Constructing indices of multivariate polarization

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Polarization is commonly connected with the division of a society into groups as possible cause of social conflicts. It is measured by quantifying and comparing socio-economic disparity, not only in terms of differences among individuals (as inequality measurement does) but also in terms of differences among population groups.

Two strands are distinguished in the literature on univariate polarization: the first one, going back to Wolfson (1994, 1997), describes the decline of the middle class, measuring how the center of the income distribution is emptied. The second strand, originating from Esteban and Ray (1994), focuses on the rise of separated income groups; polarization is the larger the more homogeneous the groups are, the more separate, and the more equal in size.

These papers study polarization in terms of the distribution of incomes; however, societal status of a person and distance between persons (and groups) are not determined by income alone but also by other monetary and non-monetary characteristics of well-being, such as wealth, education, and health. In the measurement of economic inequality and poverty, several authors have pointed out that attributes beyond income should be included in the analysis. Consequently, they have introduced various multi-attribute measures of inequality and poverty; see, e.g., Atkinson and Bourguignon (1982), Kolm (1977), Maasoumi (1986), Bourguignon and Chakravarty (2003), Tsui (1995, 1999).

Obviously, also the splitting of a society into groups is influenced by attributes besides income. This paper presents a first inquiry into the multi-attribute measurement of polarization. Our approach adopts the view of Esteban and Ray (1994): multi-attribute polarization corresponds to splitting the society into groups that are well separated, inside homogeneous, and of comparable size.

We construct multivariate indices of polarization, using the decomposition by subgroups of certain indices of multivariate inequality, in particular the inequality indices of Maasoumi (1986), Tsui (1995, 1999) and Koshevoy and Mosler (1997). These indices can

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be decomposed into a 'within groups' component and a 'between groups' component of inequality. Based on them we introduce multivariate polarization indices that increase with respect to between groups inequality and decrease with respect to within groups inequality. Besides, the relative size of the groups matters. Therefore, we employ simple measures of relative groups size that indicate the deviation from equally sized groups and construct polarization indices which, additionally, decrease in these measures. Thus, our approach results in indices which are function of three elements: the measures of inequality between groups, of inequality within groups and of relative groups size.

Such indices apply to arbitrary grouped data and do not assume given groups or relative group sizes.

Further, classical postulates on the measurement of univariate polarization are considered and extended to the multivariate setting. We then investigate how these postulates are satisfied by our polarization indices.