Complexity of multiscale residential context: Where do neighbourhood effects end?

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Extended abstract

Background and aim of the study

Socio-spatial inequalities have been increasing in many European cities (Tammaru, van Ham, Marcińczak, & Musterd, 2016), and governments have a long history of developing area-based policies to target deprived neighbourhoods. Such policies are based on the belief that living in deprived areas has negative impacts on individual outcomes, such as educational attainment, health, or success on the labour market – so-called neighbourhood effects (see Dietz, 2002; Durlauf, 2004; Ellen & Turner, 1997; Galster, 2002 for a review). Many studies have examined neighbourhood effects on individual socio-economic status, usually measured by personal income (see, for instance, Bolster et al., 2007; Brännström, 2005; Hedman, Manley, Van Ham, & Östh, 2015; Ludwig et al., 2013), or individual employment chances (Bauer, Fertig, & Vorell, 2011; Van der Klaauw & Van Ours, 2003). These studies refer to a variety of mechanisms through which spatial context could influence individual socio-economic status. For example, neighbours may serve as role models, influence other people's labour market behaviour, or provide social networks for informal job search. Furthermore, job applicants from deprived neighbourhoods may be stigmatised by potential employers, and jobs and workers can be spatially mismatched (for a comprehensive review of neighbourhood effect mechanisms, see Galster, 2012).

There is no reason to suppose that these mechanisms operate at single spatial scale. In fact the converse is true and they are likely to operate at various spatial scales: people are exposed to others from the moment they open the front door of their home, then as they move a few streets away, and also across more distant parts of the city. Thereby, specific mechanisms of neighbourhood effects can be associated with different spatial scales, for example, social mechanisms with an individual's immediate neighbourhood, and stigmatization with larger areas (Manley, Flowerdew, & Steel, 2006; Van Ham & Manley, 2012). However, poverty concentrates at different spatial levels in different places, and stigmatised areas may be particularly large in big cities compared to smaller urban settlements (Wacquant, 2007). It follows that the same mechanism of neighbourhood effects may operate at different scales in different geographical settings (Van Ham & Manley, 2012). Modelling neighbourhood effects, therefore, requires appropriate areas, once with characteristics relevant to specific outcomes being studied (Diez Roux, 2001).

Unfortunately, socio-economic data are usually only available for standard administrative units, often at a spatial scale. Therefore, most evidence on neighbourhood effects on individual socio-economic status is confined to these administrative units. This is too simplified representation of the spatial context where people live. Crucially, some administrative units used in neighbourhood effects studies such as U.S. counties (see, for instance, Chetty & Hendren, 2018) are much bigger than what both local residents and external people would consider as "neighbourhood". Therefore, what is studied under the flag of neighbourhood effects is often an effect of a much larger context.

Few studies have explicitly looked at the scale at which neighbourhood effects operate and attempted to explain the underlying mechanisms. In addition, most of these studies compare only two spatial scales. For instance, Overman (2000) examined neighbourhood effects on school dropout of Australian teenagers at two spatial levels. The author attributed the effect of the larger areas to the local labour market demand, whereas the effect of the smaller areas appeared to be consistent with social networks and peer group influences. Other examples of studying neighbourhood effects at different spatial scales deal predominantly with personal health and health-related issues (Duncan et al., 2014; Lebel, Pampalon, & Villeneuve, 2007), or with political attitudes and voting behaviour (Gannon, Livingston, Bailey, Kearns, & Leyland, 2012; Johnston et al., 2005; MacAllister et al., 2001), but also educational achievement (Andersson & Malmberg, 2014). However, neighbourhood effects on economic outcomes are hardly ever examined at more than one scale (but see Andersson & Musterd, 2010; Bolster et al., 2007; Buck, 2001; Hedman et al., 2015).

Although it has been missing from much of the empirical literature on neighbourhood effects, spatial scale is a well-known methodological issue. Along with zonation, scale is one aspect of the modifiable areal unit problem (MAUP), which occurs when statistical analyses of the same data yield different results depending on the way the data are spatially aggregated, i.e. where the boundaries are placed and how big the aggregated areas are (Manley, 2014; Openshaw & Taylor, 1979). Scale matters not only for measuring single variables and correlation between variables (Manley et al., 2006), but also for modelling socio-spatial process, notably segregation (Manley, Johnston, Jones, & Owen, 2015; Reardon et al., 2008; Wong, 2003).

Neglecting spatial scale in the empirical neighbourhood effects research is, to a great extent, due to data constraints. Increasingly available micro-geographic data overcome some of the limitations of the predominantly used administrative units, whose size does not always coincide with the spatial scale which neighbourhood effect mechanisms operate at. A further drawback of the administrative units is the boundary effect, which applies when a person living close to the edge of the area is oriented to an adjacent neighbourhood rather than to more distant parts of their own neighbourhood.

This study addresses these scale problems by investigating how the effect of spatial context on personal income changes across multiple spatial scales and in different places. We used individual level data from the Netherlands, which includes low level geocoding for each person's place of residence. We created bespoke areas (centred around each person's location) at 101 scales, as explained in Petrović, van Ham, and Manley (2018), measured the share of low-income people in these areas, and modelled its effect on personal income at the entire range of scales. The purpose is to challenge the current understanding of neighbourhood as a static single-scale entity (Manley et al., 2006) and to demonstrate the instability of contextual effect models when using different scales of context. By modelling contextual effects for the entire country as well as for specific metropolitan areas, the study demonstrates that our understanding of contextual effects depends not only on spatial scale, but on spatial scale in specific urban environments.

Data and methods

We use register data for the entire population of the Netherlands, recorded in the Social Statistical Database – SSD (*Sociaal Statistisch Bestand* – SSB; see Bakker, 2002; Houbiers, 2004). Crucially, the individual-level data are geo-referenced and include 100m×100m grid cells within which each person lives. The longitudinal and spatially detailed data made it possible for us to follow individual residential histories for a long time (1999-2014) and to measure area characteristics at multiple spatial scales. Controlling for several personal and household characteristics, namely age, education, non-Western background, household type and children, we modelled contextual effects on personal income from work for all men who were in the working age (20-65) throughout the whole period (20-51 in 1999 and 34-65 in 2014). We consider only men to avoid interaction or gender with other variables (gender effect is not the primary interest), and the fact that many women in the Netherlands work part-time.

We measured the proportions of low-income people in the increasingly large areas. Income includes income form work as well as social welfare payments received by the working age population. To calculate the share of low-income people, we adjusted the definition of the International Labour Organisation (ILO) to the local conditions in the Netherlands, and defined low-income people more rigorously as those who receive less the 40% (instead of two thirds) of the median income in their municipality. Local median from each municipality should reflect economic differences within the country. Surrounding every inhabited 100m×100m cell in the Netherlands, we created bespoke areas of 100 different sizes. The smallest neighbourhood is the cell where the person whose income is being modelled lives. From this base spatial unit other bespoke areas spread in hundred concentric circles, radii of which range from 100m up to 10km, with 100m increments.

Preliminary results

Preliminary results represent the whole-country (Figure 1) and place-specific (Figure 2) estimates of neighbourhood effects. The left part of Figure 1 shows the variance components of the neighbourhood characteristics the share of low-income people in the area. While a fixed effects model would only include the within variance, the between variance suggests that spatial distribution of people should not be ignored. Therefore, we used random effects model, whose results are shown in the right part of Figure 1. The results demonstrate that the contextual effects are different at different spatial scales, which means that using one scale can hide an effect which operates at another scale.

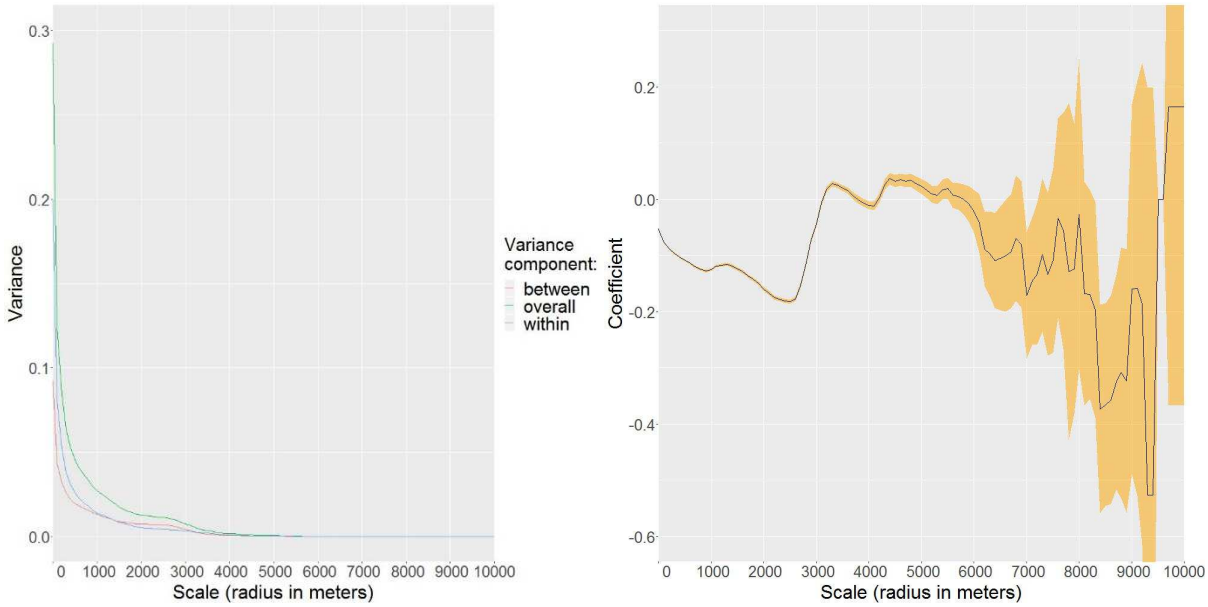

Figure 1: Variance of the share of low-income people in measured at 101 spatial scales and the effect of this variable on personal income from work (random effect model)

Figure 2 shows the results for people who lived in one of the four metropolitan regions (Amsterdam, Rotterdam, Utrecht, or Groningen) in the entire period 1999-2014. In this setting, larger areas represent a "shared context" for many people whose income is being modelled and, therefore, they do not exert an effect on people's income. Smaller areas represent more localised contexts and their effect diminishes at different scales in different urban regions. It is interesting to note that the scale at which the localised context becomes a shared context is different for each of the places.

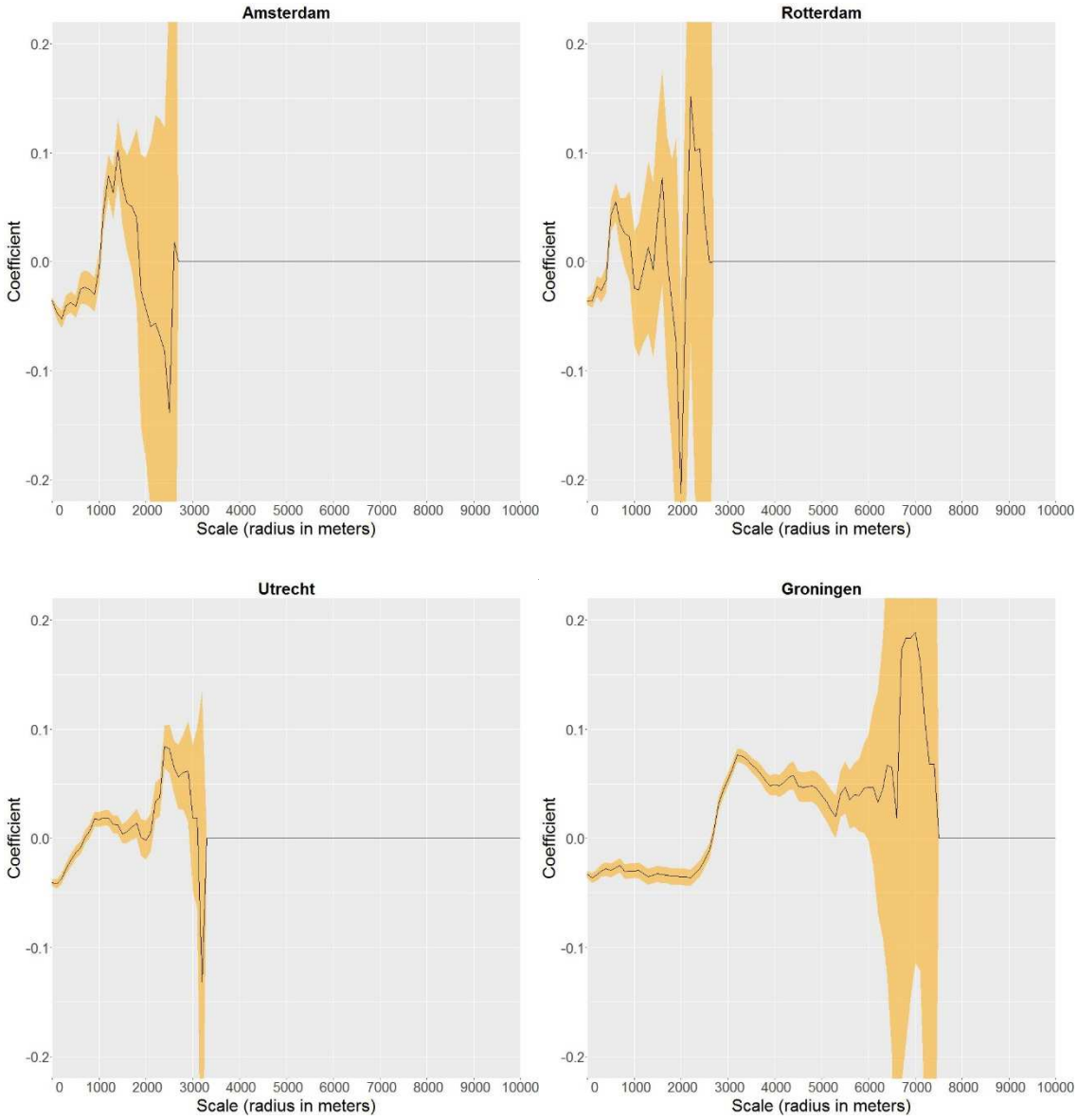

Figure 2: Effect of the share of low-income people, measured at 101 spatial scales, on personal income from work for people in the metropolitan regions of Amsterdam, Rotterdam, Utrecht, and Groningen (random effect model)

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