 as a whole has been decomposed on the level of country groups (EU15 and AC10) and on the level of Member States. Let us now zoom in on the spatial distribution of income on the sub-national level. Table A3 in the Appendix shows the results of a decomposition of personal inequality within Member States into inequality within and between NUTS1 regions for all countries which do not represent a NUTS1 region by themselves and for which data are available. Except for The Netherlands, all datasets in of the LIS sample comprise the regional identifier required to assign the surveyed households to NUTS1 regions. Thus, for the assessment of within-country regional inequality only three countries, the Czech Republic, The Netherlands and Portugal are missing.

In Table A3, the countries have been arranged in ascending order of their between-region inequality and the regions in ascending order of their personal inequality. The between-region inequality is lowest in the smallest countries of the table: Austria and Belgium. Both incorporate only three NUTS1 regions. Regional inequality appears highest in the Mediterranean Member States, especially in the "divided economy" of Italy (European Commission, 2001, p. 6). Germany is ranked fourth, although it incorporates five former socialist regions in which average disposable income is still comparatively low. Narrowing the focus further and looking at the inequality within regions, we find that it is often the regions incorporating the capital or a larger urban agglomeration which show the highest levels of personal inequality (for example Ostösterreich in Austria, Hamburg and Berlin in Germany, London in the United Kingdom, Centralny in Poland).

The within-regional inequality amounts to on average 0.155 MLD points, the between-region inequality within countries to 0.009. This average is taken over all Member States in the LIS sample for which the regional inequality is known, including those comprising only one NUTS1 region and thus having zero regional inequality. As shown in Table 5, the between-region inequality is higher in EU15 countries (0.010 MLD points) than in AC10 (0.004 MLD points), here represented just by Hungary and Poland. We obtain the between-region inequality of the east

TABLE 5
INEQUALITY BETWEEN NUTS1 REGIONS IN EUROPE 1999/2000

Geographic Unit		LIS[1]				National Accounts[2]			
			MLD				MLD		
		Popul. Share		Contribution[3]		Popul. Share		Contribution[3]	
Within	Between	(%)	Abs.	Abs.	(%)	(%)	Abs.	Abs.	(%)
MS of EU15	Regions[4]	84.5	0.0098	0.0083	16.5	83.5	0.0098	0.0082	13.4
EU15	MS	84.5	0.0052	0.0044	8.7	83.5	0.0073	0.0061	10.0
EU15	*Regions*	*84.5*	*0.0150*	*0.0127*	*25.2*	*83.5*	*0.0171*	*0.0143*	*23.4*
AC10	Regions[5]	15.5	0.0041	0.0006	1.3	16.5	0.0041	0.0007	1.1
AC10 group	MS	15.5	0.0066	0.0010	2.0	16.5	0.0162	0.0027	4.4
AC10 group	*Regions*	*15.5*	*0.0107*	*0.0017*	*3.3*	*16.5*	*0.0203*	*0.0034*	*5.5*
EU25	EU15-AC10	100.0	0.0360	0.0360	71.6	100.0	0.0435	0.0435	71.1
EU25	*Regions*	*100.0*	*0.0504*	*0.0504*	*100.0*	*100.0*	*0.0611*	*0.0611*	*100.0*

Notes:
[1]Without Cyprus, Czech Republic, Latvia, Lithuania, Malta, Portugal and Slovakia.
[2]Between-region inequality within MS imputed from LIS.
[3]MLD weighted by the population share.
[4]Without regions in Netherlands and Portugal.
[5]Without regions in the Czech Republic.
For abbreviations, see Table 1.
Source: LIS; Eurostat, New Cronos.

and west EU respectively by adding their between-country inequality to that amount. According to the extrapolated data, it receives a value of 0.017 MLD points in the EU15 and 0.020 MLD points in the AC10 (see the right-hand side of Table 5). We can calculate the overall between-region inequality of the EU25 by taking the population-weighted average of those two values and adding the between-EU15–AC10 component. The resulting amount is 0.061 MLD points. If we relied on the pure LIS data, we would obtain an amount of only 0.050 MLD points. Thus, between-region inequality accounts for roughly a quarter of the total inequality between the inhabitants of the EU25 (28 percent according to the extrapolated data, 25 percent according to the pure LIS data).

Figure 1 provides a final overview of the development of the spatial structure of personal inequality in the EU25 in the second half of the last decade. As noted above, the inequality declined in absolute terms at all geographic levels: between persons within countries, between countries within the EU15 and AC10 groups respectively, as well as between the two parts of Europe. In relative terms, the share of personal inequality within countries modestly increased, from 73 to 76 percent, at the expense of the other two components. Four of these 76 percentage points are attributable to regional inequality within countries and the remaining 72 percentage points to personal inequality within regions.

Discussion

As shown above, a personal inequality of 0.216 MLD points has been calculated for the EU25 based on the extrapolated database. This estimate has been derived by applying the average within-country inequality observed in the microdata, which represents 97 percent of the population in the EU25, to the total

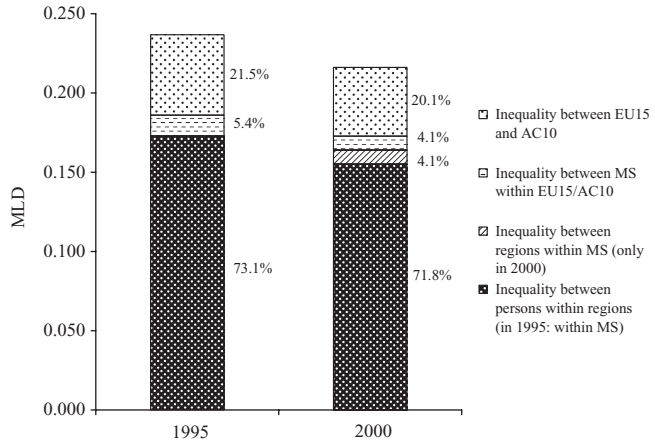

Figure 1. Development of the Spatial Structure of Inequality of the EU25[1]

Notes:
[1]Calculated on the basis of LIS data extrapolated to average HNDI and total population of the EU15 and the AC10.

population numbers of the respective country group and then imputing the between-country inequality reported by the National Accounts. An analysis based on a sub-sample of countries has shown that the interpersonal inequality changed by around 4 percent in response to the imputation of HNDI from the National Accounts. The accuracy of the presented estimate for the EU25 appears thus acceptable.

The observed development of income inequality in the EU25 during the second half of the 1990s can be comprehensively described by the term "convergence." The findings above reveal a convergence not only of national average income levels but also of inequality rates measured within and between the countries. The changes of inequality observed within countries correspond fairly well with what we would expect from the perspective of standard neo-classical trade theory and the theory of institutional competition (cf. Wildasin, 1991, 1992; Apolte, 2001; Deffains and Demougin, 2006). According to the former, the removal of trade barriers between the east and west of Europe has most likely lead to specialization on skill-intensive production in the EU15 and in more standardized production in the AC10. The demand for highly-qualified workers shifted from the east to west and demand for less qualified workers from the west to east. As a consequence, in EU15 countries the market incomes of highly qualified workers increased while those of the less qualified fell as a result of real wage losses or rising unemployment. At the same time, in the light of rising capital mobility, social policy was less effective in redistributing income from the rich to the poor, especially in the Scandinavian countries where the level of social support had been traditionally high (cf. Alber, 2002; Schmid, 2002; Hicks and Kenworthy, 2003; Ganßmann, 2004). The empirical findings in this section suggest that this goes hand in hand with a convergence of personal inequality within the countries.

In the AC10 the rapid growth of inequality, observed in previous studies for the first half of the decade, came to an end. The disruptions caused by the

economic transition, which had brought about exploding unemployment and devaluation of wages, have been overcome. Workers with comparatively low qualification now benefited from rising demand for their labor, so their wages rose relative to the average and their unemployment risk lowered. The newly built up social protection schemes began to work properly after a period of "muddling through" (Wagener, 2002, p. 171) at the beginning of the decade (cf. Wagener, 1999; Fox, 2003; Adema and Ladaique, 2005).

Finally, the geographic decomposition above allows us to specify the amount by which interpersonal inequality has increased as a result of the eastward enlargement in 2004—under the assumption, of course, that the income distribution did not significantly change between 2000 and 2004. Around the year 2000, the inter-personal inequality was a quarter higher in the EU25 than in the EU15. We would expect a jump in personal inequality of that size to bear a considerable risk of social tension in a socially integrated community of people living in a closely confined territory. In the EU25, where the population is spread over a large space and separated by national borders, and where the Member State is still an important unit of people's identification and socialization, the consequences are presumably less dramatic. Regardless of that, the finding that the income gap between the east and west accounts for more than 70 percent of the between-region inequality—and a fifth of the personal inequality—reveals the huge challenge which the enlargement has imposed on the regional cohesion policy of the EU.

5. Conclusion

In this study, the personal inequality of income in the EU25 is estimated at 0.216 points of the MLD. Which means the inequality in the EU is similarly high to that in the Member States with the most unequal distribution of income: Estonia, the United Kingdom and the Mediterranean countries of the EU15. It is smaller, indeed, than the inequality found by other studies in Canada, Russia, Indonesia or the Philippines. Furthermore, the study reveals that income levels in the EU25 converged during the second half of the 1990s on all investigated geographic levels: between the east and west of the EU, throughout the Member States and throughout persons within the Member States.

Not only did the income levels converge, but also the amount of inequality, both between Member States of the EU15 and the AC10 and between persons within the Member States. The convergence of within-country personal inequality is reflected primarily in a growth of inequality in the social-democratic welfare states of Scandinavia, accompanied by a reduction of inequality in the Mediterranean countries. This development may be attributable to intensified institutional competition caused by rising mobility of production factors in the EU. In the AC10, the rapid growth of inequality observed by other studies for the first half of the 1990s has come to an end. The inequality even lowered in two of the three AC10, which could be observed at two different points in time in the scope of this study, presumably as a result of economic stabilization, improvement of the capacities of social protection systems and a shift of demand for workers with lower qualification from the west to east.

In the years 1999/2000, more than a quarter of the EU25's personal inequality was caused by inequality between regions. One fifth was attributed to the income gap between the old and new Member States. The inequality within countries, which falls under the responsibility of social policy of the Member States' governments, accounted for three quarters of the overall personal inequality of income in the EU25. All in all, this study reveals that, whilst on the one hand inequality is diminishing on all geographic levels, the enlargement in 2004 has led to a sudden jump of inequality by 25 percent. Dealing with the east–west income gap, which constitutes a new and significant source of personal inequality in the EU, falls into the domain of regional cohesion policy conducted at a European level.

Appendix

TABLE A1

Price Level Indices Applied in the Study

		HFCE							GDP for Euro	
		For Local Currency Units					For Euro			
		Temporal Index[1]				PPP[2]	Temporal	PPP[2]	Temporal	PPP[2]
Country	Conversion Rate to the Euro	1994	1995	1997	1999	2000	Index[1] 1995	2000	Index[1] 1995	2000
Austria	13.760	/	0.935	/	/	1.008	0.976	1.008	1.017	1.024
Belgium	40.340	/	0.931	/	/	1.010	0.974	1.010	0.987	1.014
Cyprus	/	/	/	/	0.963	0.855	0.861	0.872	0.846	0.850
Czech Rep.	/	/	/	/	0.970	16.943	0.762	0.476	0.740	0.454
Denmark	/	/	0.911	/	/	9.613	0.926	1.290	0.923	1.283
Estonia	/	/	/	/	0.969	8.870	0.656	0.567	0.633	0.518
Finland	5.946	/	0.899	/	/	1.197	0.936	1.197	0.953	1.132
France	6.560	/	0.958	/	/	1.048	0.964	1.048	0.957	1.068
Germany	1.956	0.949	/	/	/	1.055	1.003	1.055	1.033	1.100
Greece	340.750	/	0.779[a]	/	/	0.830	0.865[a]	0.840	0.865	0.781
Hungary	/	0.386[b]	/	/	0.894	126.623	0.777	0.487	0.798	0.472
Ireland	0.788	/	0.845	/	/	1.137	0.816	1.137	0.780	1.094
Italy	1.936	/	0.876	/	/	0.965	0.797	0.965	0.794	0.930
Latvia	/	/	/	/	/	0.326	0.582	0.582	0.581	0.507
Lithuania	/	/	/	/	/	1.926	0.529	0.521	0.504	0.467
Luxembourg	40.340	0.880	/	/	/	1.005	0.939	1.005	0.968	1.069
Malta	/	/	/	/	/	0.683	0.920[a]	0.725	0.920	0.672
Netherlands	2.204	0.870	/	/	0.963	0.990	0.933	0.990	0.935	1.015
Poland	/	/	0.568	/	0.910	2.297	0.718	0.573	0.745	0.523
Portugal	/	/	/	/	/	0.822	0.895	0.822	0.870	0.796
Slovakia	/	/	/	/	/	18.719	0.779	0.439	0.802	0.423
Slovenia	/	/	/	0.818	/	147.701	0.908	0.721	0.920	0.702
Spain	166.386	/	0.872	/	/	0.842	0.891	0.842	0.886	0.835
Sweden	/	/	0.953	/	/	10.669	0.862	1.263	0.858	1.231
U.K.	/	/	0.897	/	0.987	0.724	0.659	1.188	0.650	1.187

Notes:
[1]Temporal price index (year 2000 = 1).
[2]EU25 = 1.
[a]Value of the corresponding GDP deflator.
[b]Value taken from the statistical office of the country.
Source: Eurostat, New Cronos.

TABLE A2

Real Household Net Disposable Income and GDP Per Capita (in 1,000 Euros)

	HNDI[1]		GDP[2]	
	1995	2000	1995	2000
Austria	19.6	21.2	21.7	25.0
Belgium	18.9	21.0	21.2	24.0
Cyprus	12.5	14.4	15.0	16.9
Czech Republic	9.1	9.9	12.0	13.0
Denmark	18.1	20.1	22.3	25.1
Estonia	4.8	6.7	6.1	8.5
Finland	13.8	17.8	17.9	22.3
France	17.4	19.8	19.6	22.0
Germany	18.7	19.7	20.6	22.6
Greece	11.8	13.6	13.9	16.0
Hungary	6.8	8.2	8.7	10.7
Ireland	12.5	18.4	16.5	24.9
Italy	16.5	18.2	20.3	22.3
Latvia	3.5	5.0	5.0	7.0
Lithuania	4.4	6.0	6.0	7.5
Luxembourg	33.0	35.9	36.9	46.4
Malta	9.3	12.7	11.7	15.9
Netherlands	19.3	22.8	21.5	25.6
Poland	5.8	7.3	7.1	9.2
Portugal	10.3	12.3	12.4	14.9
Slovakia	6.4	7.3	8.1	9.5
Slovenia	10.2	12.3	12.2	15.0
Spain	13.5	15.9	15.4	18.5
Sweden	17.4	20.3	20.6	24.1
United Kingdom	16.7	19.8	19.3	22.3

Notes:
[1]HNDI per capita at 2000 prices, PPP-adjusted, using the HFCE price indices as in Table A1.
[2]GDP per capita at 2000 prices, PPP-adjusted, using the GDP price indices as in Table A1.

TABLE A3

Spatial Decomposition of Inequality

		Population			MLD			
						Contribution[2]		No.
Country	Region	(1000)	(%)	EDI (Euro)[1]	(Abs.)	Abs.	(%)	of Obs.
Austria	Südösterreich	1,743	21.8	18,168	0.0951	0.0207	17.6	1,743
	Westösterreich	2,904	36.2	18,581	0.1119	0.0406	34.5	2,904
	Ostösterreich	3,365	42.0	19,999	0.1319	0.0554	47.1	3,365
	Within regions				0.1167	0.1167	99.3	
	Between regions				0.0009	0.0009	0.7	
	Total	*8,012*	*100.0*	*19,087*	*0.1175*	*0.1175*	*100.0*	*8,012*
Belgium	Région de Bruxelles	962	9.4	19,306	0.1299	0.0122	6.6	235
	Région Wallonne	3,343	32.6	17,918	0.1317	0.0430	23.3	824
	Vlaams Gewest	5,946	58.0	20,560	0.2196	0.1274	69.0	1,300
	Within regions				0.1825	0.1825	98.9	
	Between regions				0.0020	0.0020	1.1	
	Total	*10,251*	*100.0*	*19,581*	*0.1845*	*0.1845*	*100.0*	*2,359*

TABLE A3 (*continued*)

Country	Region	Population (1000)	Population (%)	EDI (Euro)[1]	MLD (Abs.)	MLD Contribution[2] Abs.	MLD Contribution[2] (%)	No. of Obs.
Poland	Poludniowy	8,093	20.9	5,920	0.1184	0.0248	15.9	6,533
	Wschodni	6,908	17.9	5,362	0.1454	0.0260	16.7	5,210
	Poludniowo-Zachodni	4,068	10.5	5,840	0.1534	0.0161	10.4	3,318
	Pólnocny	5,753	14.9	5,652	0.1567	0.0233	15.0	4,733
	Pólnocno-Zachodni	6,108	15.8	6,201	0.1759	0.0278	17.8	4,865
	Centralny	7,723	20.0	6,655	0.1762	0.0352	22.6	6,716
	Within regions				0.1532	0.1532	98.3	
	Between regions				0.0026	0.0026	1.7	
	Total	*38,654*	*100.0*	*5,963*	*0.1558*	*0.1558*	*100.0*	*31,375*
Germany	Thüringen	2,440	3.0	14,801	0.0808	0.0024	1.9	477
	Sachsen	4,443	5.4	15,611	0.0811	0.0044	3.4	825
	Sachsen-Anhalt	2,633	3.2	15,638	0.0883	0.0028	2.2	475
	Brandenburg	2,601	3.2	16,454	0.0893	0.0028	2.2	469
	Mecklenburg-Vorpommern	1,783	2.2	15,072	0.1005	0.0022	1.7	281
	Baden-Württemberg	10,493	12.8	18,990	0.1080	0.0138	10.8	1,259
	Rheinland-Pfalz + Saarland	5,100	6.2	16,898	0.1173	0.0073	5.7	663
	Nordrhein-Westfalen	18,000	21.9	18,582	0.1275	0.0279	21.8	2,331
	Niedersachsen	7,911	9.6	18,735	0.1289	0.0124	9.7	891
	Schleswig-Holstein	2,782	3.4	19,464	0.1413	0.0048	3.7	342
	Bremen	662	0.8	17,551	0.1424	0.0011	0.9	94
	Bayern	12,188	14.8	19,265	0.1452	0.0215	16.8	1,514
	Hessen	6,058	7.4	20,070	0.1480	0.0109	8.5	742
	Berlin	3,384	4.1	18,182	0.1537	0.0063	4.9	443
	Hamburg	1,710	2.1	18,581	0.2010	0.0042	3.3	173
	Within regions				0.1249	0.1249	97.6	
	Between regions				0.0031	0.0031	2.4	
	Total	*82,188*	*100.0*	*18,250*	*0.1280*	*0.1280*	*100.0*	*10,979*
France	Est	5,189	8.8	16,000	0.0882	0.0078	6.0	1,080
	Ouest	7,841	13.3	15,251	0.1076	0.0143	11.0	1,533
	Sud-Ouest	6,243	10.6	15,554	0.1131	0.0120	9.2	1,118
	Centre-Est	7,019	11.9	15,970	0.1140	0.0136	10.5	1,220
	Bassin Parisien	10,484	17.8	15,574	0.1178	0.0210	16.1	1,839
	Nord	4,004	6.8	14,468	0.1268	0.0086	6.6	675
	Méditerranée	7,152	12.1	14,851	0.1393	0.0169	13.0	1,220
	Île de France	11,038	18.7	21,087	0.1463	0.0274	21.1	1,602
	Within regions				0.1214	0.1214	93.6	
	Between regions				0.0083	0.0083	6.4	
	Total	*58,970*	*100.0*	*16,483*	*0.1298*	*0.1298*	*100.0*	*10,287*
United Kingdom	North East	2,581	4.5	15,063	0.1605	0.0072	3.4	1,277
	Wales	2,937	5.1	16,037	0.1720	0.0087	4.2	1,345
	East Midlands	4,191	7.3	17,330	0.1744	0.0126	6.0	1,784
	Scotland	5,119	8.9	17,053	0.1838	0.0163	7.7	2,169
	Yorkshire & Humber	5,047	8.7	16,164	0.1845	0.0161	7.7	2,229
	South West	4,936	8.5	17,274	0.1867	0.0159	7.6	2,214
	West Midlands	5,336	9.2	17,307	0.1909	0.0176	8.4	2,222
	North West	6,881	11.9	17,277	0.1954	0.0233	11.1	3,048
	Eastern	5,419	9.4	19,946	0.2074	0.0194	9.3	2,398
	South East	8,078	14.0	21,831	0.2313	0.0323	15.4	3,506
	London	7,285	12.6	21,651	0.2659	0.0335	15.9	2,632
	Within regions				0.2030	0.2030	96.6	
	Between regions				0.0072	0.0072	3.4	
	Total	*57,809*	*100.0*	*18,442*	*0.2102*	*0.2102*	*100.0*	*24,824*

TABLE A3 (*continued*)

Country	Region	Population (1000)	Population (%)	EDI (Euro)[1]	MLD (Abs.)	MLD Contribution[2] Abs.	MLD Contribution[2] (%)	No. of Obs.
Hungary	Alföld és Észak	4,144	41.2	4,907	0.1333	0.0549	36.8	918
	Dunántúl	3,073	30.5	5,602	0.1368	0.0417	28.0	632
	Közép-Magyarország	2,851	28.3	7,020	0.1462	0.0414	27.8	463
	Within regions				0.1380	0.1380	92.6	
	Between regions				0.0110	0.0110	7.4	
	Total	*10,068*	*100.0*	*5,718*	*0.1490*	*0.1490*	*100.0*	*2,013*
Greece	Attiki (incl. greater Athens)	3,885	35.6	14,120	0.1609	0.0572	28.6	916
	Nisia Aigaiou, Kriti	1,095	10.0	10,634	0.1660	0.0166	8.3	512
	Voreia Ellada	3,512	32.2	9,494	0.1954	0.0628	31.4	1,336
	Kentriki Ellada	2,425	22.2	9,676	0.2094	0.0465	23.3	1,041
	Within regions				0.1833	0.1833	91.6	
	Between regions				0.0169	0.0169	8.4	
	Total	*10,918*	*100.0*	*11,295*	*0.2001*	*0.2001*	*100.0*	*3,805*
Spain	Sur	8,568	21.3	12,336	0.1589	0.0338	16.4	904
	Noreste	4,089	10.2	17,471	0.1684	0.0171	8.3	677
	Comunidad de Madrid	5,230	13.0	20,746	0.1714	0.0223	10.8	425
	Noroeste	4,286	10.6	14,912	0.1784	0.0190	9.2	643
	Este	11,129	27.6	18,351	0.2146	0.0593	28.7	989
	Centro (ES)	5,255	13.1	13,100	0.2151	0.0281	13.6	839
	Canarias (ES)	1,707	4.2	13,246	0.2196	0.0093	4.5	278
	Within regions				0.1889	0.1889	91.3	
	Between regions				0.0179	0.0179	8.7	
	Total	*40,263*	*100.0*	*16,025*	*0.2068*	*0.2068*	*100.0*	*4,755*
Italy	Centro (IT)	10,896	19.1	14,633	0.1380	0.0264	12.8	1,617
	Nord Est	10,565	18.6	17,521	0.1574	0.0292	14.1	1,605
	Nord Ovest	14,912	26.2	17,088	0.1650	0.0432	20.9	1,927
	Sud (IT)	13,952	24.5	10,918	0.2165	0.0530	25.6	1,852
	Isole	6,624	11.6	10,024	0.2735	0.0318	15.4	922
	Within regions				0.1837	0.1837	88.8	
	Between regions				0.0233	0.0233	11.2	
	Total	*56,949*	*100.0*	*14,365*	*0.2069*	*0.2069*	*100.0*	*7,923*

Notes:
[1]Mean EDI at 2000 prices PPP-adjusted (EU25 = 1) using Eurostat's price indices for HFCE.
[2]MLD weighted by the population share.
Source: LIS; Eurostat, New Cronos.

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