The wiiw Balkan Observatory

Working Papers | 096 | March 2011

Sebastian Leitner and Robert Stehrer

Subgroup and Shapely Value Decompositions of Multidimensional Inequality: An Application to South East European Countries

The wiiw Balkan Observatory

www.balkan-observatory.net

About

Shortly after the end of the Kosovo war, the last of the Yugoslav dissolution wars, the Balkan Reconstruction Observatory was set up jointly by the Hellenic Observatory, the Centre for the Study of Global Governance, both institutes at the London School of Economics (LSE), and the Vienna Institute for International Economic Studies (wiiw). A brainstorming meeting on Reconstruction and Regional Co-operation in the Balkans was held in Vouliagmeni on 8-10 July 1999, covering the issues of security, democratisation, economic reconstruction and the role of civil society. It was attended by academics and policy makers from all the countries in the region, from a number of EU countries, from the European Commission, the USA and Russia. Based on ideas and discussions generated at this meeting, a policy paper on Balkan Reconstruction and European Integration was the product of a collaborative effort by the two LSE institutes and the wiiw. The paper was presented at a follow-up meeting on Reconstruction and Integration in Southeast Europe in Vienna on 12-13 November 1999, which focused on the economic aspects of the process of reconstruction in the Balkans. It is this policy paper that became the very first Working Paper of the wiiw Balkan Observatory Working Papers series. The Working Papers are published online at www.balkan-observatory.net, the internet portal of the wiiw Balkan Observatory. It is a portal for research and communication in relation to economic developments in Southeast Europe maintained by the wiiw since 1999. Since 2000 it also serves as a forum for the Global Development Network Southeast Europe (GDN-SEE) project, which is based on an initiative by The World Bank with financial support from the Austrian Ministry of Finance and the Oesterreichische Nationalbank. The purpose of the GDN-SEE project is the creation of research networks throughout Southeast Europe in order to enhance the economic research capacity in Southeast Europe, to build new research capacities by mobilising young researchers, to promote knowledge transfer into the region, to facilitate networking between researchers within the region, and to assist in securing knowledge transfer from researchers to policy makers. The wiiw Balkan Observatory Working Papers series is one way to achieve these objectives.

The wiiw Balkan Observatory

Global Development Network Southeast Europe

This study has been developed in the framework of research networks initiated and monitored by wiiw under the premises of the GDN–SEE partnership.

The Global Development Network, initiated by The World Bank, is a global network of research and policy institutes working together to address the problems of national and regional development. It promotes the generation of local knowledge in developing and transition countries and aims at building research capacities in the different regions.

The Vienna Institute for International Economic Studies is a GDN Partner Institute and acts as a hub for Southeast Europe. The GDN–wiiw partnership aims to support the enhancement of economic research capacity in Southeast Europe, to promote knowledge transfer to SEE, to facilitate networking among researchers within SEE and to assist in securing knowledge transfer from researchers to policy makers.

The GDN–SEE programme is financed by the Global Development Network, the Austrian Ministry of Finance and the Jubiläumsfonds der Oesterreichischen Nationalbank.

For additional information see www.balkan-observatory.net, www.wiiw.ac.at and www.gdnet.org

Wiener Institut für
Internationale
Wirtschaftsvergleiche

wiiw

The Vienna Institute
for International
Economic Studies

Subgroup and Shapely value decompositions of multidimensional inequality – An application to South East European countries

Version: March 22, 2011

Sebastian Leitner and Robert Stehrer

The Vienna Institute for International Economic Studies (wiiw)
Rahlgasse 3, A-1060 Vienna, Austria.
Phone ++43 1 533 66 10 -47
Fax ++43 1 533 66 10 -50
E-mail: Sebastian.Leitner@wiiw.ac.at
E-mail: Robert.Stehrer@wiiw.ac.at

Research was supported by the project "Economic and social development in transition: Inequality, migration and the state in Southeast Europe -Programme for research capacity building through research networks with the aim to promote development in Southeast Europe" realized in cooperation with the Global Development Network (GDN) and financed by the Jubiläumsfonds of the Austrian National Bank (OENB).

Contents

List of Tables and Figures

Abstract

Inequality is a multidimensional phenomenon though it is often discussed along a single dimension like income. This is also the case for the various decomposition approaches of inequality indices. In this paper we study one- and multidimensional indices on inequality on data for three large South-East European countries, Bulgaria, Romania and Serbia. We include four dimensions in our measure of multidimensional inequality: income, health, education and housing. We apply various decomposition methods to these one- and multi-dimensional indices. In doing so, we apply standard decomposition techniques of the mean logarithmic deviation index (I0) and decompositions based on regression analysis in conjunction with the Shapley value approach.

Keywords: *Multidimensional inequality, Inequality decomposition, Shapley value*

JEL classification: *C20, D63*

1 Introduction

Inequality is a multidimensional phenomenon though it is often discussed along a single dimension like income which is the most often variable under consideration in this respect. This focus on a single variable - and income in particular - is even more the case for decomposition of inequality indices. In this paper we instead consider inequality as a multidimensional concept for which different variables have to be taken into account simultaneously. Recently a large body of research started to focus on this multidimensional character of inequality together with the development of appropriate indices including more than one dimensions simultaneously (see Weymark, 2004; Justino, 2005; Lugo, 2005; Savaglio 2006a and 2006b; Cowell and Fiori, 2009). In this paper we provide a short discussion of the commonly suggested multidimensional indices on inequality and apply these using data for three large South-East European countries, Bulgaria, Romania and Serbia for which comparable Household Budget Surveys were available. In doing so, we include four dimensions to study inequality: income, health, education and housing. This exercise yields important insights on how inequality (and the respective measures) changes when taking more dimensions of inequality into account.

This exercise to measure the extent of inequality and do cross-country comparisons is however only a first step. In the second step we contribute to explanations of these multidimensional inequality indices by using decomposition methods (in line with the decomposition techniques known for one-dimensional decompositions methods with respect to income recipients). We apply various decomposition methods to these multidimensional indices: First, we apply standard decomposition techniques of the mean logarithmic deviation index (I_0) – i.e. subgroup decompositions – and, second, a decomposition approach based on the Shapley value approach which allows to assess the relative importance of explanatory factors for inequality. The latter gained some attention in the one-dimensional case (see Shorrocks, 1999; Wan, 2004; Israeli, 2007, for example). To our knowledge this is the first attempt to apply this regression based technique to multidimensional inequality indices.

The paper goes as follows: In Section 2 we provide a brief discussion of important one- and multi-dimensional inequality indices used throughout in the paper. We then discuss the most important aspects of the data we use (sources, measurement issues, and definitions) in Section 3. Section 4 summarises some descriptive statistics on the data used, the results from the subgroup decomposition analysis to each of the four dimensions of inequality considered in this paper and the results from the subgroup decomposition for one of the multidimensional indices. In Section 5 we then introduce the concept of Shapely decomposition and discuss the way we apply this method in the multi-dimensional case. Further we present the results of this decomposition method. Section 6 concludes.

2. One- and multidimensional inequality

2.1 The one-dimensional case

Measuring and detecting the determinants of inequality based on household survey data has a long tradition in the literature. Already in the 1970s a wide range of inequality measures existed and their properties were described in detail e.g. in two essential publications of that strand of research, Sen's 'On Economic inequality' (1973) (see Sen, 1997) and Atkinson's 'The Economics of Inequality' (1975) (Atkinson, 1975). In general, inequality measurement is based on two different (classes of) measures, the first being the well-known and most frequently used Gini index,

$$G = \frac{N+1}{N-1} - \frac{2}{N(N-1)\mu}\sum_{i=1}^{N}\rho_i y_i$$

Here N denotes the number of observations, y_i is the variable under consideration (e.g. income) and ρ_i denotes the share of units with a specific income (or expenditure) value in the total population.[1] The second group of indices considered is the generalized class of entropy measures defined as

$$I_\alpha = \frac{1}{\alpha(\alpha-1)}\frac{1}{N}\sum_{i=1}^{N}\left[1-\left(\frac{y_i}{\mu}\right)^{\alpha}\right] \text{ for } \alpha \neq 0,1$$

In both equations y_i denotes the income or expenditures (consumption) of the unit (individuals or households i), N is the number of units and μ is the unit's average income (or expenditure) in the total population. In the formula of the generalized class of entropy measures, the parameter α can be seen as an indicator of inequality aversion and it also indicates the sensitivity to transfers at different parts of the distribution (for negative α the index is sensitive to changes in the distribution that affect the lower tail); see Sen (1997) for a discussion and the frequently cited Jenkins (1995) for application and discussion. This allows, e.g., to focus on changes in the lower part of the income distribution, which might be more problematic with respect to social cohesion. For the limiting cases of $\alpha \to 0$ the entropy measure becomes Theil's second measure or the mean logarithmic deviation

$$I_0 = \frac{1}{N}\sum_{i=1}^{N} ln\ \frac{\mu}{y_i}$$

which we also use in the multidimensional case (see below). For $\alpha \to 1$ it becomes the well-known Theil measure (I_1). For $\alpha = 2$ the measure becomes the half squared coefficient of variation I_2).

2.2 The multidimensional case

One of the first to introduce a measure of multidimensional distributions of well-being based on the theory of information was Maasoumi (1986, 1999); see also Lugo (2005) for

[1] Note that the Gini index can be expressed in different ways.

a detailed discussion. He proposed to construct a multivariate inequality index in a two stage procedure. First, the attributes for each unit (e.g. individuals or households are aggregated via an aggregator function yielding a real number S_i for each person. Second, a one-dimensional measure of inequality of the family of Generalised Entropy measures is calculated. This is based on the idea that different indicators of economic welfare are distributed differently; therefore Massoumi suggests an aggregator with a distribution that most closely represents the distributional information in each attribute. In particular he proposes a multivariate generalisation of the generalised entropy measure of divergence (the Kullback-Leibler distance) or closeness between the k densities (weighted sum of the pairwise divergence terms) and arrives at a distance measure D of the following form:

$$D_\beta(S,X,w) = \sum_{k=1}^{K} d_k \left\{ \sum_{i=1}^{N} S_i \left[\left(\frac{S_i}{x_{ik}} \right)^{-\beta} \right] / \beta(\beta-1) \right\} \quad \text{for } \beta \neq 1$$

It is shown that the distribution of S which minimises D_β produces the optimal aggregation functions becomes

$$S_i = \left(\sum_{k=1}^{K} w_k x_{ik}^{\beta} \right)^{\beta}$$

where w_k is the weight given to the k-th attribute in the total aggregator function. The real number S_i denotes then the general weighted mean, called the 'well-being indicator for unit i, with the CES and Cobb-Duglas functions as special cases. The parameter β is related to the degree of substitutability between attributes and determines the shape of the contours for all pairs of attributes, identical for all pairs. The elasticity of substitution is given by β. The smaller β, the smaller is the elasticity of substitution between the attributes under consideration. For the second stage an index of the generalised entropy family is applied to the these weighted means S_i. In this paper we apply the index of Mean logarithmic deviation, which in this case becomes (see above)

$$I_{M0} = \frac{1}{N} \sum_{i=1}^{N} ln \frac{\mu}{S_i}$$

In chapter 4 we present decomposition results applying the Massoumi index. However, in chapter 5 the results of the Shapley-value decomposition are presented not only based on the Massoumi index, but also on the Gini and the multidimensional Bourguignon index.

In a comment on the Massoumi index, Bourguignon (1999) proposed a slightly different approach. While in the case of the Massoumi index normalisation is done by the mean aggregator, Bourguignon applies the value of the aggregator for the mean individual, i.e. the person that is endowed with mean attributes. The multidimensional Bourguignon index thus provides a more direct link with standard utilitarian social evaluation functions and hence with multidimensional stochastic dominance criteria as outlined in Lugo (2005). The multidimensional Bourguignon index[2] (Bourguignon, 1999) can be presented in the following form:

[2] This index could be slightly generalised which is however not done in this paper.

$$I_B = 1 - \frac{1}{N}\frac{\sum_i S_i}{\bar{S}}$$

with

$$\bar{S} = \left(\sum_{k=1}^{K} w_k \mu_k^{\beta}\right)^{\beta}$$

The Bourguignon index is hereby based on the same aggregation for S_i as the Massoumi index discussed above.

3. Data

Data for the analysis presented in this paper is drawn from different sources. For Serbia we use data from the Living Standard Measurement Survey (LSMS) for the year 2007. In the case of Bulgaria and Romania we draw upon EU SILC 2008 data. The four variables used as attributes for calculating the multidimensional inequality index are: Household income, Household health status, Household education level and Housing indicator. Let us discuss them in turn.

The first dimension of inequality considered is *household income*: In order to apply for all three countries methodologically comparable household income data we used the variable 'Total household income' (incomeal) for Serbia and for Bulgaria and Romania adjusted the variable 'Total disposable household income' (HY020) by adding the variables 'Non-cash employee income' (PY020N), 'Value of goods produced for own consumption' (PY070G), 'Imputed rent' (HY030N) and 'Regular inter-household cash transfer paid' (HY130G). The resulting household income variable was then divided by the modified OECD equivalence scale (1-0.5-0.3), in order to obtain a household income variable adjusted for household composition differences. Obviously the needs of a household grow with each additional member but – due to economies of scale in consumption– not in a proportional way, e.g. for housing space, electricity, etc. With the help of equivalence scales each household type in the population is assigned a value in proportion to its needs. In our case a weight of 1 is assigned to the household head, a weight of 0.5 to all further members of the household aged 14 years or above and a weight of 0.3 to household members aged 0-13 years.

Household health status: For the analysis we used data on the subjective health status of all household members. In the cases of Bulgaria and Romania we took the EU-SILC variable 'Genaral health' (PH010), in the case of Serbia the LSMS variable is named 'x1'. Both variables present the subjective health status of a household member ranging from 1 (very good) to 5 (very bad). Since the health status of an individual obviously depends very much upon the age of the person, we calculated a 'conditional health status'. Thus we estimated the linear age effect on subjective health with an OLS-regression (see Table 1) and used the estimation results to calculate a projected health status for every individual. The residual between the projected health status and the actual health status is taken as the

'conditional health status' of a person. The mean of the 'conditional health status' over all household members is then used as the household health status. In addition we rescaled the variable from 0 to 1.

Table 1

OLS-regression results for subjective health status

Country	Variable	Coefficient	P-value	R2
Bulgaria	Age	-0.034	0.000	0.414
	Constant	5.227	0.000	
Romania	Age	-0.033	0.000	0.412
	Constant	5.379	0.000	
Serbia	Age	-0.034	0.000	0.433
	Constant	5.069	0.000	

Household education level: For this indicator we use the mean level of years in education of all household members above 15 years of age who finished schooling or education in general. The years in education were calculated by using the variable highest education level attained by individuals (EU SILC variable "PE040: Highest ISCED level attained" in the case of Bulgaria and Romania and in the case of Serbia "Obrazovanje"). The household members were then assigned with the years in education needed to attain their respective education level.

Housing indicator: Here we calculate a combined attribute from two variables: dwelling space and dwelling problems of the household. For Serbia we used equivalence per capita square meters of living space as an indicator for dwelling space, in the case of Bulgaria and Romania the number of rooms in the dwelling divided by the equivalised household size. The LSMS (s8_1 to s8_9) and the EU SILC (HS160 to HS190) indicators respectively contain variables for problems with the dwelling (e.g. not enough daylight; noise for neighbours or outside). For the variable dwelling problems we summed up the indicated problems each household. Both variables dwelling space and dwelling problems were scaled from 0 to 1 and the mean of both taken to result in the final housing indicator.

For the decomposition analysis by subgroups of the four above described attributes of the multidimensional inequality analysis we used the following dimensions: gender and age group of the head of the household, geographical location of the household, urban versus rural household, educational attainment group and activity status (employee, self-employed, unemployed, retired, etc.) of the head of the household and household level employment rate (calculated as employed as a share of total household members).

4 Descriptive results and subgroup decomposition

4.1 Descriptive results

In Table 2 we present the descriptive statistics and indices of one-dimensional inequality in the four attributes income, health status, education and housing for Serbia, Bulgaria and Romania. As can be seen, the situation of income inequality is, when measured by the Gini index, quite similar in all three countries. Comparing income inequality within the EU, Bulgaria and Romania are at the upper boundary in the country group together with Portugal and Latvia (Atkinson, 2010). However, by adding the income components of imputed rent and goods of own production (for methodology see above) in the case of Bulgaria and Romania the level of income inequality falls slightly (see Table 2). Obviously the inequality for the attributes conditional household health status and housing is lower than for the attribute income. The average household education level however is also quite unequally distributed over the population.

Table 2

Summary statistics

	N	Mean	Median	Min	Max	MLD (I_0)	Theil (I_1)	$CoVa^2/2$ (I_2)	Gini
Serbia 2007									
Houshold p.c. income	5557	21403	18225	234	234062	0.22	0.20	0.25	0.34
Household health status (conditional)	5557	0.49	0.50	0.00	1.00	0.04	0.04	0.03	0.15
Household education level	5540	0.48	0.50	0.00	1.00	0.34	0.10	0.08	0.22
Housing indicator	5557	0.49	0.50	0.00	1.00	0.04	0.03	0.02	0.11
Bulgaria 2008									
Houshold p.c. income	4339	2958	2455	36.8	27888	0.19	0.19	0.26	0.33
Household health status (conditional)	4344	0.60	0.60	0.10	1.00	0.02	0.02	0.02	0.11
Household education level	4336	0.62	0.70	0.00	1.00	0.17	0.07	0.06	0.20
Housing indicator	4316	0.46	0.50	0.00	1.00	0.06	0.05	0.05	0.17
Romania 2008									
Houshold p.c. income	7758	2816	2417	75	51359	0.18	0.19	0.30	0.32
Household health status (conditional)	7805	0.60	0.60	0.00	1.00	0.02	0.02	0.02	0.11
Household education level	7762	0.58	0.60	0.00	1.00	0.21	0.08	0.07	0.21
Housing indicator	7758	0.48	0.50	0.00	1.00	0.06	0.05	0.05	0.17

*Sources: S*erbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

To study multidimensional inequality Table 3 presents the Maasoumi index as discussed above. For the aggregation one has to specify a weight for each of the attributes considered. We applied the same weights to the attributes[3] which we scaled from 0 to 1. Another choice has to be made on the degree of substitutability in the aggregation function. Table 3

[3] Changing the weight of an attribute obviously raises or lowers the Massoumi index depending upon if the level of inequality of the attribute is higher or lower than that of the Massoumi index. A change of weights however does not alter the structure of the below presented results of the decomposition analysis, only the magnitude of the results change.

indicates that the higher the degree of substitutability (ß) the lower is the level of the multi-dimensional inequality index. A higher degree of substitutability means that low levels on one of the attributes can be compensated more easily by high levels on another (Lugo, 2005).

Table 3

Summary statistics of the Maassoumi index

Multidimensional inequality Vector S	N	Mean	Median	Min	Max	Massoumi index MLD (I_0)	Theil (I_1)	CoVa^2/2 (I_2)	Gini
Serbia 2007									
ß = -0.75	5540	0.22	0.20	0.00	0.60	0.27	0.12	0.10	0.24
ß = -0.5	5540	0.24	0.20	0.00	0.60	0.22	0.10	0.08	0.22
ß = -0.25	5540	0.27	0.30	0.00	0.60	0.15	0.08	0.06	0.19
ß = 0.25	5540	0.32	0.30	0.00	0.60	0.04	0.03	0.03	0.14
ß = 0.5	5540	0.35	0.40	0.10	0.60	0.03	0.02	0.02	0.12
ß = 0.75	5540	0.37	0.40	0.10	0.60	0.02	0.02	0.02	0.11
Bulgaria 2008									
ß = -0.75	4308	0.18	0.20	0.00	0.60	0.15	0.10	0.09	0.23
ß = -0.5	4308	0.21	0.20	0.00	0.60	0.12	0.07	0.07	0.20
ß = -0.25	4308	0.25	0.30	0.00	0.60	0.08	0.05	0.05	0.17
ß = 0.25	4308	0.34	0.30	0.10	0.70	0.03	0.03	0.02	0.12
ß = 0.5	4308	0.38	0.40	0.10	0.70	0.02	0.02	0.02	0.11
ß = 0.75	4308	0.41	0.40	0.10	0.70	0.02	0.02	0.02	0.10
Romania 2008									
ß = -0.75	7717	0.18	0.20	0.00	0.70	0.16	0.10	0.09	0.23
ß = -0.5	7717	0.21	0.20	0.00	0.70	0.13	0.07	0.07	0.20
ß = -0.25	7717	0.25	0.20	0.00	0.70	0.09	0.05	0.05	0.17
ß = 0.25	7717	0.33	0.30	0.00	0.70	0.03	0.02	0.02	0.11
ß = 0.5	7717	0.37	0.40	0.00	0.80	0.02	0.02	0.02	0.10
ß = 0.75	7717	0.40	0.40	0.10	0.80	0.01	0.01	0.01	0.09

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

4.2 Subgroup decomposition

In this section we present results from a decomposition analysis based on the mean logarithmic deviation as discussed above. The decomposition of the mean logarithmic deviation (MLD) inequality index can be applied in the one-dimensional case as well as in the multi-dimensional case for an analysis of the determinants of inequality observed by income recipients. The MLD can be decomposed in two terms, the within and the between component

$$I_0 = \sum_k v_k I_{0,k} + \sum_k v_k \ln(1/\lambda_k)$$

where v_k denotes population shares and $\lambda_k = \mu_k/\mu$. The first term, the within component of the MLD, represents the part of the total inequality that is due to variations within the population subgroups, whereas the between component represents the part of the total inequality that accrues from differences between the means of the population subgroups.

In Tables 4-8 we present the results at a glance and in the Appendix Tables A.4-A.8 the detailed results of the decomposition into between and within group effects of the various attributes of the multidimensional inequality indicator as well as the decomposition results when using the Massoumi index for ß=0.25. This value was chosen in order to present results for a case where some, but not perfect substitution is possible. The decomposition of inequality is performed by population subgroups according to different characteristics of the household or the head of the household observed. These are the gender of the head of household, the age group, geographical region urban versus rural location, education level, employment status of the head of the household as well as household level employment rate (calculated as employed as a share of total household members). The detailed list of the variable subgroups can be found in the Appendix tables A.4 to A.8.

The higher the between component as a share of the total inequality index, in our case the mean logarithmic deviation (I_0), the more the analysed characteristic can be seen as source of inequality in an attribute. However, the magnitude of the within and between component also depends on the partition of the population into subgroups. The higher the number of subgroups which are considered in the decomposition analysis of a specific characteristic, the higher the between group component will become by definition. Therefore the results of the decomposition analysis into within and between group components should be interpreted cautiously. Comparisons over time or cross country with the same number of subgroups however can be done without difficulty. In this paper we compare the results of the decomposition analysis for Serbia in 2007 and for Bulgaria and Romania in 2008, respectively, in a cross-country perspective. In our analysis the number of dimensions in each subgroup does not differ too much, such that also a comparison across dimensions is done, though with care.

4.2.1 Decomposition of equivalised per capita household income

As can be seen from Table 4 (and Appendix Tables A.4a and A.4b) the results for the three countries differ quite substantially concerning the characteristics of heads of households influencing household income levels. In the case of Bulgaria and also Romania household income is more strongly influenced by the age of the head of household than in the case of Serbia. In Bulgaria, e.g. differences between the mean income levels of the seven age groups (see also Table A.4a) account for 8.87% of the total mean logarithmic deviation (I_0). In Romania this is the case for 5.12% of I_0, while in Serbia for only 0.8% of I_0. This means that the characteristic age can explain part of the total income inequality in Bulgaria and Romania, while this is not the case for Serbia. Furthermore the relative in-

come position of pensioner households seems to be on average much better in Serbia compared to Romania and especially Bulgaria. Another substantial difference can be detected when looking at the decomposition by rural and urban households. Here one can see that especially in Romania and Bulgaria alike, households at the countryside face much worse income positions than urban households, while this difference is rather small in Serbia. The same picture is drawn for the decomposition by region, although the differences are lower here. In the case of Serbia also information on the ethnicity group was available. The result here is very much driven by the low income levels of Roma households, receiving only 44 percent of the average per capita household income.

Table 4

Multidimensional inequality decomposition: Attribute household income

Between group components as % of Mean logarithmic deviation (I_0)

	Serbia 2007	**Bulgaria** 2008	**Romania** 2008
Decomposition by			
gender	0.52	0.13	3.49
age	0.80	8.87	5.12
region	1.47	2.25	3.47
urban / rural regions	0.21	11.87	11.45
ethnicity	2.89	.	.
education	9.00	22.83	31.56
empl. status	6.25	19.52	14.38
hh-empl-rate	8.90	26.54	13.84
refugee status	0.03	.	.

Sources: Serbia 2007: LSMS; Bulgaria, Romania 2008: EU-SILC, own calculations.

Also the decomposition by highest level of education attained of the head of household shows marked differences between the three countries. Thus in Bulgaria and Romania differences between educational attainment groups account for 23% and 32% of income differences between households. However, also in Serbia differences in education levels are among the most important characteristics influencing income variation according to the decomposition analysis.

Obviously, for the employment characteristics between-group inequality is expected to be high, since these describe the intensity in labour market participation, which should influence especially wage incomes, being the most important income source of households in general. Surprisingly however, in the case of Serbia the income differences between types of households are much lower than in Bulgaria and Romania which is again driven by the lower relative income levels of retired heads of households. In the case of Romania this is driven also by low income levels of heads of households not economically active apart from retirement. Moreover, in Bulgaria and Romania households headed by employees

(and especially self-employed in the case of Bulgaria) have much higher incomes than the average household. Obviously, the per capita income of households is expected to rise with the increase in the household employment rate. However, again Bulgaria stands out with a between group component twice as high as Romania and about three times higher as compared to Serbia.

For Serbia we had additional information on the refugee status of members of the households. If more than a third and less than two thirds of the members were refugees the value of this characteristic is given a value 0.5 in the analysis, if less than a third were refugees we give a value of 0 and if more than two thirds were refugees a value of 1. Surprisingly, the average income level of refugee households is quite similar to the average household in the country (see Table A.4b).

4.2.2 Decomposition of household health status

The decomposition of inequality of the aggregated health status of households showed that subjective health is obviously strongly influenced by the age characteristic of the household head. Since this fact may distort also other decomposition results, we calculated a conditional health variable, being the divergence of subjective health from a health status projected according to age, as already discussed above. This conditional health status was rescaled to 0 to 1. As we know from the summary Table 2 the conditional health status is quite equally distributed across households in all countries.

Table 5

Multidimensional inequality decomposition: Attribute household health status

Between group components as % of Mean logarithmic deviation (I_0)

	Serbia 2007	**Bulgaria** 2008	**Romania** 2008
Decomposition by			
gender	0.35	0.55	0.83
age	0.42	0.41	0.17
region	0.25	0.16	0.97
urban / rural regions	0.65	0.22	0.10
ethnicity	1.04	.	.
education	3.84	3.26	1.21
empl. status	1.92	3.61	1.86
hh-empl-rate	2.31	3.47	2.01
refugee status	0.08	.	.

Sources: Serbia 2007: LSMS; Bulgaria, Romania 2008: EU-SILC, own calculations.

Nevertheless as can be seen from Table A.5 (and the Table A.5b in the Appendix) in all countries the education level of the head of household seems to have some influence also on the health status of the respective household, especially in Serbia and Bulgaria. Also

those households with higher household employment rates and those headed by employed persons face a better health status.

4.2.3 Decomposition of household education level

Decomposing household education levels by the age group of the head of household indicates that obviously younger age cohorts had the chance to attain higher education levels in all three countries (see Table 6 and Appendix Tables A.6a and A.6b). However, in Romania the differences in education between younger and older age cohorts are much more pronounced.

Table 6

Multidimensional inequality decomposition: Attribute household education level

Between group components as % of Mean logarithmic deviation (I_0)

	Serbia 2007	**Bulgaria** 2008	**Romania** 2008
Decomposition by			
gender	0.08	0.02	1.96
age	0.11	2.45	8.30
region	1.57	0.38	1.11
urban / rural regions	0.77	4.47	5.68
ethnicity	0.13	.	.
education	0.78	41.74	39.35
empl. status	0.25	3.39	7.12
hh-empl-rate	0.05	4.33	5.83
refugee status	0.03	.	.

Sources: Serbia 2007: LSMS; Bulgaria, Romania 2008: EU-SILC, own calculations.

Moreover, in Bulgaria and Romania there are also marked differences between urban and rural households, while in Serbia this divide is not eminent, although as in Romania households in the capital city obviously have much higher education levels. The decomposition by level of education of the head of households shows the much higher educational segregation of the population in Bulgaria and Romania. This also means that the level of formal education of children in those countries strongly depends upon the educational level attained by their parents. In Bulgaria and Romania households with higher employment levels also have higher aggregate education levels and households headed by employees (in the case of Bulgaria also self-employed) have better education levels.

4.2.4 Decomposition of housing quality

The data underlying the fourth attribute, housing quality, shows quite low differentiation between households in general (see Table 2). From Table 7 (and the Tables A.7a and A.7b in the Appendix) we can see that the characteristics used in the decomposition analy-

sis do not give a deeper insight into the existing inequality with respect to housing in Serbia, except for the characteristic ethnicity. Especially the living space and quality of housing of Roma is reported to be below those of other ethnic groups.

Table 7

Multidimensional inequality decomposition: Attribute housing

Between group components as % of Mean logarithmic deviation (I_0)

	Serbia 2007	**Bulgaria** 2008	**Romania** 2008
Decomposition by			
gender	0.06	0.21	0.78
age	0.20	6.84	7.80
region	0.38	0.62	5.19
urban / rural regions	0.00	13.59	23.58
ethnicity	2.26	.	.
education	1.13	5.90	12.40
empl. status	0.69	5.67	9.38
hh-empl-rate	0.58	7.27	4.91
refugee status	0.06	.	.

Sources: Serbia 2007: LSMS; Bulgaria, Romania 2008: EU-SILC, own calculations.

In Bulgaria and Romania older age cohorts seem to face higher quality of housing most probably due to more dwelling space. Furthermore in those two countries housing quality of households in urban areas (in the case of Romania especially in Bucharest) is lower than that of rural households. This result is obviously driven by less living space of dwellings in urban areas. Moreover, the housing quality is influenced by education levels. However, here the higher the education level the lower the floor space of dwellings on average, since e.g. people with tertiary education most probably live in urban areas. The same is true for the decomposition analysis by employment status and household employment rate. Those households being more active on the labour market face lower housing quality. In Bulgaria households of pensioners have the highest housing quality and in Romania those of self-employed (being to a large extent most probably famers).

4.3 Decomposition of multidimensional inequality

We now come to the results for the decomposition of the multidimensional index as outlined above. The results of the decomposition of the Maasoumi index are reported in Table 8 (and the Tables A.8a and A.8b in the Appendix). As already mentioned above, all attributes considered (equivalised per capita household income, the mean of the conditional health status of all household members, the mean of the education levels of household members and the housing indicator)are given the same weights. The parameter ß is set

0.25[4], which offers a medium substitutability between the four attributes. The Mean logarithmic deviation (I_0) inequality index was then calculated and decomposed by the respective characteristics of the head of the household and the household characteristics and reported in Table 8.

Table 8

Multidimensional inequality decomposition: Massoumi inequality index (ß=0.25)

Between group components as % of Mean logarithmic deviation (I_0)

	Serbia 2007	**Bulgaria** 2008	**Romania** 2008
Decomposition by			
gender	0.11	0.39	5.06
age	0.43	3.57	6.09
region	2.37	0.94	0.99
urban / rural regions	1.50	3.24	2.06
ethnicity	2.29	.	.
education	8.15	49.21	52.68
empl. status	2.82	10.08	15.91
hh-empl-rate	2.81	12.92	13.36
refugee status	0.03	.	.

Sources: Serbia 2007: LSMS; Bulgaria, Romania 2008: EU-SILC, own calculations.

As we can see from Table 8 and the findings above the decomposition results of multidimensional inequality are strongly driven by those attributes with the highest inequality levels, which in our case are the household income and the household education level. Hence, in the case of Serbia welfare levels of households are mostly influenced by the differentiation with respect to the education level of the head of household. The employment status of the head of the household, the labour market activity of household members, the region and the ethnical background of families exert some influence on the level of well-being, while the other characteristics of the households analysed, i.e. gender, age and refugee status have only minor or no effects. In Bulgaria and Romania the characteristics of heads of households and household members used in the decomposition analysis in general explain a much higher share of welfare differences between households. Especially education level variations and differences in the magnitude of participation in the labour market are crucial for differences in welfare levels. However, also substantial differences exist between age cohorts, especially in Romania, with older age cohorts (aged 65 and above) facing lower welfare levels.

[4] A lower value of ß would obviously raise the value of the inequality index (see Table 3). At the same time the explanatory power (i.e. the between component) of the characteristics is lowered in the decomposition analysis.

5. A Shapley-value decomposition of multidimensional inequality indices

5.1 Outline of decomposition procedure

In this section we undertake a decomposition analysis based on regression analysis and the Shapley value approach.[5] To our knowledge such a regression based approach to multidimensional inequality decomposition was not yet undertaken in the literature. Compared to the subgroup decomposition approach as undertaken in Section 4 the advantage of a regression based approach is that the relative importance of many variables and groups of them to explain inequality (like age, gender, educational attainment, etc.) are taken into account simultaneously. Thus, the regression approach (step 1) allows assessing the importance of each of these explanatory variables conditional on all other variables for each of the dimension of inequality considered (income, health, education, and housing). The Shapely value approach (step 2) then further allows calculating the contribution of each of these explanatory variables to the respective inequality measure and via the aggregator function as outlined above also to the multidimensional inequality measure.

5.2.1 Step 1: Regression analysis

The basic idea is easily explained and follows several steps.[6] First, we run a regression with the variable on which the multidimensional inequality measure is based (e.g. household income, health, housing, and education) as dependent variable and the household characteristics (e.g. age, gender, education, etc.) as explanatory variables. Using these results we can calculate the predicted values for each unit (households). As for the construction of the multidimensional index we have to normalise the respective dependent variables between 0 and 1 and estimate a Tobit model. This guarantees the predicted values to also lie in the interval [0, 1]. These results countries are reported in Tables 9 to 11 separately for each country.

[5] For a more detailed outline of this approach in the one-dimensional case to Western Balkan countries see Leitner and Stehrer (2009).

[6] We only provide an intuitive discussion of this approach. For technical details see Shorrocks (1999), Wan (2004), Israeli (2007) and Leitner and Stehrer (2009) where the Shapely value approach is discussed for income inequality.

Table 9

Tobit regression results for Bulgaria

Group	Variable	Income	Health	Education	Housing
Socio-economic	Age	0.000	-0.002 **	-0.002 ***	0.000
		[0.716]	[0.019]	[0.000]	[0.749]
	Age2	0.000	0.002 ***	0.002 ***	0.002 **
		[0.722]	[0.008]	[0.000]	[0.011]
	Male	0.085 ***	0.092 ***	0.104 ***	0.006
		[0.000]	[0.000]	[0.000]	[0.475]
Employment status	Employment share	0.002	0.016 ***	0.003	0.005
		[0.272]	[0.000]	[0.257]	[0.177]
	Self-employed	0.059 ***	0.032 ***	-0.001	0.021 **
		[0.000]	[0.000]	[0.899]	[0.016]
	Unemployed	0.000	0.003	0.031 ***	0.000
		[0.968]	[0.752]	[0.000]	[0.980]
	Retired	0.017 ***	0.025 ***	0.054 ***	0.008
		[0.000]	[0.004]	[0.000]	[0.316]
	Other	0.007	-0.043 ***	0.053 ***	-0.014
		[0.119]	[0.000]	[0.000]	[0.112]
Education	Low	0.024 **	0.028	0.088 ***	0.061 ***
		[0.018]	[0.182]	[0.000]	[0.002]
	Medium	0.032 ***	0.031	0.306 ***	0.054 ***
		[0.001]	[0.119]	[0.000]	[0.005]
	Upper	0.044 ***	0.055 ***	0.503 ***	0.029
		[0.000]	[0.006]	[0.000]	[0.128]
	Tertiary	0.082 ***	0.096 ***	0.766 ***	0.026
		[0.000]	[0.000]	[0.000]	[0.185]
Region	Rural	-0.026 ***	0.007 *	-0.023 ***	0.103 ***
		[0.000]	[0.094]	[0.000]	[0.000]
Constant	Constant	0.029 **	0.499 ***	0.175 ***	0.296 ***
		[0.042]	[0.000]	[0.000]	[0.000]
	sigma	0.063 **	0.132 ***	0.088 ***	0.125 ***
		[0.000]	[0.000]	[0.000]	[0.000]
	Chi2	1705.683	405.024	7685.515	1175.344
	Obs.	4245	4245	4245	4245

Note: p-values in brackets; ***, **, * denotes significance at the 1, 5 and 10 % level respectively.

Reference categories: employees, no education and urban.

Table 10

Tobit regression results for Romania

Group	Variable	Income	Health	Education	Housing
Socio-economic	Age	0.000	-0.001	0.000	0.000
		[0.640]	[0.223]	[0.848]	[0.899]
	Age2	0.000	0.002 ***	-0.001	0.001 *
		[0.218]	[0.001]	[0.114]	[0.060]
	Male	0.036 ***	0.039 ***	0.099 ***	0.011 *
		[0.000]	[0.000]	[0.000]	[0.073]
Employment status	Employment share	0.006 ***	0.016 ***	-0.020 ***	-0.007 **
		[0.000]	[0.000]	[0.000]	[0.034]
	Self-employed	-0.013 ***	-0.015 ***	-0.026 ***	0.053 ***
		[0.000]	[0.001]	[0.000]	[0.000]
	Unemployed	-0.003	-0.008	0.043 ***	0.024 **
		[0.358]	[0.469]	[0.000]	[0.026]
	Retired	0.011 ***	-0.035 ***	0.051 ***	0.015 ***
		[0.000]	[0.000]	[0.000]	[0.008]
	Other	-0.002	-0.038 ***	0.029 ***	0.013
		[0.573]	[0.000]	[0.000]	[0.179]
Education	Low	0.004	-0.013	0.041 ***	0.054 ***
		[0.422]	[0.429]	[0.000]	[0.001]
	Medium	0.009 *	0.003	0.228 ***	0.031 *
		[0.076]	[0.861]	[0.000]	[0.056]
	Upper	0.020 ***	0.016	0.417 ***	0.002
		[0.000]	[0.303]	[0.000]	[0.925]
	Tertiary	0.064 ***	0.050 ***	0.713 ***	0.010
		[0.000]	[0.002]	[0.000]	[0.536]
Region	Rural	-0.008 ***	0.025 ***	-0.030 ***	0.131 ***
		[0.000]	[0.000]	[0.000]	[0.000]
Constant	Constant	0.016 **	0.540 ***	0.257 ***	0.312 ***
		[0.027]	[0.000]	[0.000]	[0.000]
	sigma	0.036 *	0.115 ***	0.080 ***	0.118 ***
		[0.000]	[0.000]	[0.000]	[0.000]
	Chi2	2573.475	466.421	15000.000	3259.916
	Obs.	7581	7581	7581	7581

Note: p-values in brackets; ***, **, * denotes significance at the 1, 5 and 10 % level respectively.

Reference categories: employees, no education and urban.

Table 11

Tobit regression results for Serbia

Group	Variable	Income	Health	Education	Housing
Socio-economic	Age	-0.001 **	-0.005 ***	-0.004 ***	0.000
		[0.031]	[0.000]	[0.000]	[0.915]
	Age2	0.001 **	0.005 ***	0.004 ***	0.001
		[0.048]	[0.000]	[0.000]	[0.377]
	Male	0.062 ***	0.056 ***	0.007	0.028 ***
		[0.000]	[0.000]	[0.442]	[0.000]
Employment status	Employment share	0.004 **	0.008 **	-0.024 ***	0.003
		[0.026]	[0.049]	[0.000]	[0.465]
	Informal	-0.019 ***	-0.013	-0.004	-0.019 ***
		[0.000]	[0.127]	[0.708]	[0.009]
	Self-employed	0.001	-0.007	-0.014 *	0.018 ***
		[0.756]	[0.207]	[0.056]	[0.000]
	Unemployed	-0.016 ***	-0.001	0.022 **	-0.004
		[0.000]	[0.856]	[0.037]	[0.574]
	Retired	0.021 ***	-0.011 *	0.015 *	0.019 ***
		[0.000]	[0.077]	[0.075]	[0.001]
	Other	0.001	-0.037 ***	0.026 **	0.001
		[0.796]	[0.000]	[0.029]	[0.934]
Education	Low	0.005 *	0.027 ***	0.024 ***	0.016 ***
		[0.082]	[0.000]	[0.002]	[0.001]
	Medium	0.015 ***	0.042 ***	0.049 ***	0.038 ***
		[0.000]	[0.000]	[0.000]	[0.000]
	Upper	0.024 ***	0.069 ***	0.060 ***	0.044 ***
		[0.000]	[0.000]	[0.000]	[0.000]
	Tertiary	0.073 ***	0.098 ***	0.100 ***	0.052 ***
		[0.000]	[0.000]	[0.000]	[0.000]
Region	Rural	0.006 ***	-0.005	-0.035 ***	0.009 ***
		[0.001]	[0.231]	[0.000]	[0.008]
Constant	Constant	0.061 ***	0.516 ***	0.593 ***	0.424 ***
		[0.000]	[0.000]	[0.000]	[0.000]
	sigma	0.059 ***	0.122 ***	0.162 ***	0.107 ***
		[0.000]	[0.000]	[0.000]	[0.000]
	Chi2	995.916	465.374	352.892	176.671
	Obs.	5337	5337	5337	5337

Note: p-values in brackets; ***, **, * denotes significance at the 1, 5 and 10 % level respectively.

Reference categories: employees, no education and urban.

Let us provide a short discussion of these regression results for each dependent variable across countries and start with the first variable *income*.[7] In Bulgaria and Romania age and age squared are not significant at all, whereas in Serbia these are significant with different signs. The dummy for male is significantly positive in all three countries. The employment

[7] As compared to the results of the subgroup decompositions applied in Section 4 one has to keep in mind that the regression coefficients are conditional on all other variables which are included whereas the subgroup decompositions are executed for each variable separately. Therefore the results are not strictly comparable.

share is significantly positive in all countries with the exception of Serbia. Self-employed tend to earn more in Bulgaria (compared to employees) but less in Romania with an insignificant coefficient in Serbia. There is no significant effect of status unemployed in Bulgaria and Romania but a significant negative effect in Serbia. Retired persons tend to have a higher income in all countries. Finally, the status 'other' shows no significant effects. In Serbia we consider an additional category 'informal' which shows a significant negative effect on income. With respect to education (the reference group being category 'no education') we find in most cases significantly positive effects with the coefficient increasing with the level of education as expected. Income in rural regions (reference group is urban) tend to be lower in Bulgaria and Romania; the corresponding coefficient in Serbia is however significantly positive.

With respect to *health status* we find first a significantly positive coefficient for male in all countries. Age has a negative effect as expected (not significant in Romania) whereas age squared is positive significant in all countries. Households with higher employment shares tend to be healthier which is found to be the case in all countries. Results for the other employment categories across countries are mixed however. In Bulgaria self-employed show a significantly positive effect whereas in Romania this is negatively significant, with no significant coefficient found for Serbia. We also find a significantly positive effect of status retired in Bulgaria, which in the two other countries is however negative. In Romania this coefficient is significantly negative, however. Category 'other' shows a negative significant coefficient in all three countries. Compared to the group 'no education' we find mostly positive effect of educational attainment. With respect to regions we find a significant positive effect for rural regions in Bulgaria and Romania.

When considering *educational status* we find in all countries the expected negative and significant sign for age, but positive so for age square (exception is Romania with no significant effect). Males tend to be higher educated in Bulgaria and Romania. In Serbia this variable is insignificant. The signs with respect to employment variables are in all cases positive (with the exception of employment share and self-employed in the case of Serbia) though not always significant. As expected, education is positively significant in most cases. People in rural regions tend to have lower educational levels again in line with the expectations.

Finally, for housing the results with respect to socio-economic variables we mostly find positive but not always significant coefficients. The results are also mixed with respect to employment variables. With respect to educational variables the effect in case of Bulgaria is significantly positive only in case of low educated. A similar result is found for Romania where the only significant positive effect is found for low and medium educated. In case of Serbia however all educational categories show a significantly positive effect. Finally, with

respect to the rural dimension we find that rural areas show a significantly better housing indicator.

Summarising, these results are in line with the expectations in most – though not all – cases with some striking differences across countries which might deserve further investigations at a more detailed level. Generally, the statistics of the model are good with a high Chi^2 in all cases.

5.2.2 Step 2: Shapely value decomposition

In the second step one then calculates the predicted values for each variable or groups of the variables included in the regression. We did so for five groups of variables age, gender, employment status, education, and region. In the third step one then uses these predicted values (based on groups of variables) to calculate predicted outcomes for each elimination sequence. This means that one generates predicted values when including all groups of explanatory variables, all combinations with one of them left out, all combinations with two of them left out, etc. This is done for each of the dependent variables of interest (in our case thus income, health, education and housing). Fourth, one then uses these predicted outcomes for the four dependent variables entering the overall inequality measure to combine them into the inequality measure under consideration. Finally, in the fifth step one calculates the contribution of each item of the elimination sequences basically by building averages over marginal contributions (i.e. the contribution of the left out variable relative to the set-up where this variable is included for all elimination sequences). This then provides the Shapley-value decomposition by subgroups.[8]

5.2 Summary of results

The results of this decomposition depend on two parameters which have to be chosen exogenously as already discussed above. First the weights in the aggregator S_i can be varied. The results we present here are based on each of the outcome variables (income, health, education and housing) being weighted equally. Second, a second choice to make is on the parameter β (degree of substitutability between attributes as outlined in Section 2). We have calculated the decomposition for various levels of this parameter in the range for values -0.75, -0.5, -0.25, 0.25, 0.5, and 0.75. The unexplained part tends to become lower for higher values of the β coefficient though this effect is not uniformly the case and not too strong in some cases. The decomposition of the composite measure into its determinants (i.e. the groups of variables age, employment, education, gender, region) in some cases becomes more often negative for lower values (and in particular for negative values) of this parameter β. We applied this approach for three multidimensional indices, the index

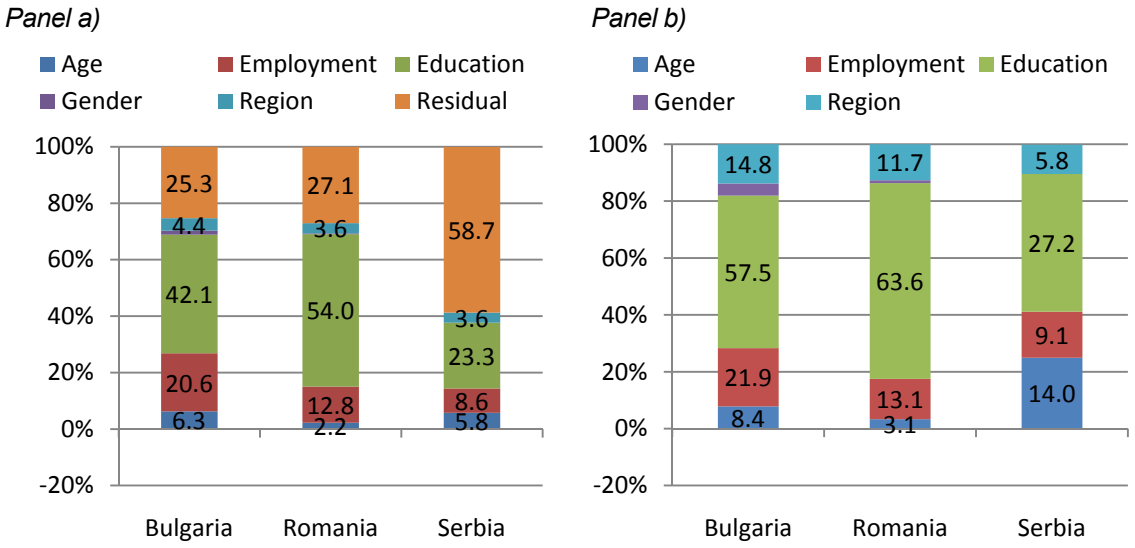
[8] Alternatively one could run separate regressions for each eliminating sequence which are then combined into the overall inequality measure; see Leitner and Stehrer (2009) for details and a comparative analysis of these methods.

suggested by Maasoumi (1986, 1999), the index suggested by Bourguignon (1999) and the Gini index. It turned out that this approach works best for the Gini coefficient with the unexplained part always being lower compared to the Bourguignon and the Maasoumi index. The reason for this might be that the Gini index is less prone to outliers (as basically based on the rank of the units considered) though this deserves some more attention in future research. We present the results for various levels of this parameter β and each of the three considered inequality indices in the Appendix Tables A.1-A.3 and restrict the discussion in the text to the results when using the Gini index.

Thus we summarise our findings for a value of $\beta = 0.5$ and the Gini inequality measure[9]. Figure 1, Panel a) presents the contribution for each group of variables to the Gini inequality measure together with the unexplained part, i.e. the residual). For the interpretation of the relative importance of each factor it is easier to draw the diagram focusing only on the explained part which is done in Panel b).

Figure 1

Contribution to inequality ($\beta = 0.5$, Gini coefficient)



As one can see in Panel a) the residual in case of Bulgaria and Romania is rather low with only about a quarter. This means that about 75% of inequality is explained by the variables age, employment, education, gender and region. However, in case of Serbia this is not the case as the residual almost reaches 60%. For an easier comparison of the relative importance of the explanatory variables we therefore plot in Panel b) the contribution of each of these variables to the explained part only. The most important determinant of inequality of the explained part (Panel b) is education which ranks first in all countries. In Bulgaria this contributes to almost 57.5% and in Romania even to 63.6% to the composite inequality

[9] Results for β=0.25 are quite similar, however.

measure. In Serbia education accounts for is 27.2%. The second most important variable is employment in case of Bulgaria and Romania contributing 21.9% and 13.1% respectively. The second most important determinant in Serbia is age with 14% and employment ranks third with 9.1%. The third most important determinant in Bulgaria and Romania is the regional dimension with 14.8% and 11.7% respectively. In Serbia this ranks fourth with 5.8%. Finally, age contributes relatively little to inequality in Bulgaria (8.4%) and Romania (3.1%). Somewhat surprisingly, gender plays a minor role in all countries with the exception to Bulgaria where it amounts to 4.6% of the explained part.

6 Conclusions

In this paper we analysed multidimensional inequality in three large South-East European countries, Serbia (2007) and Bulgaria and Romania (2008). In order to construct the multidimensional inequality index, we included four dimensions: household income, household health, household education level and housing quality and applied various decomposition methods to one- and multidimensional indices of inequality..

In Section 4 we applied standard decomposition techniques on the mean logarithmic deviation of all four single dimensions and on the multidimensional index as suggested by Massoumi (1986, 1999).-. The results indicate that in the case of Bulgaria and Romania income and education inequality can be explained very well by the differences in the characteristics educational attainment level of the head of the household, the participation of household members in the labour market and the differences between rural and urban regions. The same characteristics stand out in the case of income inequality in Serbia but their explanatory power is much lower, while education inequality cannot be explained at all. Also the decomposition analysis for the dimension household health points towards the importance of education and labour market participation. Inequality in housing is mostly influenced by differences between rural and urban households in Bulgaria and Romania. The decomposition analysis of the Massoumi index again underlines the outstanding importance of education differences in determining inequality in welfare levels in Bulgaria and Romania. The labour market participation of household members and the employment status of the head of the household in addition have some explanatory power. In the case of Serbia the same characteristics are the most relevant, but their significance is much lower.

In Section 5 we applied a Shapely value decomposition of the multidimensional inequality measures considered. This method is based on a regression approach which allows considering all explanatory variables simultaneously and conditional on each other. Further the Shapley value approach allows calculating the contribution of groups of these variables to the respective inequality measure. This approach seems to work best for the Gini coefficient. In all three countries education turns out to be the most important determinant of the

composite inequality measure with employment status ranking second in Bulgaria and Romania and third in Serbia. For the latter country age is somewhat more important. Similarly important is the regional dimension. Gender only plays a less important or even only minor role in most countries. From a methodological point of view this section has shown in which way a regression based Shapely value decomposition can be applied to multidimensional inequality measures and the way it allows for a comparison across countries. As opposed to the traditional decomposition methods as undertaken in the previous sections this approach allows to consider all potential explanatory factors simultaneously and to derive indicators of their relative importance in a simple and effective way. Generally, results on the relative importance do not differ substantially from the classical subgroup decomposition approach (also applied to multidimensional inequality indices) and therefore this regression based Shapely value approach might be a useful alternative in doing comparisons across countries and over time.

References

Atkinson, A. B. (1975). The Economics of Inequality. Oxford: Clarendon Press.

Atkinson, A. B. and E. Marlier (eds.) (2010). Income and living conditions in Europe. Luxembourg: Publication Office of the European Union.

Bourguignon, F. (1999). Comment to: Multidimensional approaches to welfare analysis. In J. Silber

(Ed.), Handbook of Inequality Measurement. Kluwer, M.A.

Cowell, F. A. and C. V. Fiorio (2009). Inequality decompositions. A reconciliation. ECINEQ Working Paper Series WP 2009-117.

Israeli, O. (2007). A Shapely-based decomposition of the R-square of a linear regression. Journal of Economic Ineaquality 212, 199–.

Jenkins, S. P. (1995). Accounting for inequality trends: Decomposition analysis for the UK, 1971-86.

Economica 62, 29–63.

Justino, P. (2005). Empirical Applications of Multidimensional Inequality Analysis, PRUS Working Paper, No. 23.

Leitner, S. and R. Stehrer (2009). Determinants of inequality in selected SEE countries: Results from

Shapley value decompositions. GDN research paper, mimeo.

Lugo, M. A. (2005). Comparing multidimensional indices of inequality: Methods and applications.

ECINEQ Working Paper 2005-14.

Maasoumi, E. (1986). The measurement and decomposition of multidimensional inequality. Econometrica, 991–997.

Maasoumi, E. (1999). Multidimensional approaches to welfare analysis. In J. Silber (Ed.), Handbook

of Income Inequality Measurement. Boston: Kluwer Academic.

Savaglio, E. (2006a). On multidimensional inequality with variable population size, Economic Theory 28, 85-94.

Savaglio, E. (2006b) .Three approaches to the analysis of multidimensional inequality, in Farina, F. and E. Savaglio (eds), Inequality and Economic Integration, Routledge, London.

Sen, A. (1997). On Economic Inequality. Oxford, UK: Oxford University Press.

Shorrocks, A. F. (1999). Decomposition procedures for distributional analysis: A unified framework based on the shapely value. Draft paper, University of Essex .

Wan, G. (2004). Accounting for income inequality in rural China: A regression-based approach. Journal of Comparative Economics 32, 348–363.

Weymark, J. A. (2004). The normative approach to the measurement of multidimensional inequality. Working Paper 03-W14R, Vanderbilt University, Nashville.

Appendix Tables

Table A.1

Decomposition results for Bulgaria

		Bourguignon			Maasoumi			Gini		
beta	Group	Index	Contr.	in %	Index	Contr.	in %	Index	Contr.	in %
-0.75	Age	0.101	-0.004	-4.021	0.069	-0.022	-31.427	0.198	-0.011	-5.544
	Employment		0.007	6.456		-0.023	-33.433		0.020	10.088
	Education		-0.017	-16.651		-0.045	-65.075		-0.019	-9.446
	Gender		-0.001	-1.427		-0.005	-7.232		0.001	0.510
	Region		0.059	58.714		0.131	190.791		0.157	79.262
	Residual		0.057	56.927		0.032	46.375		0.050	25.129
-0.50	Age	0.090	-0.006	-6.356	0.053	-0.015	-27.649	0.175	-0.008	-4.854
	Employment		-0.001	-0.922		-0.014	-26.602		0.018	10.095
	Education		-0.019	-21.297		-0.026	-49.848		-0.010	-5.527
	Gender		-0.002	-2.012		-0.003	-6.421		0.001	0.469
	Region		0.067	74.160		0.087	163.891		0.130	74.409
	Residual		0.051	56.427		0.025	46.629		0.044	25.407
-0.25	Age	0.075	-0.006	-7.616	0.040	-0.007	-17.036	0.152	-0.004	-2.651
	Employment		-0.004	-5.540		-0.004	-10.176		0.019	12.769
	Education		-0.016	-21.971		-0.008	-20.587		0.006	3.715
	Gender		-0.002	-2.414		-0.002	-4.041		0.001	0.648
	Region		0.061	81.459		0.042	105.390		0.092	60.135
	Residual		0.042	56.081		0.019	46.449		0.039	25.383
0.25	Age	0.040	-0.001	-2.414	0.025	0.000	-0.663	0.120	0.005	4.076
	Employment		0.000	-0.568		0.003	11.127		0.024	20.137
	Education		-0.001	-3.566		0.007	29.282		0.038	31.391
	Gender		-0.001	-1.462		0.000	-0.403		0.001	1.230
	Region		0.021	52.632		0.003	13.007		0.021	17.723
	Residual		0.022	55.378		0.012	47.649		0.031	25.443
0.50	Age	0.024	0.000	0.540	0.021	0.000	0.757	0.111	0.007	6.267
	Employment		0.001	2.538		0.002	10.777		0.023	20.562
	Education		0.002	7.972		0.008	38.937		0.047	42.057
	Gender		0.000	-0.875		0.000	-0.093		0.002	1.421
	Region		0.009	35.392		0.000	1.955		0.005	4.390
	Residual		0.013	54.434		0.010	47.667		0.028	25.303
0.75	Age	0.011	0.000	2.370	0.019	0.000	0.926	0.105	0.008	7.346
	Employment		0.000	3.500		0.002	8.897		0.019	18.260
	Education		0.002	17.256		0.008	43.902		0.050	47.419
	Gender		0.000	-0.534		0.000	-0.041		0.002	1.563
	Region		0.003	24.003		0.000	-1.247		0.000	0.443
	Residual		0.006	53.405		0.009	47.562		0.026	24.968

Table A.2

Decomposition results for Romania

		Bourguignon index			Maasoumi index			Gini index		
beta	Group	Index	Contr.	in %	Index	Contr.	in %	Index	Contr.	in %
-0.75	Age	0.089	-0.002	-2.616	0.088	-0.005	-6.199	0.222	0.002	0.732
	Employment		0.003	3.759		0.002	2.138		0.022	9.907
	Education		0.021	23.574		0.023	26.002		0.069	30.933
	Gender		-0.001	-0.585		-0.004	-4.910		0.001	0.255
	Region		0.017	18.794		0.026	28.935		0.064	29.036
	Residual		0.051	57.074		0.048	54.034		0.065	29.138
-0.50	Age	0.088	-0.002	-2.335	0.063	-0.004	-5.730	0.189	0.002	0.904
	Employment		0.002	1.853		0.002	2.564		0.020	10.510
	Education		0.020	23.167		0.018	29.001		0.063	33.097
	Gender		-0.001	-1.132		-0.003	-4.633		0.000	0.164
	Region		0.020	22.497		0.016	25.334		0.049	25.956
	Residual		0.049	55.950		0.034	53.463		0.056	29.368
-0.25	Age	0.077	-0.001	-1.620	0.040	-0.002	-4.976	0.155	0.002	1.305
	Employment		0.000	0.627		0.001	3.669		0.019	12.283
	Education		0.018	23.541		0.015	36.153		0.059	38.073
	Gender		-0.001	-1.302		-0.001	-3.577		0.000	0.254
	Region		0.018	23.888		0.007	17.718		0.030	19.304
	Residual		0.042	54.866		0.021	51.013		0.045	28.781
0.25	Age	0.039	0.000	0.998	0.018	-0.001	-4.071	0.105	0.003	2.701
	Employment		0.000	0.117		0.001	4.515		0.016	15.083
	Education		0.012	29.289		0.009	51.866		0.055	52.622
	Gender		0.000	-0.336		0.000	-0.602		0.001	0.814
	Region		0.008	19.490		0.000	1.350		0.002	2.037
	Residual		0.020	50.441		0.008	46.942		0.028	26.743
0.50	Age	0.023	0.001	2.270	0.015	-0.001	-4.427	0.094	0.002	2.225
	Employment		0.000	-0.171		0.001	4.249		0.012	12.822
	Education		0.008	33.293		0.008	53.667		0.051	54.015
	Gender		0.000	0.182		0.000	-0.041		0.000	0.280
	Region		0.004	16.957		0.000	-1.346		0.003	3.595
	Residual		0.011	47.468		0.007	47.898		0.025	27.064
0.75	Age	0.010	0.000	3.211	0.013	-0.001	-5.112	0.088	0.002	1.998
	Employment		0.000	-0.605		0.001	4.296		0.010	11.262
	Education		0.004	36.838		0.007	54.222		0.048	53.961
	Gender		0.000	0.487		0.000	0.057		0.000	0.171
	Region		0.002	15.306		0.000	-2.309		0.004	5.064
	Residual		0.005	44.763		0.006	48.845		0.024	27.544

Table A.3

Decomposition results for Serbia

		Bourguignon index			Maasoumi index			Gini index		
beta	Group	Index	Contr.	in %	Index	Contr.	in %	Index	Contr.	in %
-0.75	Age	0.142	0.002	1.347	0.711	0.002	0.315	0.261	0.008	2.921
	Employment		0.009	6.403		0.011	1.508		0.044	16.723
	Education		0.008	5.765		0.013	1.786		0.062	23.705
	Gender		0.000	-0.266		-0.002	-0.248		0.001	0.366
	Region		0.001	0.450		0.001	0.148		0.005	1.994
	Residual		0.122	86.301		0.686	96.491		0.142	54.290
-0.50	Age	0.135	0.002	1.278	0.657	0.002	0.259	0.237	0.008	3.173
	Employment		0.008	6.160		0.007	1.089		0.036	15.323
	Education		0.007	5.196		0.010	1.458		0.054	22.669
	Gender		0.000	-0.315		-0.001	-0.182		0.000	0.146
	Region		0.001	0.496		0.001	0.132		0.005	2.125
	Residual		0.118	87.185		0.639	97.244		0.134	56.565
-0.25	Age	0.120	0.001	1.181	0.540	0.001	0.228	0.211	0.007	3.546
	Employment		0.007	5.525		0.004	0.770		0.029	13.514
	Education		0.005	4.351		0.007	1.303		0.046	21.670
	Gender		0.000	-0.275		-0.001	-0.123		0.000	-0.053
	Region		0.001	0.527		0.001	0.127		0.005	2.290
	Residual		0.107	88.691		0.528	97.695		0.125	59.033
0.25	Age	0.064	0.001	1.1	0.039	0.001	1.7	0.149	0.007	5.0
	Employment		0.003	4.3		0.001	2.9		0.015	10.2
	Education		0.002	3.1		0.004	9.7		0.034	22.5
	Gender		0.000	0.0		0.000	-0.3		0.000	-0.2
	Region		0.000	0.6		0.000	1.1		0.005	3.1
	Residual		0.058	90.9		0.033	84.9		0.088	59.2
0.50	Age	0.034	0.000	1.180	0.027	0.001	1.938	0.128	0.007	5.797
	Employment		0.001	3.957		0.001	2.234		0.011	8.609
	Education		0.001	2.863		0.003	10.570		0.030	23.319
	Gender		0.000	0.114		0.000	-0.090		0.000	-0.070
	Region		0.000	0.804		0.000	1.398		0.005	3.615
	Residual		0.031	91.082		0.023	83.951		0.075	58.731
0.75	Age	0.014	0.000	1.184	0.023	0.000	1.860	0.118	0.007	6.021
	Employment		0.000	3.397		0.000	1.588		0.008	6.820
	Education		0.000	2.413		0.002	9.839		0.027	22.772
	Gender		0.000	0.255		0.000	0.034		0.000	0.356
	Region		0.000	0.933		0.000	1.423		0.004	3.797
	Residual		0.013	91.819		0.020	85.257		0.071	60.235

Table A.4a

Multidimensional inequality decomposition
Attribute household income

	Serbia 2007							Bulgaria 2008							Romania 2008						
	MLD	components within	components between	% of MLD	Attribute level	in % of average		MLD	components within	components between	% of MLD	Attribute level	in % of average		MLD	components within	components between	% of MLD	Attribute level	in % of average	
Decompostion by gender																					
Total	0.22	0.21	0.00	**0.52**	21403	100	**Total**	0.19	0.19	0.00	**0.13**	2958	100	**Total**	0.18	0.17	0.01	**3.49**	2816	100	
men	0.22	0.16	-0.02		22015	103	men	0.19	0.08	-0.01		3026	102	men	0.18	0.12	-0.05		3010	107	
women	0.21	0.06	0.02		19785	92	women	0.18	0.11	0.01		2914	99	women	0.16	0.05	0.05		2390	85	
Decompostion by age																					
Total	0.22	0.21	0.00	**0.80**	21403	100	**Total**	0.19	0.17	0.02	**8.87**	2958	100	**Total**	0.18	0.17	0.01	**5.12**	2816	100	
0-24	0.30	0.00	0.00		23015	108	0-24	0.27	0.01	0.00		3039	103	0-24	0.26	0.00	0.00		2241	80	
25-34	0.24	0.01	-0.01		24174	113	25-34	0.25	0.02	-0.01		3230	109	25-34	0.22	0.02	-0.02		3540	126	
35-44	0.26	0.03	0.00		21672	101	35-44	0.25	0.03	-0.01		3262	110	35-44	0.22	0.03	-0.01		3032	108	
45-54	0.26	0.06	-0.01		21979	103	45-54	0.20	0.04	-0.04		3612	122	45-54	0.21	0.04	-0.02		3102	110	
55-64	0.21	0.05	-0.01		22105	103	55-64	0.18	0.04	-0.02		3210	109	55-64	0.18	0.04	-0.01		2992	106	
65-74	0.17	0.04	0.01		20648	96	65-74	0.11	0.02	0.04		2453	83	65-74	0.10	0.02	0.03		2471	88	
75+	0.16	0.02	0.02		18903	88	75+	0.10	0.02	0.05		2133	72	75+	0.11	0.02	0.04		2277	81	
Decompostion by region																					
Total	0.22	0.21	0.00	**1.47**	21403	100	**Total**	0.19	0.18	0.00	**2.25**	2958	100	**Total**	0.18	0.17	0.01	**3.47**	2816	100	
Belgrade	0.27	0.05	-0.02		23736	111	Nothern Region	0.19	0.10	0.05		2699	91	Nord-East	0.19	0.03	0.01		2657	94	
Vojvodina	0.21	0.05	-0.01		22221	104	Southern region incl. Sofia	0.18	0.08	-0.04		3242	110	South-East	0.20	0.02	0.01		2667	95	
West Serbia	0.17	0.02	0.01		20127	94								South	0.17	0.03	0.01		2631	93	
Sumadija	0.21	0.04	0.00		21158	99								South-West	0.18	0.02	0.01		2576	91	
East Serbia	0.21	0.02	0.00		22126	103								West	0.15	0.02	0.00		2798	99	
South-East Serbia	0.18	0.03	0.02		18300	86								North-West	0.15	0.02	0.00		2914	103	
														Centre	0.15	0.02	0.00		2815	100	
														Bucharest	0.16	0.01	-0.03		3895	138	
Decompostion by urban / rural																					
Total	0.22	0.21	0.00	**0.21**	21403	100	**Total**	0.19	0.17	0.02	**11.87**	2958	100	**Total**	0.18	0.16	0.02	**11.45**	2816	100	
urban	0.24	0.13	-0.01		22000	103	urban	0.16	0.07	-0.09		3679	124	urban	0.16	0.06	-0.09		3584	127	
rural	0.19	0.09	0.02		20723	97	rural	0.17	0.10	0.12		2412	82	rural	0.16	0.10	0.11		2386	85	
Decompostion by ethnicity																					
Total	0.22	0.21	0.01	**2.89**	21403	100															
Serbian	0.21	0.18	-0.02		21791	102															
Montenegrin	0.17	0.00	0.00		24998	117															
Bosnian	0.22	0.00	0.01		13920	65															
Albanian	0.33	0.00	0.00		16875	79															
Hungarian	0.20	0.01	0.00		20679	97															
Croatian	0.18	0.00	0.00		23016	108															
Roma	0.23	0.00	0.01		9347	44															
Others	0.21	0.01	0.00		20982	98															

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

Table A.4b

Multidimensional inequality decomposition
Attribute household income

	Serbia 2007						Bulgaria 2008						Romania 2008					
	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average
Decompostion by education																		
Total	0.22	0.20	0.02	**9.00**	21403	100	**Total**	0.19	0.14	0.04	**22.83**	2958	100	**Total**	0.18	0.12	0.06	**31.56**	2816	100
No education	0.20	0.01	0.02		14425	67	No education	0.17	0.00	0.02		1386	47	No education	0.13	0.00	0.02		1496	53
Low education	0.18	0.06	0.05		18656	87	Low education	0.14	0.01	0.05		1797	61	Low education	0.09	0.02	0.07		1885	67
Medium education	0.20	0.03	0.01		20728	97	Medium education	0.16	0.05	0.08		2267	77	Medium education	0.12	0.03	0.06		2147	76
Upper secondary	0.21	0.07	-0.01		22301	104	Upper secondary	0.13	0.06	-0.03		3205	108	Upper secondary	0.13	0.06	-0.02		2960	105
University	0.22	0.02	-0.04		34964	163	University	0.15	0.03	-0.07		4441	150	University	0.13	0.01	-0.07		5598	199
Decompostion by empl. status																		
Total	0.22	0.20	0.01	**6.25**	21403	100	**Total**	0.19	0.15	0.04	**19.52**	2958	100	**Total**	0.18	0.15	0.03	**14.38**	2816	100
Employee	0.21	0.06	-0.04		24973	117	Employee	0.16	0.06	-0.08		3669	124	Employee	0.16	0.05	-0.08		3657	130
Informally employed	0.23	0.01	0.01		18095	85														
Self-employed	0.21	0.03	-0.01		23491	110	Self-employed	0.25	0.01	-0.03		5198	176	Self-employed	0.27	0.03	0.03		2816	100
Unemployed	0.30	0.02	0.03		13320	62	Unemployed	0.23	0.02	0.03		2081	70	Unemployed	0.23	0.00	0.01		1866	66
Retired	0.16	0.07	0.02		20420	95	Retired	0.11	0.05	0.10		2360	80	Retired	0.11	0.05	0.06		2516	89
Others not econ. active	0.27	0.01	0.02		15467	72	Others not econ. active	0.20	0.01	0.02		2323	79	Others not econ. active	0.28	0.01	0.02		1615	57
Decompostion by hh-empl-rate																		
Total	0.22	0.20	0.02	**8.90**	21403	100	**Total**	0.19	0.14	0.05	**26.54**	2958	100	**Total**	0.18	0.15	0.02	**13.84**	2816	100
0 - < 0.2	0.20	0.07	0.08		16919	79	0 - < 0.2	0.12	0.05	0.15		2035	69	0 - < 0.2	0.12	0.05	0.09		2250	80
0.2 - < 0.4	0.18	0.03	0.03		18323	86	0.2 - < 0.4	0.18	0.02	0.02		2491	84	0.2 - < 0.4	0.13	0.02	0.02		2369	84
0.4 - < 0.6	0.18	0.05	-0.03		24488	114	0.4 - < 0.6	0.15	0.03	-0.02		3332	113	0.4 - < 0.6	0.16	0.03	-0.01		3010	107
0.6 - < 0.8	0.21	0.02	-0.02		25845	121	0.6 - < 0.8	0.13	0.02	-0.03		3842	130	0.6 - < 0.8	0.16	0.02	-0.03		3664	130
0.8 - < 1	0.22	0.03	-0.03		27430	128	0.8 - < 1	0.16	0.02	-0.06		4677	158	0.8 - < 1	0.22	0.04	-0.05		3693	131
Decompostion by refugee-status																		
Total	0.22	0.22	0.00	**0.03**	21403	100												
0	0.21	0.21	0.00		21386	100												
0.5	0.27	0.00	0.00		20982	98												
1	0.21	0.00	0.00		22760	106												

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

Table A.5a

Multidimensional inequality decomposition
Attribute household health status (relative)

deviation of subj. health status from project. health status according to age

	Serbia 2007						Bulgaria 2008						Romania 2008					
	MLD	components within	components between	% of MLD	Attribute level	in % of average		MLD	components within	components between	% of MLD	Attribute level	in % of average		MLD	components within	components between	% of MLD	Attribute level	in % of average
Decompostion by gender																				
Total	0.04	0.04	0.00	**0.35**	0.49	100	**Total**	0.02	0.02	0.00	**0.55**	0.60	100	**Total**	0.02	0.02	0.00	**0.83**	0.60	100
men	0.04	0.03	-0.01		0.49	100	men	0.02	0.01	-0.01		0.61	101	men	0.02	0.01	-0.01		0.61	101
women	0.06	0.02	0.01		0.47	96	women	0.02	0.01	0.01		0.59	99	women	0.03	0.01	0.01		0.58	97
Decompostion by age																				
Total	0.04	0.04	0.00	**0.42**	0.49	100	**Total**	0.02	0.02	0.00	**0.41**	0.60	100	**Total**	0.02	0.02	0.00	**0.17**	0.60	100
0-24	0.02	0.00	0.00		0.53	109	0-24	0.01	0.00	0.00		0.59	99	0-24	0.01	0.00	0.00		0.60	100
25-34	0.04	0.00	0.00		0.50	102	25-34	0.02	0.00	0.00		0.59	99	25-34	0.03	0.00	0.00		0.60	100
35-44	0.03	0.00	0.00		0.49	101	35-44	0.02	0.00	0.00		0.60	100	35-44	0.02	0.00	0.00		0.61	101
45-54	0.04	0.01	0.00		0.49	100	45-54	0.02	0.00	0.00		0.61	102	45-54	0.02	0.00	0.00		0.60	100
55-64	0.05	0.01	0.00		0.48	98	55-64	0.02	0.01	0.00		0.60	100	55-64	0.03	0.01	0.00		0.59	98
65-74	0.04	0.01	0.01		0.47	96	65-74	0.03	0.01	0.00		0.59	99	65-74	0.03	0.01	0.00		0.60	100
75+	0.04	0.01	0.00		0.49	100	75+	0.03	0.01	0.00		0.59	98	75+	0.03	0.00	0.00		0.60	99
Decompostion by region																				
Total	0.04	0.04	0.00	**0.25**	0.49	100	**Total**	0.02	0.02	0.00	**0.16**	0.60	100	**Total**	0.02	0.02	0.00	**0.97**	0.60	100
Belgrade	0.04	0.01	0.00		0.50	102	Nothern Region	0.02	0.01	0.00		0.59	99	Nord-East	0.03	0.00	0.00		0.59	98
Vojvodina	0.05	0.01	0.00		0.48	98	Southern region incl. Sofia	0.02	0.01	0.00		0.60	101	South-East	0.02	0.00	0.00		0.58	97
West Serbia	0.04	0.00	0.00		0.49	100								South	0.03	0.00	0.00		0.60	100
Sumadija	0.04	0.01	0.00		0.48	99								South-West	0.02	0.00	0.00		0.61	102
East Serbia	0.04	0.00	0.00		0.48	98								West	0.02	0.00	0.00		0.63	104
South-East Serbia	0.04	0.01	0.00		0.48	98								North-West	0.03	0.00	0.00		0.59	98
														Centre	0.02	0.00	0.00		0.61	102
														Bucharest	0.02	0.00	0.00		0.60	99
Decompostion by urban / rural																				
Total	0.04	0.04	0.00	**0.65**	0.49	100	**Total**	0.02	0.02	0.00	**0.22**	0.60	100	**Total**	0.02	0.02	0.00	**0.10**	0.60	100
urban	0.04	0.02	-0.01		0.50	101	urban	0.02	0.01	0.00		0.61	101	urban	0.02	0.01	0.00		0.59	99
rural	0.05	0.02	0.01		0.47	97	rural	0.02	0.01	0.00		0.59	99	rural	0.03	0.02	0.00		0.60	100
Decompostion by ethnicity																				
Total	0.04	0.04	0.00	**1.04**	0.49	100														
Serbian	0.04	0.04	0.00		0.49	99														
Montenegrin	0.02	0.00	0.00		0.55	113														
Bosnian	0.03	0.00	0.00		0.49	100														
Albanian	0.01	0.00	0.00		0.55	112														
Hungarian	0.04	0.00	0.00		0.48	98														
Croatian	0.04	0.00	0.00		0.47	95														
Roma	0.06	0.00	0.00		0.40	82														
Others	0.04	0.00	0.00		0.49	100														

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

Table A.5b

Multidimensional inequality decomposition
Attribute household health status (relative)

deviation of subj. health status from project. health status according to age

	Serbia 2007						Bulgaria 2008						Romania 2008					
	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average
Decomposition by education																		
Total	0.04	0.04	0.00	**3.84**	0.49	100	**Total**	0.02	0.02	0.00	**3.26**	0.60	100	**Total**	0.02	0.02	0.00	**1.21**	0.60	100
No education	0.05	0.00	0.00		0.44	91	No education	0.03	0.00	0.00		0.56	93	No education	0.08	0.00	0.00		0.58	96
Low education	0.05	0.02	0.02		0.46	94	Low education	0.03	0.00	0.00		0.57	95	Low education	0.03	0.01	0.00		0.58	97
Medium education	0.04	0.01	0.00		0.48	98	Medium education	0.03	0.01	0.01		0.58	96	Medium education	0.03	0.01	0.00		0.59	98
Upper secondary	0.03	0.01	-0.01		0.51	103	Upper secondary	0.02	0.01	0.00		0.60	101	Upper secondary	0.02	0.01	0.00		0.60	100
University	0.03	0.00	-0.01		0.54	111	University	0.01	0.00	-0.01		0.64	107	University	0.01	0.00	-0.01		0.64	106
Decomposition by empl. status																		
Total	0.04	0.04	0.00	**1.92**	0.49	100	**Total**	0.02	0.02	0.00	**3.61**	0.60	100	**Total**	0.02	0.02	0.00	**1.86**	0.60	100
Employee	0.03	0.01	-0.01		0.51	104	Employee	0.01	0.00	-0.01		0.62	103	Employee	0.01	0.00	-0.01		0.62	103
Informally employed	0.03	0.00	0.00		0.48	99														
Self-employed	0.03	0.01	0.00		0.49	100	Self-employed	0.01	0.00	0.00		0.65	108	Self-employed	0.02	0.00	0.00		0.61	102
Unemployed	0.04	0.00	0.00		0.47	97	Unemployed	0.02	0.00	0.00		0.57	95	Unemployed	0.03	0.00	0.00		0.59	98
Retired	0.05	0.02	0.01		0.47	97	Retired	0.03	0.01	0.00		0.59	99	Retired	0.03	0.01	0.01		0.58	97
Others not econ. active	0.06	0.00	0.01		0.43	89	Others not econ. active	0.04	0.00	0.01		0.54	90	Others not econ. active	0.08	0.00	0.00		0.55	92
Decomposition by hh-empl-rate																		
Total	0.04	0.04	0.00	**2.31**	0.49	100	**Total**	0.02	0.02	0.00	**3.47**	0.60	100	**Total**	0.02	0.02	0.00	**2.01**	0.60	100
0 - < 0.2	0.06	0.02	0.02		0.46	93	0 - < 0.2	0.04	0.01	0.02		0.57	95	0 - < 0.2	0.04	0.02	0.01		0.58	97
0.2 - < 0.4	0.03	0.00	0.00		0.49	100	0.2 - < 0.4	0.02	0.00	0.00		0.59	99	0.2 - < 0.4	0.02	0.00	0.00		0.59	99
0.4 - < 0.6	0.03	0.01	-0.01		0.50	102	0.4 - < 0.6	0.01	0.00	0.00		0.61	102	0.4 - < 0.6	0.02	0.00	0.00		0.60	100
0.6 - < 0.8	0.02	0.00	-0.01		0.51	103	0.6 - < 0.8	0.01	0.00	0.00		0.62	104	0.6 - < 0.8	0.01	0.00	0.00		0.62	103
0.8 - < 1	0.05	0.01	-0.01		0.51	103	0.8 - < 1	0.01	0.00	-0.01		0.64	106	0.8 - < 1	0.02	0.00	-0.01		0.63	105
Decomposition by refugee-status																		
Total	0.04	0.04	0.00	**0.08**	0.49	100												
0	0.04	0.04	0.00		0.49	99												
0.5	0.03	0.00	0.00		0.48	99												
1	0.04	0.00	0.00		0.46	94												

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

Table A.6a

Multidimensional inequality decomposition
Attribute average household education level

	Serbia 2007							Bulgaria 2008							Romania 2008						
	MLD	components within	components between	% of MLD	Attribute level	in % of average		MLD	components within	components between	% of MLD	Attribute level	in % of average		MLD	components within	components between	% of MLD	Attribute level	in % of average	
Decompostion by gender																					
Total	0.34	0.34	0.00	**0.08**	0.48	100	**Total**	0.17	0.17	0.00	**0.02**	0.62	100	**Total**	0.20	0.20	0.00	**1.96**	0.58	100	
men	0.36	0.26	0.01		0.48	99	men	0.15	0.06	0.00		0.62	101	men	0.11	0.08	-0.04		0.62	107	
women	0.30	0.08	-0.01		0.50	105	women	0.19	0.11	0.00		0.62	100	women	0.39	0.12	0.04		0.51	88	
Decompostion by age																					
Total	0.34	0.34	0.00	**0.11**	0.48	100	**Total**	0.17	0.17	0.00	**2.45**	0.62	100	**Total**	0.20	0.19	0.02	**8.30**	0.58	100	
0-24	0.23	0.00	0.00		0.57	120	0-24	0.23	0.01	0.00		0.60	97	0-24	0.03	0.00	0.00		0.64	111	
25-34	0.21	0.01	0.00		0.53	109	25-34	0.10	0.01	0.00		0.64	103	25-34	0.09	0.01	-0.02		0.72	124	
35-44	0.36	0.05	0.00		0.49	103	35-44	0.15	0.02	-0.01		0.67	108	35-44	0.05	0.01	-0.02		0.68	118	
45-54	0.35	0.08	0.00		0.48	100	45-54	0.11	0.02	-0.01		0.66	107	45-54	0.07	0.01	-0.03		0.67	116	
55-64	0.34	0.08	0.00		0.48	100	55-64	0.14	0.03	-0.01		0.65	105	55-64	0.08	0.02	-0.01		0.62	107	
65-74	0.35	0.08	0.00		0.48	100	65-74	0.14	0.03	0.01		0.60	97	65-74	0.25	0.05	0.04		0.49	85	
75+	0.36	0.05	0.00		0.47	99	75+	0.34	0.06	0.03		0.51	83	75+	0.53	0.09	0.06		0.42	72	
Decompostion by region																					
Total	0.34	0.34	0.01	**1.57**	0.48	100	**Total**	0.17	0.17	0.00	**0.38**	0.62	100	**Total**	0.20	0.20	0.00	**1.11**	0.58	100	
Belgrade	0.07	0.01	-0.03		0.60	124	Nothern Region	0.20	0.10	0.02		0.60	97	Nord-East	0.30	0.05	0.01		0.55	95	
Vojvodina	0.38	0.09	0.00		0.49	101	Southern region incl. Sofia	0.14	0.07	-0.02		0.65	104	South-East	0.15	0.02	0.00		0.56	97	
West Serbia	0.48	0.06	0.01		0.44	92								South	0.28	0.04	0.01		0.55	94	
Sumadija	0.40	0.07	0.01		0.46	95								South-West	0.22	0.02	0.00		0.58	100	
East Serbia	0.32	0.04	0.01		0.44	91								West	0.17	0.02	0.00		0.60	103	
South-East Serbia	0.38	0.06	0.01		0.47	97								North-West	0.18	0.02	0.00		0.59	102	
														Centre	0.14	0.02	-0.01		0.61	105	
														Bucharest	0.08	0.01	-0.02		0.70	121	
Decompostion by urban / rural																					
Total	0.34	0.34	0.00	**0.77**	0.48	100	**Total**	0.17	0.17	0.01	**4.47**	0.62	100	**Total**	0.20	0.19	0.01	**5.68**	0.58	100	
urban	0.26	0.14	-0.04		0.52	108	urban	0.10	0.04	-0.06		0.71	115	urban	0.07	0.03	-0.07		0.71	123	
rural	0.43	0.20	0.04		0.45	93	rural	0.22	0.12	0.07		0.55	89	rural	0.26	0.17	0.08		0.51	89	
Decompostion by ethnicity																					
Total	0.34	0.34	0.00	**0.13**	0.48	100															
Serbian	0.34	0.29	0.00		0.49	101															
Montenegrin	0.08	0.00	0.00		0.53	110															
Bosnian	0.33	0.00	0.00		0.48	100															
Albanian	1.22	0.01	0.00		0.34	71															
Hungarian	0.44	0.02	0.00		0.46	96															
Croatian	0.17	0.00	0.00		0.53	110															
Roma	0.37	0.01	0.00		0.46	96															
Others	0.20	0.01	0.00		0.50	104															

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

Table A.6b

Multidimensional inequality decomposition
Attribute average household education level

	Serbia 2007						Bulgaria 2008						Romania 2008					
	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average
Decompostion by education																		
Total	0.34	0.34	0.00	**0.78**	0.48	100	**Total**	0.17	0.10	0.07	**41.74**	0.62	100	**Total**	0.20	0.12	0.08	**39.35**	0.58	100
No education	0.63	0.03	0.00		0.45	94	No education	3.53	0.09	0.04		0.11	18	No education	4.31	0.11	0.05		0.10	16
Low education	0.39	0.14	0.03		0.45	93	Low education	0.05	0.01	0.08		0.28	45	Low education	0.06	0.01	0.12		0.29	50
Medium education	0.28	0.05	0.00		0.49	102	Medium education	0.02	0.00	0.07		0.49	80	Medium education	0.01	0.00	0.04		0.49	84
Upper secondary	0.30	0.10	-0.02		0.51	106	Upper secondary	0.01	0.00	-0.05		0.70	112	Upper secondary	0.01	0.00	-0.08		0.69	118
University	0.22	0.02	-0.01		0.56	116	University	0.01	0.00	-0.07		0.93	150	University	0.00	0.00	-0.05		0.95	164
Decompostion by empl. status																		
Total	0.34	0.34	0.00	**0.25**	0.48	100	**Total**	0.17	0.17	0.01	**3.39**	0.62	100	**Total**	0.20	0.19	0.01	**7.12**	0.58	100
Employee	0.33	0.09	-0.01		0.50	104	Employee	0.09	0.03	-0.04		0.70	114	Employee	0.02	0.01	-0.07		0.73	125
Informally employed	0.37	0.02	0.00		0.47	99														
Self-employed	0.41	0.06	0.01		0.44	92	Self-employed	0.08	0.00	0.00		0.67	108	Self-employed	0.19	0.02	0.01		0.52	90
Unemployed	0.37	0.02	0.00		0.50	104	Unemployed	0.15	0.01	0.01		0.54	87	Unemployed	0.16	0.00	0.00		0.58	100
Retired	0.30	0.12	-0.01		0.49	102	Retired	0.21	0.09	0.04		0.57	92	Retired	0.29	0.14	0.06		0.51	88
Others not econ. active	0.46	0.02	0.00		0.49	101	Others not econ. active	0.37	0.03	0.01		0.55	89	Others not econ. active	0.41	0.01	0.01		0.48	83
Decompostion by hh-empl-rate																		
Total	0.34	0.34	0.00	**0.05**	0.48	100	**Total**	0.17	0.17	0.01	**4.33**	0.62	100	**Total**	0.20	0.19	0.01	**5.83**	0.58	100
0 - < 0.2	0.35	0.11	0.00		0.49	101	0 - < 0.2	0.28	0.11	0.06		0.54	87	0 - < 0.2	0.36	0.15	0.08		0.49	84
0.2 - < 0.4	0.31	0.06	0.00		0.50	104	0.2 - < 0.4	0.16	0.02	0.00		0.60	97	0.2 - < 0.4	0.03	0.00	-0.01		0.62	108
0.4 - < 0.6	0.35	0.09	0.00		0.49	101	0.4 - < 0.6	0.08	0.02	-0.01		0.67	107	0.4 - < 0.6	0.08	0.01	-0.01		0.63	109
0.6 - < 0.8	0.35	0.04	0.00		0.48	100	0.6 - < 0.8	0.06	0.01	-0.02		0.71	115	0.6 - < 0.8	0.03	0.00	-0.02		0.70	121
0.8 - < 1	0.37	0.05	0.01		0.46	97	0.8 - < 1	0.07	0.01	-0.02		0.73	117	0.8 - < 1	0.13	0.02	-0.02		0.66	114
Decompostion by refugee-status																		
Total	0.34	0.34	0.00	**0.03**	0.48	100												
0	0.35	0.34	0.00		0.48	101												
0.5	0.07	0.00	0.00		0.52	108												
1	0.24	0.00	0.00		0.53	110												

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

Table A.7a

Multidimensional inequality decomposition
Attribute housing (space and quality)

	Serbia 2007						Bulgaria 2008						Romania 2008					
	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average
Decompostion by gender																		
Total	0.04	0.04	0.00	**0.06**	0.49	100	**Total**	0.06	0.06	0.00	**0.21**	0.46	100	**Total**	0.06	0.06	0.00	**0.78**	0.48	100
men	0.03	0.02	0.00		0.50	101	men	0.05	0.02	-0.01		0.47	102	men	0.06	0.04	0.01		0.47	97
women	0.05	0.01	0.00		0.49	100	women	0.06	0.04	0.01		0.46	99	women	0.06	0.02	-0.01		0.50	104
Decompostion by age																		
Total	0.04	0.04	0.00	**0.20**	0.49	100	**Total**	0.06	0.06	0.00	**6.84**	0.46	100	**Total**	0.06	0.05	0.00	**7.80**	0.48	100
0-24	0.03	0.00	0.00		0.50	102	0-24	0.07	0.00	0.00		0.39	86	0-24	0.04	0.00	0.00		0.44	91
25-34	0.05	0.00	0.00		0.49	100	25-34	0.07	0.01	0.01		0.41	89	25-34	0.06	0.00	0.01		0.41	85
35-44	0.05	0.01	0.00		0.48	98	35-44	0.06	0.01	0.02		0.41	89	35-44	0.06	0.01	0.01		0.43	90
45-54	0.04	0.01	0.00		0.49	100	45-54	0.06	0.01	0.01		0.44	95	45-54	0.06	0.01	0.02		0.44	91
55-64	0.03	0.01	0.00		0.50	102	55-64	0.05	0.01	0.00		0.46	101	55-64	0.05	0.01	0.00		0.48	100
65-74	0.03	0.01	0.00		0.50	102	65-74	0.05	0.01	-0.01		0.49	106	65-74	0.05	0.01	-0.02		0.52	108
75+	0.03	0.00	0.00		0.50	101	75+	0.04	0.01	-0.02		0.53	115	75+	0.05	0.01	-0.02		0.54	112
Decompostion by region																		
Total	0.04	0.04	0.00	**0.38**	0.49	100	**Total**	0.06	0.06	0.00	**0.62**	0.46	100	**Total**	0.06	0.05	0.00	**5.19**	0.48	100
Belgrade	0.04	0.01	0.00		0.48	99	Nothern Region	0.06	0.03	-0.01		0.47	103	Nord-East	0.05	0.01	-0.01		0.50	104
Vojvodina	0.04	0.01	0.00		0.50	102	Southern region incl. Sofia	0.06	0.03	0.01		0.45	97	South-East	0.06	0.01	0.00		0.50	103
West Serbia	0.03	0.00	0.00		0.49	100								South	0.06	0.01	-0.01		0.51	106
Sumadija	0.03	0.01	0.00		0.49	101								South-West	0.06	0.01	-0.01		0.52	107
East Serbia	0.03	0.00	0.00		0.51	104								West	0.06	0.01	0.00		0.46	95
South-East Serbia	0.03	0.00	0.00		0.49	100								North-West	0.05	0.01	0.00		0.46	97
														Centre	0.05	0.01	0.01		0.45	93
														Bucharest	0.07	0.01	0.02		0.39	81
Decompostion by urban / rural																		
Total	0.04	0.04	0.00	**0.00**	0.49	100	**Total**	0.06	0.05	0.01	**13.59**	0.46	100	**Total**	0.06	0.04	0.01	**23.58**	0.48	100
urban	0.04	0.02	0.00		0.50	101	urban	0.06	0.03	0.07		0.40	86	urban	0.06	0.02	0.09		0.37	78
rural	0.04	0.02	0.00		0.49	101	rural	0.04	0.02	-0.06		0.51	111	rural	0.03	0.02	-0.07		0.53	111
Decompostion by ethnicity																		
Total	0.04	0.03	0.00	**2.26**	0.49	100												
Serbian	0.03	0.03	0.00		0.49	101												
Montenegrin	0.04	0.00	0.00		0.51	104												
Bosnian	0.04	0.00	0.00		0.48	98												
Albanian	0.01	0.00	0.00		0.51	104												
Hungarian	0.02	0.00	0.00		0.52	106												
Croatian	0.02	0.00	0.00		0.51	105												
Roma	0.11	0.00	0.01		0.37	75												
Others	0.02	0.00	0.00		0.51	104												

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

Table A.7b

Multidimensional inequality decomposition
Attribute housing (space and quality)

	Serbia 2007						Bulgaria 2008						Romania 2008					
	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average
Decompostion by education																		
Total	0.04	0.04	0.00	**1.13**	0.49	100	**Total**	0.06	0.06	0.00	**5.90**	0.46	100	**Total**	0.06	0.05	0.01	**12.40**	0.48	100
No education	0.07	0.00	0.00		0.45	92	No education	0.06	0.00	0.00		0.48	105	No education	0.03	0.00	0.00		0.56	118
Low education	0.04	0.01	0.01		0.49	99	Low education	0.06	0.01	-0.01		0.53	115	Low education	0.03	0.01	-0.03		0.57	119
Medium education	0.03	0.01	0.00		0.50	102	Medium education	0.05	0.01	-0.02		0.50	109	Medium education	0.05	0.01	-0.02		0.52	108
Upper secondary	0.03	0.01	-0.01		0.50	103	Upper secondary	0.06	0.02	0.02		0.44	95	Upper secondary	0.06	0.03	0.05		0.43	90
University	0.02	0.00	0.00		0.51	104	University	0.06	0.01	0.02		0.42	91	University	0.04	0.00	0.02		0.40	84
Decompostion by empl. status																		
Total	0.04	0.04	0.00	**0.69**	0.49	100	**Total**	0.06	0.06	0.00	**5.67**	0.46	100	**Total**	0.06	0.05	0.01	**9.38**	0.48	100
Employee	0.03	0.01	0.00		0.49	101	Employee	0.06	0.02	0.03		0.42	91	Employee	0.06	0.02	0.05		0.41	85
Informally employed	0.05	0.00	0.00		0.47	96														
Self-employed	0.03	0.00	0.00		0.51	103	Self-employed	0.06	0.00	0.00		0.46	100	Self-employed	0.03	0.00	-0.02		0.55	114
Unemployed	0.05	0.00	0.00		0.47	97	Unemployed	0.07	0.01	0.00		0.45	99	Unemployed	0.06	0.00	0.00		0.47	98
Retired	0.03	0.01	0.00		0.50	102	Retired	0.05	0.02	-0.04		0.50	109	Retired	0.05	0.03	-0.03		0.50	105
Others not econ. active	0.05	0.00	0.00		0.47	96	Others not econ. active	0.07	0.00	0.00		0.43	94	Others not econ. active	0.04	0.00	0.00		0.47	97
Decompostion by hh-empl-rate																		
Total	0.04	0.04	0.00	**0.58**	0.49	100	**Total**	0.06	0.05	0.00	**7.27**	0.46	100	**Total**	0.06	0.05	0.00	**4.91**	0.48	100
0 - < 0.2	0.04	0.01	0.00		0.49	101	0 - < 0.2	0.05	0.02	-0.04		0.51	112	0 - < 0.2	0.05	0.02	-0.03		0.51	107
0.2 - < 0.4	0.04	0.01	0.01		0.48	98	0.2 - < 0.4	0.06	0.01	0.02		0.41	89	0.2 - < 0.4	0.06	0.01	0.01		0.43	90
0.4 - < 0.6	0.03	0.01	0.00		0.49	101	0.4 - < 0.6	0.06	0.01	0.01		0.43	94	0.4 - < 0.6	0.06	0.01	0.01		0.45	94
0.6 - < 0.8	0.03	0.00	0.00		0.50	101	0.6 - < 0.8	0.05	0.01	0.01		0.41	90	0.6 - < 0.8	0.06	0.01	0.02		0.42	87
0.8 - < 1	0.03	0.00	-0.01		0.52	105	0.8 - < 1	0.05	0.01	0.00		0.45	99	0.8 - < 1	0.06	0.01	0.00		0.49	102
Decompostion by refugee-status																		
Total	0.04	0.04	0.00	**0.06**	0.49	100												
0	0.04	0.03	0.00		0.49	101												
0.5	0.01	0.00	0.00		0.51	104												
1	0.04	0.00	0.00		0.49	100												

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

Table A.8a

Multidimensional inequality decomposition
Massoumi inequality index (ß=0.25)

	Serbia 2007						Bulgaria 2008						Romania 2008					
	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average
Decompostion by gender																		
Total	0.04	0.04	0.00	**0.11**	0.32	100	**Total**	0.03	0.03	0.00	**0.39**	0.34	100	**Total**	0.03	0.03	0.00	**5.06**	0.33	100
men	0.04	0.03	0.00		0.32	101	men	0.03	0.01	-0.01		0.34	101	men	0.02	0.01	-0.02		0.34	103
women	0.04	0.01	0.00		0.32	100	women	0.03	0.02	0.01		0.33	98	women	0.04	0.01	0.02		0.31	93
Decompostion by age																		
Total	0.04	0.04	0.00	**0.43**	0.32	100	**Total**	0.03	0.03	0.00	**3.57**	0.34	100	**Total**	0.03	0.02	0.00	**6.09**	0.33	100
0-24	0.04	0.00	0.00		0.35	111	0-24	0.04	0.00	0.00		0.32	93	0-24	0.01	0.00	0.00		0.33	100
25-34	0.04	0.00	0.00		0.34	107	25-34	0.03	0.00	0.00		0.33	98	25-34	0.02	0.00	0.00		0.35	107
35-44	0.04	0.01	0.00		0.32	101	35-44	0.03	0.00	0.00		0.34	100	35-44	0.02	0.00	-0.01		0.35	105
45-54	0.04	0.01	0.00		0.32	101	45-54	0.03	0.00	-0.01		0.35	104	45-54	0.02	0.00	-0.01		0.35	105
55-64	0.04	0.01	0.00		0.32	101	55-64	0.02	0.01	-0.01		0.35	103	55-64	0.02	0.00	-0.01		0.34	104
65-74	0.04	0.01	0.00		0.32	100	65-74	0.02	0.00	0.00		0.33	97	65-74	0.03	0.01	0.01		0.32	96
75+	0.04	0.01	0.00		0.32	99	75+	0.03	0.01	0.01		0.31	92	75+	0.04	0.01	0.02		0.30	90
Decompostion by region																		
Total	0.04	0.04	0.00	**2.37**	0.32	100	**Total**	0.03	0.03	0.00	**0.94**	0.34	100	**Total**	0.03	0.03	0.00	**0.99**	0.33	100
Belgrade	0.03	0.00	-0.01		0.35	110	Nothern Region	0.03	0.02	0.01		0.33	97	Nord-East	0.03	0.00	0.00		0.32	97
Vojvodina	0.04	0.01	0.00		0.32	101	Southern region incl. Sofia	0.03	0.01	-0.01		0.34	101	South-East	0.02	0.00	0.00		0.32	98
West Serbia	0.05	0.01	0.01		0.31	97								South	0.03	0.00	0.00		0.33	99
Sumadija	0.04	0.01	0.00		0.32	99								South-West	0.03	0.00	0.00		0.33	101
East Serbia	0.04	0.00	0.00		0.32	99								West	0.02	0.00	0.00		0.33	101
South-East Serbia	0.04	0.01	0.01		0.31	97								North-West	0.03	0.00	0.00		0.33	100
														Centre	0.02	0.00	0.00		0.33	101
														Bucharest	0.02	0.00	-0.01		0.35	107
Decompostion by urban / rural																		
Total	0.04	0.04	0.00	**1.50**	0.32	100	**Total**	0.03	0.03	0.00	**3.24**	0.34	100	**Total**	0.03	0.03	0.00	**2.06**	0.33	100
urban	0.04	0.02	-0.02		0.33	104	urban	0.03	0.01	-0.02		0.35	104	urban	0.02	0.01	-0.02		0.35	105
rural	0.04	0.02	0.02		0.31	97	rural	0.03	0.02	0.02		0.32	95	rural	0.03	0.02	0.02		0.32	98
Decompostion by ethnicity																		
Total	0.04	0.04	0.00	**2.29**	0.32	100												
Serbian	0.04	0.03	0.00		0.32	101												
Montenegrin	0.02	0.00	0.00		0.36	113												
Bosnian	0.04	0.00	0.00		0.30	93												
Albanian	0.07	0.00	0.00		0.28	86												
Hungarian	0.04	0.00	0.00		0.32	100												
Croatian	0.02	0.00	0.00		0.34	106												
Roma	0.06	0.00	0.01		0.24	74												
Others	0.03	0.00	0.00		0.33	104												

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.

Table A.8b

Multidimensional inequality decomposition
Massoumi inequality index (ß=0.25)

	Serbia 2007						Bulgaria 2008						Romania 2008					
	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average	MLD	components within	components between	% of MLD	Attribute level	in % of average
Decompostion by education																		
Total	0.04	0.04	0.00	**8.15**	0.32	100	**Total**	0.03	0.01	0.01	**49.21**	0.34	100	**Total**	0.03	0.01	0.01	**52.68**	0.33	100
No education	0.06	0.00	0.01		0.28	86	No education	0.12	0.00	0.02		0.15	45	No education	0.13	0.00	0.02		0.15	45
Low education	0.04	0.01	0.02		0.30	94	Low education	0.02	0.00	0.03		0.26	76	Low education	0.01	0.00	0.03		0.27	83
Medium education	0.03	0.01	0.00		0.32	101	Medium education	0.01	0.00	0.02		0.31	92	Medium education	0.01	0.00	0.01		0.31	95
Upper secondary	0.03	0.01	-0.01		0.34	105	Upper secondary	0.01	0.00	-0.02		0.35	104	Upper secondary	0.01	0.00	-0.02		0.35	105
University	0.03	0.00	-0.02		0.39	121	University	0.01	0.00	-0.03		0.41	120	University	0.01	0.00	-0.03		0.43	130
Decompostion by empl. status																		
Total	0.04	0.04	0.00	**2.82**	0.32	100	**Total**	0.03	0.03	0.00	**10.08**	0.34	100	**Total**	0.03	0.02	0.00	**15.91**	0.33	100
Employee	0.04	0.01	-0.01		0.34	106	Employee	0.02	0.01	-0.02		0.36	106	Employee	0.01	0.00	-0.03		0.36	110
Informally employed	0.04	0.00	0.00		0.31	96														
Self-employed	0.04	0.01	0.00		0.32	101	Self-employed	0.02	0.00	-0.01		0.39	114	Self-employed	0.02	0.00	0.00		0.32	98
Unemployed	0.05	0.00	0.01		0.29	91	Unemployed	0.03	0.00	0.01		0.30	89	Unemployed	0.03	0.00	0.00		0.31	94
Retired	0.04	0.01	0.00		0.32	101	Retired	0.03	0.01	0.02		0.33	96	Retired	0.03	0.01	0.02		0.32	96
Others not econ. active	0.06	0.00	0.01		0.29	90	Others not econ. active	0.05	0.00	0.01		0.30	87	Others not econ. active	0.05	0.00	0.01		0.27	83
Decompostion by hh-empl-rate																		
Total	0.04	0.04	0.00	**2.81**	0.32	100	**Total**	0.03	0.03	0.00	**12.92**	0.34	100	**Total**	0.03	0.02	0.00	**13.36**	0.33	100
0 - < 0.2	0.04	0.01	0.02		0.30	95	0 - < 0.2	0.03	0.01	0.03		0.31	91	0 - < 0.2	0.03	0.01	0.03		0.31	92
0.2 - < 0.4	0.03	0.01	0.00		0.32	99	0.2 - < 0.4	0.03	0.00	0.01		0.32	93	0.2 - < 0.4	0.01	0.00	0.00		0.32	98
0.4 - < 0.6	0.04	0.01	-0.01		0.34	105	0.4 - < 0.6	0.02	0.00	-0.01		0.35	103	0.4 - < 0.6	0.02	0.00	-0.01		0.34	103
0.6 - < 0.8	0.04	0.00	-0.01		0.34	106	0.6 - < 0.8	0.02	0.00	-0.01		0.36	107	0.6 - < 0.8	0.01	0.00	-0.01		0.36	109
0.8 - < 1	0.04	0.01	-0.01		0.34	107	0.8 - < 1	0.02	0.00	-0.02		0.39	115	0.8 - < 1	0.02	0.00	-0.02		0.37	111
Decompostion by refugee-status																		
Total	0.04	0.04	0.00	**0.03**	0.32	100												
0	0.04	0.04	0.00		0.32	101												
0.5	0.02	0.00	0.00		0.34	105												
1	0.03	0.00	0.00		0.33	104												

Sources: Serbia 2007: Living standard measurement survey; Bulgaria, Romania 2008: EU-SILC, own calculations.