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On the measurement of regional inequality: does spatial dimension of income inequality matter?

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Abstract The paper concerns selected theoretical and empirical aspects of the decomposition of income inequality by spatially defined subgroups. Special consideration is given to the implications for measurement and comparison of regional inequality. The decomposition by the Theil coefficient is applied at global and European levels including estimates of historical development. Additionally, the empirical evidence on the decomposition of inequality in a number of countries is reviewed, regional inequality for 46 countries is estimated, and a simple method of cross-country classification according to relative importance of spatial dimension of inequality is provided.

JEL Classification D31 · D63 · O15 · R12

1 Introduction

When we think of regional income inequality, one typically considers the variability in regional mean incomes (i.e., we replace the incomes of citizens in particular regions by their respective regional averages). While this concept can effectively refer to the aggregate direction of regional development, it does not fully explore the question of whether the citizens differ in their incomes because of their spatial location, or whether they differ due to high within-region income inequality. In such a case, the decomposition of inequality, which identifies the shares of overall inequality attributable to between-region and within-region variability, becomes a helpful tool for the positive analysis

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of inequality and, eventually, also for the purposes of social policy design and evaluation.

This paper focuses on the spatial decomposition of inequality by the Theil coefficient at global, European and country levels. The relative extent of between-region inequality (i.e., spatial dimension of inequality) is thus compared across geographical scales, while also estimating some historical development figures which are provided at global and European levels. Additionally, we suggest a simple way of comparison of the relative importance of spatial dimension of income inequality among 46 countries. For this purpose, we confront the between-region inequality with the inequality among income deciles for each country. As we dispute the independence of regional inequality measures on the number of regions and on the way of regional breakdown, we strive to control for these variables dividing the analyzed units (i.e., world, Europe, and each of 46 countries) into similar numbers (10 if applicable) of socio-geographical regions in our calculations.

The remainder of the paper is composed of the following. Section 2 draws mainly on the findings obtained recently by Shorrocks and Wan (2005) and discusses some methodological questions and theoretical propositions of the decomposition of inequality by the Theil coefficient based on spatially defined subgroups. Then we proceed further to examine some basic issues related to the comparison of regional inequality. A discussion of data utilized in this paper is also found in Sect. 2. Section 3 provides an empirical analysis of the decomposition of inequality at the global, European, and country level as mentioned in the previous paragraph. Section 4 concludes with some general comments.

2 Methodological and theoretical notes

2.1 The decomposition of inequality by the Theil coefficient

An inequality among inhabitants of any unit divided into a number of regions (regional subpopulations), or other mutually exclusive and completely exhaustive subgroups, can be broken down into two components. Generally, using the appropriate technique, these two components correspond to the inequality between the (weighted) subgroups‘ averages (B) and the sum of (weighted) inequalities within particular subgroups (W). The inequality within any of the subpopulations can be further additively decomposed in the same manner, as the number of stages is dependent upon the detail of information available (see e.g., Akita 2003 for the two-stage Theil decomposition).

In practice, there are several decomposable inequality indicators. Perhaps the most convenient for the decomposition is the family of Generalized entropy indices including the Mean logarithmic deviation, the Theil coefficient, and the Half of the squared coefficient of variation (Theil 1972; Bourguignon 1979; Shorrocks 1984; Cowell 1980; among others). Although the specifics of the Theil coefficient are, for the most part, examined in this paper, the theoretical propositions as well as the empirical results are likely to be similar for the other

indices from the family (Elbers et al. 2002; Gray et al. 2004; Shorrocks and Wan 2005). The Theil coefficient of income inequality may be written as:

$$T = \frac{1}{n} \sum_{i=1}^{n} \frac{yi}{y} \ln \frac{yi}{y} \tag{1}$$

where T denotes the overall income inequality, n is population size, y corresponds to average income per capita, and y_i is the income of the ith individual.

If a population can be territorially divided into k regions (generally k symbolizes mutually exclusive and exhaustive subpopulations), then T can be itemized as:

$$T = \left(\sum_{j=1}^{k} \frac{n_j}{n} \frac{y_j}{y} \ln \frac{y_j}{y} \right) + \left(\sum_{j=1}^{k} \frac{1}{n} \frac{y_j}{y} \sum_{i=1}^{n_j} \frac{y_{ij}}{y_j} \ln \frac{y_{ij}}{y_j} \right) = B + W \tag{2}$$

where n_j refers to the population size of the jth region, y_j is the mean income of the jth region, and y_{ij} corresponds to the income of the ith individual in the jth region.

2.2 Some theoretical suggestions

This section examines the relationship between the overall inequality (T) and its associated components (B, W), as well as the relationship between the regional inequality measures versus the number of regions (k), the population size, and the area size of a system under observation. Initial points for this discussion represent the propositions or 'theoretical results' pointed out by Shorrocks and Wan (2005) as well as the findings demonstrated previously by Hampl (2000), and Novotný (2004a,b). Again, although the particular case of the Theil coefficient is considered, the propositions are likely to have a more general validity, supposing some conditions are in place.

Firstly, it is worth mentioning the range of possibilities for T and B/T (i.e., of the Theil coefficient of regional inequality expressed in absolute value and in relative terms as the proportion of the overall inequality, respectively). While the formula (1) implies that overall inequality (T) falls within the interval between 0 (perfect equality) and ln n (maximum inequality), the range of B/T ratio obviously corresponds to the interval between 0 and 1. As suggested in formula (2), if the average incomes of all regions are identical ($B = 0$), then $T = W$ and $B/T = 0$. Reversely, replacing the income of each individual by the regional mean ($W = 0$), would give $T = B$ and $B/T = 1$. Note that the special cases of these extremes occur if there is no regional division within a population ($k = 1$) or, reversely, if there is the same number of regions as individuals ($k = n$, assuming one person in each region).

The second proposition made by Shorrocks and Wan (2005, p. 66) states that B and B/T increase (at least it does not decrease) with k. In other words, one

could assume that the measures of regional inequality are likely to be affected by the quantity of regions within a system being analyzed. Although this proposition seems to be intuitively apparent, it has yet to have been fully analysed formally. Similarly as Marshall and Olkin (1979) and Hampl (2000, p. 48–50), Shorrocks and Wan (2005, p. 66–67), provide that the probability for the frequency of larger regions (and, also analogously, more populous ones) decreases whenever we divide a constant population into more regions. Another interpretation is that, in theory, richer individuals tend to be more isolated in particular regions (as far as $B = T$ if $k = n$). The variability of regional mean incomes thus increases with k. Moreover, because of (2), a change in B associated with a change in k (for example by l regions) affects W and reversely, so that:

$$B_{k+l} - B_k = W_k - W_{k+l} \tag{3}$$

Nevertheless, it should be noted that the context of the explanation mentioned above refers to a situation when k increases by l due to a division of one or more of the existing regions into two or more parts. That does not, however, imply that B_{k+l} (as well as B_{k+l}/T) is necessarily higher than B_k (and B_k/T) for all possible ways of regional breakdowns (allocations of individuals to regions). Typically, for example, if the urban-rural split is considered as a way of regional breakdown, then the between-region component is generally high, though there are only two "regions" observed (see Shorrocks and Wan 2005 for the empirical documentation of this fact). This sends a clear message: the manner of partition into regions matters, and, therefore, in order to make a regional inequality measure comparable, some basic principles of the socio-geographical regionalization have to be respected. In particular, the regions within a unit which are being analyzed should be contiguous and roughly comparable according to the area size. In addition, the essentially functional nature of a socio-geographical region should be taken into account, assuming the settlement centres (cities or metropolitan regions) should not, for instance, be separated from their surrounding peripheries. This simple requisite is, in fact, rarely followed in practice, as the administrative division is usually normatively employed. However, the results may be affected considerably, as in the example of the between-region inequality (B) expressed in the Theil coefficient in Table 7 in Appendix for the Czech Republic, which would be almost two times higher if we did not amalgamate the administrative region of Prague with its periphery, i.e., Central Bohemia (see Blažek 1996).

Thirdly, do regional income inequality (B) and its share in overall inequality (B/T) depend on the population and area size of a unit? Felsenstein and Portnov (2005, p. 648) quote a number of, rather intuitive, "beliefs" that small countries do not exhibit significant regional differences. Nevertheless, there is little evidence and any theoretical explanation for these claims. This matter will not be looked at in detail here, but some general comments on the issue can be made. From the theoretical point of view, the size should not directly affect the Theil coefficient, since it satisfies a property of the scale-invariance. As such, were rich and poor people relatively randomly distributed around the

world, B (as well as B/T) would generally be fractional at higher geographical levels. Most of the inequality would fall on the "within-micro-regional" income differentiation. This could be called a "natural" state of income distribution, assuming it could describe a situation until the beginning of the 18th century or so, as is suggested by Bairoch (1993, p. 104) and others. However, similarly as in many other dimensions of societal organization, the natural randomness of income distribution has been overcome. From that time the macro-regional economic divide has gained considerable importance, from the global point of view. In principle, regional equality is associated with regional integration that is assumed to assert itself "from below" (i.e., from lower geographical levels). Since economic development is essentially selective in character, an increase in regional integration within a system at one scale primarily leads to an increase in regional inequality measured at a higher level. Expected regional inequality is thus likely to increase with geographical level (implicitly with area size) where it is observed. However, despite the primitive framework that has been outlined, one can hardly answer the question at hand, without inductive documentation and interpretation of the empirics of regional inequality across countries and other systems at different geographical scales.

2.3 The comparison of regional income inequality

From an academic and a practical point of view it is not uncommon to ask the question: is regional inequality higher in one country than in another one? Often, however, it may be difficult to ascertain a suitable answer. The attributes and suitability of particular indices for comparison of inequality are commonly discussed, other methodological requirements, such as the manner of partition into regions (subpopulations) are, nevertheless, rarely considered. In addition, as we also strive to suggest in this paper, the comparison of regional inequality may be particularly problematic since the units under analysis usually differ substantially in the number of their inner regions (subpopulations). Although some theoretical arguments have already been pointed out in previous section, the exact behaviour of the regional inequality measurements with respect to k could hardly have been made clear beforehand. Typically, it depends on the amount of information that is lost or obtained whenever k changes by l (i.e., on the amount of inequality which is transformed from W_k to B_{k+l} if the number of regions changes by l units). Due to the fact that most of the existing studies on regional inequality comparison do not control for the variable, their results are likely to be affected when k significantly differs. Such is not the case in this paper which makes considerable effort to calculate and compare regional inequality based on the similar number of regions ($k = 10$, if applicable).

Perhaps the most problematic issue associated with the comparison of B and, above all, of B/T across countries is the question of data availability (quality is of course also a factor but it will not be discussed at this point). It is common to have some information on regional mean incomes (GDP per capita is often

applied as a rough proxy) in a country, but analysis is often hampered by a lack of information on the nature of income distribution within particular regions. More frequently, however, we have some estimates referring to the nature of overall income distribution–for example in the form of a vector of national income deciles, as in this paper. As a result of the aggregation of income deciles, the Theil coefficient applied to these groups does not strictly correspond to the overall inequality (T) which also includes the within-decile component. Therefore, a distinction should be made between these two indicators denoting T' as the estimated overall inequality based on the income deciles. Although the size of the within-decile component in relation to the overall inequality is not examined theoretically, the difference between T and T' does not seem to be fundamental from the empirical point of view (as will be seen later in Table 1, for instance). It is therefore possible to employ B/T' as a proxy for B/T for the purposes of the cross-country comparison of the relative importance of spatial dimension of inequality in Sect. 3. To appreciate the merit of the indicator, we can simply interpret T' as indicating what B would be if each of the income deciles lived in one specific region.

2.4 Data

The international differences measured were based upon GNI per capita in terms of purchasing power parity as provided by the World Bank. Given the historical development of international inequalities, the GDP series in purchasing power parity constructed by Maddison (2003) were applied. Similarly, the intra-country regional disparities within particular countries are estimated according to the GDP per capita disparities. The majority of the data originates directly from national statistical offices (supranational in the case of Eurostat) either as they appear on the websites or via email correspondence. In some cases data from the national Human Development Reports were adapted.[1] There are numerous well-known, and no doubt considerable, problems associated with the GDP concept. However, the issues surrounding the data related to non-household income, regional price differences, environmental costs, etc., will not be addressed within the confines of this paper.

The within-country (or within-region) dispersions of incomes were estimated on the basis of information included in the national income deciles drawn from various household surveys. In this regard, the principal source was the World Income Inequality Database (WIID2) that has been compiled by the World Institute for Development Economic Research. The preferred surveys were those with households as the basic statistical units and persons as the units of analysis (i.e., per capita estimates) in most cases. Unfortunately, the surveys tend to differ in their concept of income (or consumption in some developing countries). The specification of income definition applied in each of the 46

[1] National Human Development Reports: Egypt 1998/99, India 2001, Kazakhstan 2002, Kyrgyzstan 2000, Madagascar 2000, Nepal 2001, Niger 1999, Paraguay 2003, Senegal 2001, Uzbekistan 2000.

countries appears in the last column of Table 8 in Appendix. Similar information for additional countries as well as other details of particular surveys and discussion of other problematic issues can be found on the WIID2 database website (http://www.wider.unu.edu/wiid).

The data on national income distributions from WIID2 were revised and, in some cases, supplemented by analogous information obtained directly from a national statistics office.[2] In spite of this fact, there was no information on income distribution for more than one-third of the world's countries. In these cases, a country's income distribution was extrapolated on the basis of geographical and cultural proximity (i.e., according to the distribution of a neighbouring country). The bias associated with such an adjustment is obviously present, though it need not be fundamental. Generally, societies which share similar histories and geographies (in broad meaning) tend to have a similar nature of income distribution (for a description of geographical variation in within-country income inequality see e.g., Deininger and Squire 1996 or Cornia and Kiiski 2001).

World and European income distributions were estimated by aggregating the income deciles of particular countries as follows. First, a national GNI was divided into tenths according to income distribution reported for the country. Then, all the income groups were sorted by their respective GNI per capita. Finally, the income share belonging to a particular tenth of the world or European population was proportionally derived. Although this simple method undoubtedly lacks a precision, it is nonetheless acceptable for the general purposes of this paper.

In addition, the historical development of world and European income distributions was modelled using the estimates of income deciles worked out by Bourguignon and Morrisson (2002). Data used in their paper and extensive description of their estimates appear on http://www.delta.ens.fr/XIX/. The comparability of the historical and more recent results based on different sources must be treated with extra caution due to different country groupings as well as numerous additional discrepancies.

3 Empirical evidence

The following text provides the empirical analysis of the spatial decomposition of inequality in the world, Europe, and in a number of countries. The estimates of the historical development of global and European income distributions are included. A discussion of the evidence drawn from literature is followed by a new comparison of the relative importance of the spatial dimension of inequality across 46 countries in relation to the national level.

[2] Such as in cases of the Czech Republic, Slovakia, and Japan.

3.1 The decomposition of global and European income inequality

To begin, the structure of data needs to be clarified by focusing on the overall global and European inequality at different levels of aggregation (Table 1). The most detailed perspective undertaken here corresponds to the inequalities among 1,750 and 350 income cells (ten income deciles within particular countries). The overall global and European inequalities which are analyzed below, however, refer to the differentiation among 100 income cells (ten income deciles within each world macro-region or European region). In addition, another type of non-spatial grouping represents the estimated global and European income deciles as aggregated from deciles of particular countries. Although all of the categories are primarily based on the same data, some information is obviously lost due to the aggregation. Understandably, this is more pronounced if employing the spatial groupings rather than the aggregation of overall income deciles. A considerably larger amount of overall inequality changes into the within-region than into the within-decile component. Incidentally, this is also an empirical proof that the Theil coefficient is not independent of the level of aggregation or, in other words, the number of regions (subpopulations) among which it is calculated.

The research on global income inequality has proliferated recently, catalyzed by the globalization debate (e.g., Dostál and Hampl 2000; Milanovic 2002; Sala-i-Martin 2002; Firebaugh 2003). Although a huge discussion exists about the recent trends in global inequality, the issue is anything but clear, and this holds true for both the overall global inequality and the between-region component when expressed in absolute terms (see Table 2). By contrast, the results confirm our expectations regarding the long term development of the structure of global inequality. In this respect, we find a large increase in *B/T* between 1820 and 1960, when it reached its historical maximum. It has been slightly decreasing since that time (disregarding 2003, when based on different sources of data). Nowadays, about one half of the overall global income inequality can be ascribed to disparities between the averages of ten world macro-regions.

An examination of the decomposition at the macro-regional level is presented by the example of Europe (disregarding the Post-Soviet states). In this regard, it is frequently reported that regional disparities have ameliorated in Europe during recent decades, for the most part due to ongoing European integration. However, this argument typically only relates to the limited territory of the "old" European Union (i.e., prior to the 2004 enlargement). Some convergence in regional mean incomes has progressed within the area, both regarding the absolute values of *B* (e.g., Suarez-Villa and Cuadrado-Roura 1993 or Armstrong 1995), but also relatively, in terms of *B/T* ratio (Morrisson and Murtin 2004). By contrast, it seems that, by taking the continent as a whole into account, regional inequality has not changed markedly for centuries (e.g., Berend 2003). The estimates of the development of European inequality in Table 3 support the latter. Although the overall income inequality has decreased considerably among European citizens since 1870, the improvement is primarily due to the substantial decline in the within-region component. The between-

Table 1 The global and European inequality in 2003 measured at different levels of aggregation

Global inequality among:	Theil	Percentage	European inequality among:	Theil	%
1,750 income groups	0.815	100	350 income groups	0.244	100
100 income groups (T)	0.784	96	100 income groups (T)	0.241	99
10 income deciles (T')	0.753	92	10 income deciles (T')	0.235	96
175 countries	0.530	65	35 countries	0.075	31
10 macro-regions	0.407	50	10 regions	0.062	25

See Appendix A3 for the partitions into the world macro-regions and European regions

Table 2 The development of global income inequality: decomposition by the Theil coefficient

	1820	1870	1910	1950	1960	1970	1980	1992	2003
B	0.051	0.158	0.258	0.435	0.403	0.399	0.406	0.388	0.407
W	0.499	0.510	0.510	0.365	0.330	0.350	0.416	0.442	0.377
T	0.550	0.668	0.768	0.800	0.733	0.749	0.822	0.830	0.784
B/T (%)	9	24	34	54	55	53	49	47	52

The calculations for 2003 are based on different sources than for previous years. See Appendix A3 for the world partition into 10 macro-regions B inequality between 10 macro-regions, W inequality within 10 macro-regions, T overall global inequality

Table 3 The development of European income inequality: decomposition by the Theil coefficient

	1870	1913	1950	1960	1970	1980	1992	2003
B	0.074	0.068	0.091	0.081	0.063	0.052	0.093	0.062
W	0.469	0.446	0.256	0.253	0.247	0.248	0.241	0.179
T	0.543	0.514	0.347	0.334	0.310	0.300	0.334	0.241
B/T (%)	14	13	26	24	20	17	28	26

The calculation for 2003 is based on different sources than for previous years. See Appendix A3 for the European partition into 10 regions B inequality between 10 European regions, W inequality within 10 European regions, T overall European inequality

region component has not shown any explicit trend. The relative importance of the spatial dimension of inequality has thereby significantly increased since the second half of the 19th century, with two peaks in 1950 and 1990. Currently, the inequality among ten European regions captures around one fourth of the overall European inequality. The spatial dimension of income inequality is, on the one hand, relatively unimportant in Europe compared to the structure of global inequality, while, on the other hand, there is an evident and persisting core-periphery division, dating well back into continent's history. Today, according to the Theil decomposition, the East-West divide (considered to be along the western border of Finland, Poland, the Czech Republic, Slovakia, Hungary, and Slovenia) explains almost one fifth of the income inequality amongst European citizens.

3.2 The decomposition of inequality at national level: review of existing records

Most empirical studies on the decomposition of inequality analyze income inequality within and between regions of individual countries. Although there is a large and growing volume of literature on this topic, it is difficult to make any general conclusion by examining the results. A variety of problems exist regarding methodological and data inconsistencies and, perhaps more importantly, the diversity of conditions within particular countries under analysis. Unfortunately, this paper lacks sufficient space needed to provide a conclusive discussion on the role of the individual factors and clarification of other variables. A similar review can be found in Shorrocks and Wan (2005) and, as such, only some brief comments related to the issues mentioned above will be highlighted. For the list of considered studies on the decomposition of inequality at the national level see Table 7 in Appendix.

Firstly, the between-region inequality is generally smaller compared to the within-region component, although considerable variability of particular values should be mentioned. Secondly, the rank order correlations between the inequality indicators (B/T, B, and T) and other variables, including number of regions, population size, area size, and GDP per capita, are presented in Table 4. Not surprisingly, the positive relationships between B/T and B as well as between B and T tend to be relatively high. Furthermore, the results indicate significant correlations between B as well as B/T on one side and k on the other. In this regard, however, only the dependence of B/T to k can be accepted, because the partial correlation coefficient is not significant for B when controlled for the level of economic development.[3] Contradictory to the theoretical proposition any evident relationship between B/T and the area size has yet to be identified. Additionally, weak correlations exist when regional inequality is expressed in absolute terms (B) and when we consider the population as an indicator of country size. Nevertheless, as previously suggested, even the population size should be interpreted carefully as a determinant of regional inequality, since we do not control for the influences of other factors.

Further consideration should be given to the relationship between the inequality and the level of economic development. In fact, this is a commonly debated issue, since the level of economic development is sometimes treated as an important determinant of income inequality, both regarding the differentiation among households and among regions (see Kuznets 1955; Williamson 1965, respectively, for pioneer works in the fields). At this point, a significant negative relationship between GDP per capita and regional inequality variables (B as well as B/T) is found. The correlation with T is lower, thought significant at p-level of 0.05.

[3] The relationship between k and GDP per capita exists due to the method of the estimates of inequality decomposition with detailed regional breakdowns applied in some less developed countries—see Table 7 in Appendix.

Table 4 Spearman rank order correlation coefficients (based on results drawn from the literature—the set of 19 countries—see Table 7 in Appendix)

	B	*T*	*k*	Pop. size	Area size	Per cap. GDP
B/*T*	0.903**	0.312	0.607**	0.453*	0.186	−0.583**
B		0.747**	0.603	0.527*	0.432*	−0.597**
T			0.497*	0.350	0.441*	−0.447*

B between-region component, *T* overall inequality, *k* number of regions, GDP per capita considered in purchasing power parity terms
* Value significant at the p-level of 0.05, ** Value significant at the p-level of 0.01

Few case studies exist which focus on the development of a country structure of inequality over a longer period of time. One example is the analysis undertaken by Motonishi (2003) who reported that the change in between-region component was a comparatively less important source of the overall income inequality augmentation in Thailand between the years 1976 and 1998. This is, however, an infrequent example. By contrast, Loikkanen et al. (2005) found that the amelioration of disparities among regions was the principal cause of a relatively significant decrease in the overall Finnish income inequality between the years 1971 and 1998. A similar conclusion holds true for Indonesia in the 1990s (Tadjoeddin 2003), as well as for China and Russia during a similar period (Galbraith et al. 2004), though the latter analysis differs in methodology. Interestingly, although the between-region component generally takes a minor share relative to the within-region differentiation, it often "drives" the changes in the overall inequality.

3.3 The cross-country comparison of regional inequality: an alternative approach

Comparing the existing evidence on the share of the between-region component across countries is problematic due to a limited number of studies which also tend to differ in methodology. Typically, the problem occurs at a different level of aggregation and/or in a different number of regions within particular countries. A more exploitable method for the cross-country comparison, which has been suggested in Sect. 2, will be empirically examined at this point. The Theil coefficient of regional inequality (B) is computed for a country and confronted with estimates of overall (T') and within-region ($W' = T' - B$) differentiation. The estimated overall inequality is based on the country income deciles, as they are aggregated from household survey data. The regional inequality corresponds here to the level of inequality among regional means in GDP per capita (gross value added in Ireland and income in Niger and Vietnam). The administrative regions are merged in some countries in order to

Table 5 Classification of countries according to their structure of inequality

	Estimates of within-region inequality ($W' = T' - B$)		
	Low $W' < 0.150$	Medium W' (0.150, 0.300)	High $W' > 0.300$
Low regional inequality $B < 0.015$	*Sweden, Netherlands, Norway, Austria, Denmark*	USA, Australia, Japan, Canada, UK, Switzerland, France	**Senegal**
Medium regional inequality B (0.015, 0.059)	*Finland, Germany,* Spain, Poland, Czech Republic, *Belgium*	Ireland, Italy, China	**Paraguay, Madagascar, Bolivia,** Uzbekistan, Russia, **Nepal, Egypt, Mexico,** Argentina
High regional inequality $B > 0.060$	*Hungary,* India, Estonia, Kyrgyzstan	Vietnam, Indonesia, **Thailand, South Africa**	Peru, **Chile,** Niger, **Sri Lanka,** Philippines, **Brazil,** Kazakhstan

Countries within particular categories are sorted in ascending order according to B. Countries in bold are distinguished by very high overall income inequality estimates ($T' > 0.500$), while those in italics by very low overall inequality ($T' < 0.150$)

reach a comparable number of socio-geographical regions in all countries ($k = 10$, if applicable).[4]

Using data on GDP per capita as a proxy for regional mean incomes lacks precision and, thus, it would be incorrect to interpret B/T' explicitly in terms of the share of the between region component (as we do with respect to B/T). Nevertheless, it would seem that the indicator could roughly illustrate the differences in the structure of inequality and thus demonstrate the relative importance of spatial dimension of inequality across countries.

Data pertaining to the set of 46 countries (see Table 8 in Appendix) was compiled and classified by ranking the countries according to their estimated within-region and between-region inequality. There are nine groups, or categories, of countries identified in this way in Table 5. The spatial dimension of inequality is estimated to be somewhat less important in the categories of countries above the main diagonal of the table, while the contrary is suggested for the groups below the diagonal.

The possible relationships between the inequality indicators ($B, T', B/T'$) and other variables (including population size, area size, and GDP per capita) are examined as in the previous section, but with consideration given to the set of 46 countries. The rank order correlation coefficients in Table 6 provide results roughly similar to those in Table 2 based on the review of the literature. As one might expect, B/T' is positively related to its absolute value (B) and, at the same time, B is generally higher in countries with higher T'. No relationship is confirmed with respect to the dependence of regional inequality on the

[4] Unfortunately, the specifics of regional division within each of 46 analyzed countries can not be discussed in this paper. An exhaustive list can be found in Novotný (2004a) or obtained from the author upon request.

Table 6 Spearman rank order correlation coefficients (the set of 46 countries – see Table 8 in Appendix)

	B	T'	Pop. size	Area size	Per cap. GDP
B/T'	0.813**	−0.069	0.086	−0.126	−0.277*
B		0.475**	0.184	0.101	−0.628**
T'			0.235	0.384**	−0.688**

B between-region inequality, T' overall inequality estimated on the basis of national income deciles, GDP per capita considered in purchasing power parity terms
* Value significant at the p-level of 0.05, ** Value significant at the p-level of 0.01

area or population size. Lastly, a negative relationship between the indicators of inequality and the level of GDP per capita is observed once again.

The comparison of the results taken from the existing literature and those obtained by the calculations made above can be based exclusively on the findings for 11 countries including: Brazil, Canada, the Czech Republic, Finland, Indonesia, Italy, Poland, Russia, Switzerland, Thailand, and Vietnam. As one might expect, the shares of the between-region components based on regional disparities in GDP per capita are generally higher (with the mean B/T' corresponding to 20%) compared to those from existing literature on the decomposition of inequality, where the income, consumption or expenditure concept is typically employed (B/T corresponds to 10% on average). Nevertheless, the latter set of results is more variable which may refer to a considerable heterogeneity of particular studies. Generally, a significant positive correlation between both sets exists.

4 Concluding summary

This paper has focused on a few of the topics related to decomposition of inequality by spatially defined subgroups. It is a method that offers an alternative viewpoint to regional inequality as it is understood in relation to overall inequality, i.e., by the share of the between-region component.

It has been shown that the measures of regional inequality tend to be sensitive to the specifics of regional breakdown especially to the level of aggregation (number of regions under consideration). The real behaviour of the between-region component and its dependence on the number of regions can scarcely be anticipated ex-ante. Therefore, usage of the same or similar number of regions is a desirable attribute to the comparison of regional inequality among two or more geographical systems. Moreover, it is advisable for the regions (essentially functional in character) to be delimited according to some basic principles of socio-geographical regionalization.

Generally, a twofold orientation of the development of inequality has been emphasized. These two dimensions include: the development in time and the reproduction of inequality across geographical scales. An increase in regional integration associated with the amelioration of inequality at one level usually corresponds to a reproduction of inequality at higher geographical levels.

Therefore, when seeking to answer the question of whether the spatial dimension of income inequality is an important source of overall income differentiation, it depends, first of all, on the geographical level of the analysis. Clearly regional integration asserts itself from below and the mechanisms regulating socioeconomic inequality are weaker, ineffective, or do not exist at higher scales. The between-region component has been found to be considerably higher at the global level compared to that of Europe, which is, subsequently, higher than the average at the country level. The distribution of income amongst world citizens is currently dominated by the macro-differentiation, but it is a phenomenon that does not appear to be much older than a century. Perhaps, we can expect a reverse in the structure of the global income inequality—some inklings of the convergence in (population weighted) national and macro-regional incomes exist, while, at the same time, there has been a growing income inequality recently reported within a number of countries, such as China, India, and the USA, for example. As globalization becomes more of an issue, the inequality that exists between the new, spatially unbound, global classes is becoming increasingly important as a source of the world inequality.

Nonetheless, at the national level, the between-region inequality is generally smaller relative to the within-region differentiation. However, this conclusion obscures a considerable variability across countries. In this respect, country size has not been found to be a significant determinant of the spatial dimension of inequality. In essence, other factors have suppressed the "size" impact on regional inequality of a country, if one is present. One of the factors is the level of economic development, since, as put forth in this paper, a significant negative relationship has been observed between a country GDP per capita and the level of inequality.

A simple method for cross-country comparison of the structure of inequality has been applied to the set of 46 countries classifying them according to relative importance of the spatial dimension of inequality. It has been shown that a greater amount of attention should be paid to the spatial dimension of inequality in countries such as Hungary, India, and Kyrgyzstan, as well as Vietnam, Indonesia, Thailand, South Africa, and Finland, Germany, Spain, Poland, the Czech Republic, and Belgium. This is not the case for 17 other countries which have been identified by virtue of their relatively small contribution of the between-region component. Although Senegal is the most pronounced case, the USA, Japan, France, Paraguay, or Madagascar were also included into this group, for instance. A strategy for addressing inequality in these countries should concentrate more on other (i.e., non-spatial) aspects of income distribution.

It should be noted that non-spatial dimensions such as education, age, ethnicity, and gender are perhaps the most engaging aspects. The spatial dimension of inequality becomes more appealing when it is associated with one or more of previously mentioned dimensions of socio-economic stratification. As such, a more thorough examination into disaggregated patterns and determinants of regional inequality would be a desirable research avenue to explore. This, however, is dependent on significant dissemination and an improvement in the quality of regional data.

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Appendix 1

Table 7 Review of empirical evidence on the decomposition of inequality by spatially defined subpopulations (19 countries)

Country	Source	Measure	Concept	k	Year	B	B/T (%)
Brazil (Southeast + Northeast)	Elbers et al. (2004)	GE0	Per capita income	10	1997	0.142	25
Canada	Gray et al. (2004)	GE1	Family income	9	1997	0.005	2
Czech Republic	Forster et al. (2005)	GE1	Disposable income	8	1996	0.004	3
Ecuador	Elbers et al. (2002)	GE0	Est. per capita expenditure	1579	1994	NA	41
Finland	Loikkanen et al. (2005)	GE0	Per capita income	4	1971	0.016	13
					1998	0.005	5
Germany	Schwarze (1996)	GE0	Individual income	2	1992	0.029	22
India	Mishra and Parikh (1992)	GE1	Per capita expenditure	17	1983	0.010	6
Indonesia	Tadjoeddin (2003)	GE1	Per capita expenditure	26	1990	0.041	17
					1999	0.050	22
Italy	Forster et al. (2005)	GE1	Disposable income	19	1995	0.025	13
Madagascar	Elbers et al. (2002)	GE0	Est. per capita expenditure	1248	1993	NA	25
Mozambique	Simler and Nhate (2005)	GE1	Est. per capita consumption	424	1997	0.081	20
Philippines	Balisacan and Fuwa (2003)	GE1	Consumption expenditure	13	2000	0.048	13
Poland	Forster et al. (2005)	GE1	Disposable income	9	1999	0.003	2
Portugal	Parente and d'Uva (2003)	GE0	Income per capita	7	1997	0.016	6
Russia	Forster et al. (2005)	GE1	Disposable income	9	1995	0.035	10
South Africa	Alderman et al. 2002 (from Simler and Nhate 2005)	GE0	Est. per capita consumption	354	1996	NA	80
Switzerland	Ernst et al. 2000 (from Shorrocks and Wan 2005)	GE0	Income per capita	3	1992	0.001	1
Thailand	Motonishi (2003)	GE0	Household income	13	1976	0.074	23
					1998	0.102	21
Vietnam	Minot et al. (2003)	GE1	Per capita expenditure	614	1999	0.073	36

GE0 Mean logarithmic deviation, GE1 Theil coefficient

Table 8 The decomposition of inequality by the Theil coefficient: an alternative approach (46 countries)

	Concept (B)	Year (B)	k	B	B/T' (%)	T'	Year (T')	Concept (T')
Argentina	GDP	1993	11	0.055	15	0.377	2003	Income
Australia	GDP	1999	8	0.005	3	0.175	1989	Net monetary income
Austria	GDP	2000	9	0.013	9	0.144	1997	Net monetary income
Belgium	GDP	2000	10	0.042	37	0.113	1997	Net monetary income
Bolivia	GDP	2000	9	0.024	4	0.688	2000	Gross monetary income
Brazil	GDP	1998	9	0.096	15	0.657	2001	Gross income
Canada	GDP	1998	11	0.009	6	0.165	2000	Net monetary income
Chile	GDP	1998	10	0.075	12	0.629	2000	Gross income
China	GDP	1998	11	0.055	17	0.331	1995	Net income
Czech Republic	GDP	2001	11	0.036	21	0.174	2003	Net income
Denmark	GDP	2000	11	0.014	15	0.096	1992	Net monetary income
Egypt	GDP	1999	4	0.048	9	0.514	1997	Consumption
Estonia	GDP	1999	5	0.087	40	0.216	2000	Net monetary income
Finland	GDP	1999	9	0.017	15	0.114	2000	Net monetary income
France	GDP	2000	10	0.014	9	0.166	1994	Net monetary income
Germany	GDP	2000	11	0.019	14	0.131	2000	Net monetary income
Hungary	GDP	2000	11	0.065	44	0.149	1999	Net monetary income
India	GDP	2000	12	0.078	37	0.211	2000	Consumption
Indonesia	GDP	1998	10	0.071	28	0.258	1996	Gross income
Ireland	GVA	1995	10	0.020	10	0.201	1996	Net monetary income
Italy	GDP	2000	11	0.036	18	0.204	2000	Net monetary income
Japan	GDP	1997	10	0.005	2	0.252	1997	Earned income
Kazakhstan	GDP	2000	11	0.116	25	0.464	1996	Net income
Kyrgyzstan	GDP	1998	8	0.154	71	0.216	1999	Consumption
Madagascar	GDP	1999	6	0.019	3	0.669	1993	Gross income
Mexico	GDP	1999	12	0.051	10	0.531	2000	Gross income
Nepal	GDP	1996	11	0.043	9	0.501	1996	Gross income
Netherlands	GDP	2000	11	0.009	6	0.148	1999	Net monetary income
Niger	Income	1998	8	0.077	17	0.447	1994	Consumption
Norway	GDP	1997	10	0.010	8	0.121	2000	Net monetary income
Paraguay	GDP	1992	8	0.017	3	0.558	1999	Gross income
Peru	GDP	2000	11	0.068	15	0.444	1997	Gross income
Philippines	GDP	2000	12	0.085	21	0.408	2000	Gross Income
Poland	GDP	2000	12	0.025	14	0.173	1999	Net monetary income
Russia	GDP	2000	12	0.037	11	0.341	2000	Net monetary income
Senegal	GDP	2000	10	0.014	2	0.860	1991	Gross monetary income
South Africa	GDP	2000	9	0.493	72	0.686	1997	Gross income
Spain	GDP	2000	7	0.023	14	0.166	1990	Net monetary income
Sri Lanka	GDP	1998	9	0.077	11	0.691	2000	Gross income
Sweden	GDP	2000	10	0.006	5	0.116	2000	Net monetary income
Switzerland	GDP	2000	11	0.014	7	0.207	1992	Monetary income
Thailand	GDP	2000	12	0.298	52	0.575	1999	Net income
UK	GDP	2000	11	0.011	5	0.218	1999	Net monetary income
USA	GDP	1999	11	0.004	2	0.258	2000	Net monetary income
Uzbekistan	GDP	1999	8	0.029	8	0.377	2001	Net income
Vietnam	Income	2001	8	0.071	31	0.229	1998	Consumption

B regional inequality expressed in Theil coefficient, k number of regions, T overall inequality, T' overall inequality estimated on the basis of national income deciles

Appendix 2

Partitions into the world macro-regions and European regions

10 world macro-regions:

(1) Africa (excl. North Africa), (2) North Africa and South-West Asia (from Morocco to Afghanistan, incl. Turkey, excl. Post-soviet states), (3) South Asia (from Pakistan to Bangladesh), (4) South-East Asia (from Burma to East Timor), (5) East Asia (China, Taiwan, Mongolia, the Koreas, Japan (6) Post-Soviet countries (excl. Baltic states), (7) Europe (excl. Post-Soviet countries except Baltic states), (8) North America (Canada, USA), (9) Latin America and Caribbean, (10) Australia and Oceania

10 European regions:

(1) Pyrenean (Portugal, Spain), (2) Italian (Italy, Malta), (3) French (France, Luxembourg), (4) British (UK, Ireland), (5) German (Germany, Switzerland, Austria, Netherlands, Belgium), (6) Central-Eastern (Czech Rep., Slovakia, Poland, Hungary, (7) Balkan (from Slovenia to Greece), (8) Romanian-Bulgarian, (9) Baltic (Finland, Estonia, Latvia, Lithuania), (10) Scandinavian (Iceland, Norway, Sweden, Denmark)

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