Cultural diversity and segregation in German cities – descriptive evidence from geo-referenced data

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International migration gives rise to significant changes in the demographic composition of new host regions and neighborhood. These changes likely cause important social and economic effects in the regions of destination. A rapidly growing number of studies investigates the economic effects of cultural diversity of regions (e.g. Niebuhr 2010, Suedekum et al. 2014).

Beneficial economic effects of cultural diversity can result from productive complementarities. Workers who differ with respect to their cultural background likely possess skills that are complementary in production processes. Ottaviano and Peri (2006) for example argue that skills of foreign workers might complement those of the native labour force and cultural diversity has thus a positive impact on regional productivity. Interaction between workers with different skills and cognitive abilities is supposed to foster knowledge transfer and the generation of new ideas (Alesina and La Ferrara 2005).

However, there are likely adverse effects of diversity as well. Heterogeneity of the workforce might hamper the interaction between different groups. Lazear (2000) considers costs of diversity arising from barriers to communication caused by different languages and cultures. Some authors stress the importance of social similarity for interaction, communication, and cohesion among the workforce (Pelled et al. 1999). Interaction may therefore decrease as workforce heterogeneity increases and diversity may cause misunderstanding, conflicts and uncooperative behavior (DiTomaso et al. 2007, Basset-Jones 2005).

Positive and negative effects of cultural diversity require that individuals are exposed to heterogeneity. When diversity at the regional level is concerned interaction assumes that different cultural groups are not perfectly segregated from each other. However, a specific degree of diversity at the regional level might involve quite different patterns of spatial clustering. Simulation results in Arribas-Bel et al. (2016) suggest that more diverse populations are associated with a greater degree of spatial clustering for given preferences and geography.

Data

We investigate the relationship between cultural diversity of the workforce measured at the city level and segregation at the neighborhood level in all German cities with at least 100,000 inhabitants. We calculate diversity measures and indicators of spatial clustering based on geo-referenced register data. The register data are collected in the administrative processes of the

German Federal Employment Agency (FEA) and maintained in the Integrated Employment Biographies (IEB) of the Institute of Employment Research (IAB). The IEB cover all employed persons who are subject to social security contributions, recipients of unemployment benefit and social welfare, participants in active labor market policy and persons registered as job seekers at the FEA.

A geo-coded version of the IEB is available for the years 2007 to 2009. Each person in the IEB is assigned to quadratic grid cells of 500 meter length with respect to both her workplace and the residential address corresponding to each person's main spell at June 30th 2009 (see Scholz et al. 2012). We use these grid cells as our basic definition of neighborhood.

Whereas most studies which deal with cultural diversity make use of population data, we use all individuals covered by the IEB as our population. In the IEB the citizenship of the persons is available. Thus, nationality defines cultural identity of employees in this study. Country of birth is the most widely used indicator in this context. However, information on country of birth is not available in German statistics. With the data at hand we can differentiate between more than 200 nationalities.

Measurement of diversity and spatial clustering

Different measures are applied in order to investigate cultural diversity and spatial clustering of ethnic groups at the city and the neighborhood level.

The inverse Herfindahl index is a first measure of cultural diversity and indicates the probability that two randomly drawn individuals in an area belong to two different groups:

$$H_a = 1 - \sum_{g=1}^{G} \frac{P_{ga}}{P_{\bullet a}}$$

Where P_{ga} is the population of group g in area a and $\bullet$ indicates aggregation over the corresponding index. G is the number of different nationalities in region a. The inverse Herfindahl index considers both richness of the distribution, i.e. number of nationalities is the area, and the evenness of the distribution across groups. The diversity of a region will thus increase if the number of distinct ethnic groups rises and/or if the proportions of different nationalities converge. A disadvantage of this measure is, however, that the index assigns disproportionately high weights to the largest groups and the results are therefore largely determined by the natives. The inverse Herfindahl index is highly correlated with the shares of Germans and foreigners, respectively (see Niebuhr 2010 for corresponding evidence for Germany).

We also use the segregation index proposed by Duncan and Duncan (1955). The measure points to the share of people of group g which would have to relocate in order to arrive at a spatial distribution that is identical to that of a reference group. Nijkamp and Poot (2015) note that the measure is also known as the dissimilarity index when it is computed between one group and all other groups. The index for group g across area units a is given by:

$$S_g = \frac{1}{2} \sum_{a=1}^{A} \left| \frac{P_{ga}}{P_{g\bullet}} - \frac{(P_{\bullet a} - P_{ga})}{(P_{\bullet\bullet} - P_{g\bullet})} \right|$$

The segregation index takes its maximum value one if the group g never co-locates with other groups in specific areas. In contrast, the minimum value zero points to a spatial distribution of group g that coincides with that of the rest of the population. However, a particular value of S_g can correspond with dispersed or highly clustered spatial pattern because the distribution of group g is compared with the spatial distribution of a reference group. In the equation above the reference is given by the entire population excluding the group under consideration.

The so-called isolation index provides information on the extent to which the considered group dominates the population of a specific neighborhood. Thus, the measure enables us to deal with the problem mentioned above that the indicated amount of segregation can arise from a pronounced spatial clustering as well as a rather dispersed spatial distribution. The measure indicates the degree of clustering of a specific group, i.e. the extent to which members of the group are disproportionately located in the same areas:

$$I_g = \sum_{a=1}^{A} \frac{ga(P_{ga} / P_{\bullet a})}{P_{g\bullet} / P_{\bullet\bullet}}$$

where $ga = P_{ga} / P_{g\bullet}$ are weights which reflect the areas share of the population of group g. A value of one indicates that the group is distributed in proportion to the total population. A much larger value of I_g points to isolation or a pronounced spatial clustering. The most extreme pattern is given by a distribution where all group members locate in one particular area in which no other groups reside. Arribas-Bel et al. (2016) note, however, that the isolation index only provides limited information on the spatial patterns.

Another segregation measure that we consider in this analysis is the concentration index by Ellison and Glaeser (1997). We use the formulation by Maré et al. (2012) who focus on the spatial concentration of people rather than firms. The idea of the measure is to compare the actual location pattern with a pattern that results from a random assignment of individuals to areas:

$$C_g = \frac{\dfrac{\left\{\sum_{a=1}^{A}\left(\dfrac{P_{ga}}{P_{g\bullet}} - \dfrac{P_{\bullet a}}{P}\right)^2\right\}}{\left(1 - \sum_{a=1}^{A}\left(P_{\bullet a}/P\right)^2\right)} - \dfrac{1}{P_{g\bullet}}}{\left(1 - \dfrac{1}{P_{g\bullet}}\right)}$$

A value of the concentration index close to zero points to a rather even distribution of the group across areas. We calculate a benchmark for C_g using information on a group whose location is considered to be more or less random or in other words roughly proportional to area population sizes. Arribas-Bel et al. (2016) propose to use the spatial distribution of females (or of males) as a benchmark. Both genders should show relatively low values of C_g which can then be used as a reference for gauging spatial clustering of different cultural groups.

Apart from the inverse Herfindahl index the measures discussed so far provide information on the spatial clustering of a specific group relative to the rest of the population. Thus, we might use these indices in order to compare the spatial distribution two groups, e.g. foreigners versus natives. A measure that allows a multigroup analysis is Theil's information index:

$$T = \sum_{g=1}^{G} \sum_{a=1}^{A} \frac{P_{\bullet a}}{P_{\bullet\bullet}} \left[\frac{\left(P_{ga}/P_{\bullet a}\right)\left(\ln\left(P_{g\bullet}/P_{\bullet\bullet}\right) - \ln\left(P_{ga}/P_{\bullet a}\right)\right)}{\sum_{g=1}^{G} \left(P_{g\bullet}/P_{\bullet\bullet}\right) \ln\left(P_{g\bullet}/P_{\bullet\bullet}\right)} \right]$$

In case all groups are equally distributed across areas, the Theil index takes the value zero. It converges towards one if the spatial pattern approaches near-complete segregation.[1]

Results

- Coming soon

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[1] Calculation of the index requires there is at least one individual of each group in each area. For computation Arribas-Bel et al. (2016) suggest to add a negligible amount to zero counts if a share is zero.

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