

Sinks and Sluices: Contrasting Dynamics in Spatial Assimilation Pathways*

Kristian Gade Kjellmann, Anja Jørgensen

Abstract: This study examines how neighbourhoods can be understood through their functional roles in immigrant settlement trajectories. The analysis treats neighbourhoods not as fixed containers of deprivation, concentration, or opportunity but as dynamic and shaped by group-specific settlement patterns. Drawing on register data on first-generation immigrants arriving in Denmark between 2007 and 2012, internal migration is modelled through immigrant-group networks of resettlement flows between neighbourhoods. The concepts of *sinks* and *sluices* are used as analytical relabellings of existing theoretical insights about settlement, stability, and onward mobility. The Hubs and Authorities (HITS) algorithm is used to identify sinks as prominent destinations with limited onward movement and sluices as central transitional locations. These classifications are then linked to a composite measure of integration-related outcomes, based on selected socioeconomic and household-related indicators observed at settlement and five years later.

The findings do not show a uniform association between sink or sluice functions and integration-related outcomes. Sink neighbourhoods are, on average, associated with somewhat higher reductions in disadvantage than sluices, especially in the second cohort, but this pattern is modest and varies across immigrant groups, cohorts, and specific neighbourhoods. The same neighbourhood may function as a site of prolonged settlement for one immigrant group and as a transitional location for another; or it may change function over time. The main contribution is therefore methodological and conceptual: the sink-sluice distinction identifies neighbourhoods that occupy central roles in immigrant settlement patterns and may warrant closer investigation as potential sites of spatial assimilation, enclave formation, constrained mobility, selective movement, or neighbourhood succession. The study thus offers a way to move beyond general claims about segregation toward a more differentiated account of how place, mobility, and integration are connected.

Keywords: Immigration • Internal migration • Residential assimilation • Neighbourhood dynamics

* This article belongs to a special issue on "Migration Trajectories Across the Life Course".

1 Introduction

Denmark, like other Western European countries, has seen an increase in immigrants in recent years. This has led to increased segregation between migrants and natives with growing neighbourhood divergence (*Andersen 2017; Imeraj/Gadeyne 2024; Malmberg et al. 2018*), spurring extensive policy changes and new empirical research on segregation in Europe. From a policy perspective, increased segregation is considered a negative outcome with specific concerns raised about the erosion of generalised trust, reduced employment opportunities, and obstacles to integration. Segregated neighbourhoods are associated with higher seclusion and the strengthening of non-native cultural norms and values. On the research side, the emphasis is on specific neighbourhood effects like deprivation and segregation on integration outcomes, focusing less on trajectories despite encouragement to do so (*Galster 2012*). However, a growing body of literature addresses trajectories of immigrant populations, revealing group-specific patterns of internal migration but with non-uniform outcomes across immigrant groups. These studies primarily concentrate on individual-level outcomes and predictors of settlement and resettlement, while paying comparatively less attention to neighbourhoods as an analytical unit with variable functions for immigrant settlement patterns. Because recent studies indicate that the same immigrant group may experience different integration outcomes depending on neighbourhood context (e.g. *Catney 2018*) and that the relationship between individual-level outcomes and neighbourhood characteristics can function in both directions (e.g. *Bolt/Kempen 2010; Vaalavuo et al. 2019*), there is a growing need for research that conceptualises neighbourhoods as active contexts shaped by, and shaping migration flows and settlement processes. The purpose of this study is to analyse how individual neighbourhoods may function differently in terms of integration outcomes for different immigrant groups. Furthermore, the study aims to move beyond treating a neighbourhood as a fixed unit, instead viewing it through the perspective of those moving into it. Employing the terminology of sinks and sluices, we construct a data-driven typology of neighbourhoods based on internal re-migration patterns of immigrants. We then examine how neighbourhoods with specific internal migration patterns may be associated with different integration-related trajectories for different immigrant groups. The study employs network-analysis methods to identify neighbourhoods of interest in terms of internal migration patterns, treating neighbourhoods as network nodes and migrations as ties. The neighbourhoods are then further analysed based on the characteristics of both the neighbourhood population and the immigrant in-movers.

2 Immigration, internal migration, and mobility

Patterns of immigrant settlement and internal migration are central to understanding integration processes. Immigrants do not distribute themselves geographically in random fashion but rather settle in specific neighbourhoods that differ by opportunity

structure, social composition, and institutional resources (Andersen 2017; Catney *et al.* 2021; Peach 1996; Galster 2012; Sampson/Sharkey 2008; Vogiazides/Chihaya 2020). These settlement patterns are directly related to integration outcomes and neighbourhood development (Sampson *et al.* 2002; Nieuwenhuis *et al.* 2020; Wimark *et al.* 2019).

To theorise these processes, it is necessary to consider how neighbourhoods may evolve through migration and how they, in turn, shape social and economic outcomes.

2.1 An ecological perspective on migration

In studies of segregation, neighbourhoods are commonly treated either as context exposure or as outcomes of socio-spatial processes, with their characteristics typically captured through measures of deprivation, immigrant concentration, or income composition. However, neighbourhoods can also be understood as social units, each with its own social characteristics, situated at very different stages of community interaction and social cohesion. This view directs attention to the uneven integration of immigrants, showing how opportunities for belonging or exclusion are tied to local dynamics of settlement and displacement rather than structural forces alone.

A human ecology perspective on neighbourhoods emphasises the need for a differentiated understanding both of places and of the residential preferences of distinct social and cultural groups. Within this perspective, urban settings are seen not only as diverse but as segmented into neighbourhoods that vary by cultural and demographic homogeneity, social cohesion, and resident continuity (Burgess 1925; Park 1952; Park *et al.* 1925). Seminal works in this tradition highlight how social problems like organised crime, youth delinquency, mental illness, and homelessness are tied to local variations in socioeconomic standards, community interaction, and social cohesion (Anderson 1923; Faris/Dunham 1939; Landesco 1929; Reckless 1933; Shaw 1930; Thrasher 1927; Zorbaugh 1929). Social relatedness to place is thus intrinsically linked to broader processes of growth, stability, and decline in different urban neighbourhoods. This has several implications. First, it is affected by demographic and socioeconomic processes of urban change, the outcomes of which vary across neighbourhoods. Second, it is related to residential moves – highlighting that some individuals are long embedded in their neighbourhoods while others are more transitory.

While the concept of ecological succession – the gradual replacement of species in an ecosystem (Robert Ezra Park 1936) – has been criticised for being deterministic and for assuming a one-way trajectory of neighbourhood evolution (Athens 2020), the ecological vocabulary of urban change remains useful as a way of recognising that neighbourhoods are interconnected and that residential segregation is tied to selective mobility. Empirical research consistently shows that immigrant groups are not randomly distributed, but rather settle in specific neighbourhoods (Andersen 2017; Catney *et al.* 2021; Peach 1996; Galster 2012; Sampson/Sharkey 2008). In recent years, this sorting has intensified in the Nordic countries for non-European

immigrants especially, as non-European immigrants become distributed across fewer neighbourhoods over time, leading to increasing residential segregation (Malmberg *et al.* 2018). However, an ecological interpretation of this trend has an important limitation: it risks treating neighbourhoods as uniform environments whose meanings and effects are the same for all residents. Immigrant groups may use the same neighbourhoods differently depending on their resources, family ties, co-ethnic networks, housing-market constraints, and exposure to discrimination. Thus, immigrant concentration in particular neighbourhoods cannot be interpreted only as a stage in a general process of succession or assimilation, since residence in immigrant-dense areas may result from contrasting mechanisms: restricted residential choice and unequal access to other neighbourhoods on the one hand, or strategic proximity to family, co-ethnic networks, local institutions, and enclave resources on the other. How neighbourhoods function is therefore likely to differ across groups, making it necessary to analyse residential segregation as heterogeneous processes through which different groups convert resources, constraints, and local ties into distinct residential trajectories (Bolt/Kempen 2010; Vaalavuo *et al.* 2019; McAvay/Safi 2018; Vogiazides 2018; Vogiazides/Chihaya 2020).

2.2 Neighbourhood sorting and integration outcomes

The negative effects of residential segregation are numerous and well-documented. Segregation is associated with restricted labour-market opportunities, poorer health outcomes, and limited host-language proficiency (Peach 1996; Wimark *et al.* 2019). These, in turn, have been linked to over-qualification (Kracke/Klug 2021; Wald/Fang 2008) and comparatively low earnings (Battu/Sloane 2004). Furthermore, segregation and marginalisation are linked to reduced out-group contact, which has been shown to decrease generalised trust and affect spatial, social, and economic mobility (Andersen 2015; Dinesen/Sønderskov 2015; Imeraj/Gadeyne 2024; Peach 1996; Putnam 2007; Tubergen *et al.* 2004). Immigrants are also more likely to reside in deprived neighbourhoods, which can affect employment rates up to ten years after immigration (Vogiazides/Chihaya 2020; Wimark *et al.* 2019). The neighbourhood as a setting and community also affects integration by providing either positive or negative examples for socialisation into the host country, as noted by Wimark *et al.* (2019): “a scarcity of employed persons nearby may lead to negative attitudes to work” (p. 120). Conversely, some studies have found how the presence of affluent neighbours can have positive effects on immigrant economic outcomes, but seemingly more so in the U.S. than in Western Europe (Galster 2012; Wessel *et al.* 2017). However, distinct immigrant settlement patterns do not determine integration outcomes. Especially the role of “immigrant-dense” neighbourhoods has been disputed, either being viewed as a “port of first entry” (Burgess 1928) that upwardly mobile residents seek away from, or as a stable community. Spatial assimilation theory explicitly links economic success and residential settlement, where residence in immigrant-dense neighbourhoods is seen as a temporary stepping stone, with resettlement into more native-dense neighbourhoods as an intrinsic part of economic integration and acculturation (Massey *et al.* 1994; Massey/

Denton 1985). By contrast, ethnic enclave theory states how immigrant groups may achieve economic success without acculturation, and thus experience economic mobility without resettlement (Portes/Manning 1986). Building on this notion, segmented assimilation theory underlines how acculturation processes can be highly selective and differ across immigrant groups (Portes/Zhou 1993). These perspectives highlight the importance of understanding internal migration of immigrants as an integral part of integration, but also imply that integration may go hand-in-hand with residential trajectories and settling with natives for some immigrant groups but not for others. The majority of immigrants engage in internal re-migration as part of settling in a country (Bernard/Vidal 2023). Due to the negative outcomes often associated with living in immigrant-dense neighbourhoods, it is often assumed that immigrants living in such neighbourhoods is a matter of displacement rather than preference or choice. Research has even been criticised for equating so-called “multi-ethnic neighbourhoods” with segregated neighbourhoods (Catney *et al.* 2021). Living with other immigrants or co-nationals can bring benefits such as social cohesion, strengthened cultural practices, and support for local institutions and businesses (Chihaya *et al.* 2022; Peach 1996; Vogiazides 2018). Perceptions of neighbourhoods may also differ, especially in countries with welfare support, as low-income immigrants may see low-income neighbourhoods as adequate when they have access to public welfare support (Wessel *et al.* 2017). Studies of internal migration patterns provide insights into immigrant neighbourhood preferences. Income, higher education, and having a native-born spouse have been found to increase the likelihood of immigrants moving to less deprived neighbourhoods (Clark *et al.* 2014; Imeraj/Gadeyne 2024; Vogiazides 2018), while time in the host country, increased immigrant populations, and the presence of local ties decrease the likelihood of moving (Andersen 2017, 2015; Fischer/Malmberg 2001; Imeraj/Gadeyne 2024). Unemployment and lower income are associated with increased mobility without improved residential conditions (Andersen 2017; Vogiazides/Chihaya 2020); this pattern extends also to non-immigrants in Oslo (Toft 2018). Studies also find that especially non-European immigrants tend to live in metropolitan or inner-city areas (Imeraj/Gadeyne 2024; Malmberg *et al.* 2018).

2.3 Variations in immigrant settlement and outcomes

While overall trends for immigrant settlement patterns can be observed, studies find that they differ substantially between immigrant groups with different propensities to move based on migrant background (Benassi *et al.* 2024; Imeraj/Gadeyne 2024; Simpson/Finney 2009; Benassi/Iglesias-Pascual 2023), and there are considerable differences in the likelihood of upward residential mobility across immigrant groups (Vogiazides 2018; Vogiazides/Chihaya 2020; Wessel *et al.* 2017). Differences in length of stay in the initial neighbourhood have also been observed between immigrant groups (Wimark *et al.* 2019). Some studies attribute these differences to religion, with more openly religious immigrant groups tending to settle in the same neighbourhoods (Sapiro 2019; Shuttleworth *et al.* 2021). Others find that preferences simply differ across immigrant groups (Andersen 2017; Van Der

Laan Bouma-Doff 2007). *Benassi/Iglesias-Pascual* (2023) found that neighbourhood sorting is tied to specific immigrant groups, with a tendency for immigrants to live alongside members of the host society if they share ethnic or cultural traits, while other groups are more often concentrated in lower-income areas, citing social rejection as a likely cause. Ethnic origin by itself has not been associated with leaving immigrant-dense neighbourhoods (*Andersson* 2013); a more recent study suggests that ethnic minorities are by contrast less likely to move out of such areas (*Boschman et al.* 2017). Ethnic enclave theory assumes that shared cultural norms and social cohesion among residents are necessary for the neighbourhood to function as a community. These need not always be present. *Robert Sampson's* concept of collective efficacy (*Sampson* 2013) underlines how neighbourhoods differ in their capacity to act and function as communities. The concept stresses the need to look beyond demographic distributions and availability of economic resources to understand how individuals mobilise and engage socially and culturally within the neighbourhood, as changes in one aspect are not necessarily tied to changes in the other (*Sampson et al.* 1997). Indeed, within-country regional differences in terms of immigrant settlement patterns have been observed, with different preferences for and effects of living in metropolitan areas (*Benassi et al.* 2024; *Vogiazides/Chihaya* 2020; *Wessel et al.* 2017). A study by *Vogiazides and Chihaya* (2020) of immigrant trajectories in Sweden showed that immigrants moving across greater distances have a greater probability of staying in persistent neighbourhood deprivation regardless of settlement location. Increases in income, while generally associated with migrating to more affluent areas, have in Finland been observed to increase the probability of re-migrating to low-income neighbourhoods as well as non-low-income areas within the same immigrant group (*Vaalavuo et al.* 2019), highlighting unobserved factors in explaining determinants of immigrant settlement and integration trajectories.

2.4 Neighbourhood functioning and neighbourhood effects

The literature reviewed above suggests that immigrant groups differ in settlement locations and in how settlement relates to their integration outcomes. Existing research often approaches segregation through the lens of neighbourhood effects, treating neighbourhoods either as exposures or outcomes defined by features such as deprivation, immigrant concentration, or income composition. However, previous studies find distinct settlement patterns tied to specific immigrant groups, suggesting that this is not simply a matter of fixed neighbourhood characteristics but a matter of specific places. A central implication here is that immigrant-dense neighbourhoods are not inherently detrimental, just as dispersal is not inherently beneficial. Neighbourhoods may operate as sites of support, constraint, accumulation, or temporary locations depending on the interaction between resources, preferences, discrimination, local social processes, and metropolitan opportunity structures (*Portes/Manning* 1986; *Portes/Zhou* 1993; *Sampson et al.* 1997; *Sampson et al.* 2002; *Vaalavuo et al.* 2019; *Bolt/Kempen* 2010). Crucially, because different immigrant groups and differently positioned migrants do not convert resources into residential

mobility in the same way, the segregation consequences of settlement may diverge between immigrant groups in the same location.

To move beyond a reductionist understanding of neighbourhoods as effects, this article conceptualises neighbourhoods through immigrant groups' settlement patterns. To this end, we use the concepts *sinks* and *sluices* as an adaptation and analytical relabelling of insights from urban ecology, spatial assimilation, ethnic enclave theory, and segmented assimilation into concepts that capture the relational role of neighbourhoods.

Starting from the urban-ecology insight that neighbourhoods are shaped by mobility, *sinks* refer to neighbourhoods acting as prominent destinations while characterised by limited onward movement. Such immobility may indicate deprivation and constrained residential options, but it may also reflect stability, social embeddedness, or the benefits of ethnic enclave formation. *Sluices*, by contrast, refer to neighbourhoods characterised by higher turnover acting as transitional locations, which may reflect both patterns of spatial assimilation and thus socio-economic advancement via resettlement, or continued forced re-migration due to social rejection, housing discrimination, and urban development (Vogiazides/Chihaya 2020; Benassi/Iglesias-Pascual 2023; Vaalavuo et al. 2019).

These concepts integrate the separate central insights of the literature reviewed above. Segmented assimilation suggests that mobility processes differ across groups, ethnic enclave theory cautions against equating staying in place with deprivation or failed integration, and neighbourhood-effects research shows that the consequences of residence depend on local social processes and compositional characteristics (Portes/Manning 1986; Portes/Zhou 1993; Sampson et al. 1997; Sampson et al. 2002). The concepts of sinks and sluices therefore shift the analytical focus from whether neighbourhoods possess particular features to how they function in the migration trajectories of specific immigrant groups.

3 Research aim and analytical strategy

Using the concepts of sinks and sluices, this study examines how internal migration flows identify neighbourhood functions in immigrant settlement trajectories. We analyse group- and cohort-specific networks of resettlement among first-generation immigrants arriving in Denmark between 2007 and 2012, classify unusually prominent destination and transitional neighbourhoods, and examine how these classifications relate to subsequent reductions in integration-related disadvantage. The analysis is exploratory and examines overall differences between sinks and sluices, their geographic distribution, and neighbourhood-specific variation across immigrant groups and cohorts in the Copenhagen metropolitan area.

4 Data and population

We use individual-level register data on first-generation immigrants arriving in Denmark between 2007 and 2012. We limit our population of study to immigrant groups with a steady immigration flow to Denmark in the period of study; here defined as immigrants from countries with 100 immigrants or more per year, leaving immigrants from 25 different countries of origin. We thus define *immigrant group* based on country of origin, which is measured using Statistics Denmark's origin country variable based on the person's country of birth. The population is further limited to those of working age (between 20–64) at time of immigration. As our aim pertains to the identification of neighbourhood traits based on immigrants with a settlement trajectory of staying in Denmark, we exclude immigrants with a student residence permit, as well as immigrants who left Denmark and re-immigrated within the period of study. The population is divided into two cohorts: (1) immigration in 2007–2009 and (2) immigration in 2010–2012. We observe internal migration patterns within the first three years of immigration for both cohorts. As we focus on *neighbourhood level* characteristics, neighbourhoods are characterised first by their migration patterns (in- and outflow), second by the characteristics of the immigrants moving there, and third by the relative change in characteristics of those immigrants five years later. This means that the characteristics of an immigrant group moving to a neighbourhood is observed both at the time of in-moving and five years later.

We use parishes as proxies for neighbourhoods. While subject to the uncertain geographic context problem, using parishes strikes a balance between ensuring a fixed delineation of neighbourhoods across time and an area large enough to ensure enough immigrants from a specific country. Parishes have previously been used in studies of neighbourhood deprivation and social exposure (Schofield *et al.* 2017; Meijer *et al.* 2013). Making parishes our main unit of analysis means that we are not able to capture within-group and within-neighbourhood variation. Individual-level factors like life-course stage, family status, education, labour market sector, language proficiency, as well as differences in available housing, social networks, and institutions matter substantially both for settlement opportunities and for later integration-related outcomes. Our analytical aim, however, is not to explain determinants of specific integration outcomes, but rather to identify specific neighbourhoods of interest and how their role may differ generally between immigrant groups.

Throughout this paper, we use the term *immigrants* to refer to the first-generation immigrants born outside Denmark who have migrated to Denmark (i.e. our population of study), and *immigrant groups* as immigrants from the same country of origin; that is, country of birth. We use the term *in-mover* to refer to immigrants moving to another neighbourhood within Denmark. As we only study the resettlement patterns of immigrants, *in-mover* always refers to an *immigrant in-mover*.

The analysis of internal migration patterns is based on a total of 88,992 immigrants (31,811 in cohort 1; 39,275 in cohort 2) and 128,623 resettlements (including initial settlement) across 2,056 distinct neighbourhoods (parishes). For analysing reduction

in integration-related disadvantage, we focus on a subset of neighbourhoods and immigrant groups (see the methods section below), limiting the sample for this analysis to 8,985 immigrants (3,639 in cohort 1; 5,346 in cohort 2) across 145 distinct neighbourhoods (parishes).

4.1 The Danish context and immigrant population

Immigrants accounted for 8.1 percent of the population in Denmark in 2013, with 58 percent of the first-generation immigrants being from non-Western countries (defined as countries not in EU28, Norway, Switzerland, Canada, the United States, Australia and New Zealand) (*Statistics Denmark* 2013). The largest immigrant-origin groups in 2013 were Türkiye, Poland, and Germany. The composition of immigrant groups reflects different historical migration streams, including earlier labour migration in the 1980s from countries such as Türkiye, Pakistan, and Yugoslavia, later refugee migration from countries such as Lebanon, Iran, Somalia, Bosnia-Herzegovina, Afghanistan, and Iraq, and more recent intra-European migration from countries such as Poland and Romania (*Statistics Denmark* 2013).

Settlement is spatially concentrated. Immigrants and descendants are not evenly distributed across Denmark but are more likely to live in or near larger cities. In 2013, the Copenhagen metropolitan area had the highest share of immigrants and descendants at 16.5 percent compared with the national average of 10.7 percent, while Ishøj, a municipality in the Copenhagen metropolitan region, had the highest municipal share in the country at 34.5 percent. Non-western immigrants and descendants made up more than 80 percent of all immigrants and descendants in several municipalities in the Copenhagen metropolitan area, including Ishøj, Brøndby, and Vallensbæk (see Appendix Fig. A1 for detailed location) (*Statistics Denmark* 2013).

5 Methods

Our methodology has two overall goals: (1) identifying neighbourhoods of interest based on settlement patterns (in- and outflow) at the immigrant group-level, and (2) discerning how settlement in specific neighbourhoods varies in integration-related outcomes depending on immigrant group. We treat resettlements of immigrant groups as a network of neighbourhoods connected by the residential moves between them. Through this, neighbourhoods of interest (sinks and sluices) are identified via the characteristics of how the neighbourhood functions in the network for the particular immigrant group. A composite measure is used to capture reductions in disadvantage related to integration.

5.1 Internal migrations as networks

Given that neighbourhoods are continually reshaped by migration flows, it becomes necessary to identify which neighbourhoods occupy pivotal roles in these dynamics,

making network-based approaches appropriate, as they allow us to detect patterns of inflows and outflows (Carvalho/Charles-Edwards 2020). Contrasted with simply counting the number of in-movers, network-based methods are able to also capture how neighbourhoods are interconnected by resettlement of people between them, making it possible to distinguish neighbourhoods that function more as temporary settlements from the more stable ones. In order to identify neighbourhoods with such role functions, internal migration patterns of first-generation immigrants are represented as a series of directed, weighted networks, with one network for each immigrant group k and time period t (75 networks in total). Each network uses neighbourhoods – measured as parishes – as nodes, and resettlements between neighbourhoods as directed edges. Each time period includes all resettlements occurring within the first three years of immigration to Denmark for each cohort. Formally, each network is defined as

$$G_t^{(k)} = (V, E_t^{(k)}, W_t^{(k)})$$

where V is the common set of neighbourhoods used across immigrant groups and time periods, $E_t^{(k)} \subseteq V \times V$ is the set of directed edges representing settlement flows between neighbourhoods for immigrant group k during time period t , and $W_t^{(k)}$ is the set of edge weights, corresponding to the share of immigrants from group k moving to a specific neighbourhood during time period t .

An edge

$$(i, j) \in E_t^{(k)}$$

denotes that immigrants from country k moved from neighbourhood i to neighbourhood j in time period t .

The internal migration networks are constructed from all recorded internal resettlements within each observation period, rather than only from the first and last observed neighbourhoods. Thus, all intermediate moves occurring within the first three years of immigration within each cohort are incorporated into each immigrant group-cohort network as individual directed edges. For example, if an individual moves from neighbourhood i to neighbourhood j , and later from j to neighbourhood l within the observed period, both resettlements contribute to the network: the first increases the inflow to j , while the second increases the outflow from j .

5.2 Hubs and Authorities (HITS)

Neighbourhoods of interest in terms of differing settlement patterns are identified via the *Hubs and Authorities (HITS)* algorithm (Kleinberg 1999; Manning et al. 2008). This algorithm ranks nodes of a network based on respective hubs and authority-scores. The algorithm was initially developed in order to study how websites serve different roles but has also been extended to migration research (Pitoski et al. 2021).

For our purposes, we adapt the HITS algorithm to derive neighbourhoods that fit our concepts of *sinks* and *sluices*. *Sinks* are neighbourhoods that occupy an unusually prominent position as destinations for a given immigrant group, while *sluices* are neighbourhoods that occupy an unusually prominent position as transitional locations. In network terminology, *sinks* correspond to nodes with unusually high authority scores, whereas *sluices* correspond to nodes with unusually high hub scores.

The HITS algorithm is well suited for operationalising these neighbourhood functions. Authority scores identify nodes that receive flows from important sending nodes, while hub scores identify nodes that send flows to important receiving nodes. Unlike simple measures of in-degree, out-degree, or total migration volume, HITS counts not only how many immigrants move in or out of a neighbourhood. It also captures how a neighbourhood is positioned within the wider structure of group-specific resettlement patterns: a neighbourhood has a high authority score when it has a high share of in-movers from neighbourhoods with high turnover, and a high hub score when it has high turnover and sends movers to nodes with high authority scores. As the internal migration networks are constructed from all resettlements, intermediate neighbourhoods also contribute to hub and authority scores through their aggregate position in all observed resettlement flows. This means that the classification does not distinguish whether the same individuals who move into a neighbourhood are also those who later move out. Accordingly, the terms *sink* and *sluice* should be understood as aggregate neighbourhood role functions defined by settlement patterns, rather than direct measures of individual-level retention or passage.

The HITS algorithm is applied separately to each internal migration network, $(G_t^{(k)})$, in order to identify neighbourhoods whose observed network position deviates from what would be expected in a mobility network with a similar structure. For each observed network, we generate 500 simulated networks using a configuration model (Fosdick et al. 2018), implemented in R using the *igraph* package (Csárdi/Nepusz 2006). Each simulated network preserves the degree sequence of the observed network, while ties are randomly rewired and observed edge weights are randomly distributed across the simulated ties. This produces a set of null networks with the same neighbourhoods and the same number of connected neighbourhoods, but without the specific observed pattern of directed mobility between them.

HITS is then applied to each of the 500 simulated networks. For each neighbourhood, this yields a simulated distribution of expected hub and authority scores under a network with the same degree composition as the observed network. We then compare the observed HITS scores from $(G_t^{(k)})$ to these simulated distributions. A neighbourhood is classified as a *sluice* if its observed hub score is at least two standard deviations above the mean of its simulated hub-score distribution. Similarly, a neighbourhood is classified as a *sink* if its observed authority score is at least two standard deviations above the mean of its simulated authority-score distribution.

To avoid identifying neighbourhoods on the basis of very small migration flows, we only classify neighbourhoods with at least 10 in-movers from the immigrant

group during the period. Among the neighbourhoods satisfying this threshold and the simulation-based criterion, we retain the ten neighbourhoods of each type with the highest number of in-movers. If several neighbourhoods are tied at the tenth rank, all tied neighbourhoods are included. Consequently, the number of identified sink and sluice neighbourhoods differs across immigrant groups and time periods, with neither type identified for some immigrant groups.

This procedure identifies neighbourhoods whose hub or authority scores are unlikely to arise solely from the size and connectivity of the group-specific mobility network. Rather than selecting the highest-ranking neighbourhoods directly, the classification is based on whether a neighbourhood's observed role in the migration network deviates substantially from the role expected in a mobility network of similar size, connectedness, and resettlement distribution.

5.3 Assessing integration-related outcomes

To assess how sink and sluice neighbourhoods differ in subsequent integration-related outcomes, we construct a simple disadvantage-reduction score. The measure is calculated at the person-settlement level, meaning that immigrants may contribute more than one observation if they move into several neighbourhoods during the observation window.

For each settlement observation, disadvantage is measured at the time of in-movement, D_0 , and again five years later, D_5 . The score is based on five binary indicators: low income (L), unemployment (U), non-homeownership (H), not being partnered or married (P), and belonging to the lowest income quintile within the neighbourhood of residence (N). Income is based on Eurostat's definition of equivalised income (Eurostat 2025). Each indicator contributes 20 points, producing a disadvantage score ranging from 0 to 100:

$$D_{it} = 20 \times (L_{it} + U_{it} + H_{it} + P_{it} + N_{it}),$$

where higher values indicate more observed disadvantage. Disadvantage reduction is then calculated as the non-negative difference between disadvantage at settlement and disadvantage five years later:

$$R_i = \max(D_{i0} - D_{i5}, 0).$$

The five-year score is measured regardless of whether the immigrant remains in the original neighbourhood of settlement. The measure therefore captures subsequent change among immigrants who moved into a given neighbourhood, not change in the neighbourhood population itself. Person-settlement scores are then aggregated to the neighbourhood-level by calculating the mean reduction among immigrants with disadvantage to overcome at settlement, defined as those with $D_{i0} > 0$:

$$R_{nb} = \frac{1}{N_{nb, D_0 > 0}} \sum_{i \in nb, D_{i0} > 0} R_i.$$

Restricting the aggregation to observations with $D_{i0} > 0$ means that R_{nb} captures average disadvantage reduction only among initially disadvantaged immigrants moving into neighbourhood nb . It therefore does not treat already advantaged in-movers with no scope for improvement as cases of no disadvantage reduction.

Tab: 1: Number of immigrants and mean number of settlements in population of study

Country of origin	Cohort 1 (2007-2009)		Cohort 2 (2010-2012)	
	Number of immigrants	Mean number of resettlements	Number of immigrants	Mean number of resettlements
Austria	342	1.34	388	1.31
Belgium	240	1.25	358	1.26
Bulgaria	921	1.80	1,920	1.81
Czech Republic	364	1.27	473	1.28
Estonia	215	1.61	431	1.62
France	1,703	1.25	1,993	1.30
Germany	6,033	1.43	4,626	1.40
Great Britain	1,699	1.45	1,842	1.55
Hungary	622	1.59	1,085	1.69
Iran	330	1.65	880	1.61
Italy	1,361	1.47	1,779	1.54
Latvia	697	1.58	1,353	1.64
Lithuania	1,485	1.62	2,737	1.71
Netherlands	768	1.36	939	1.39
Pakistan	370	1.46	352	1.49
Philippines	364	1.34	326	1.32
Poland	7,331	1.51	6,598	1.54
Portugal	330	1.59	438	1.74
Romania	1,833	1.73	5,711	1.83
Russia	399	1.36	445	1.38
Spain	1,700	1.23	2,344	1.41
Switzerland	241	1.29	278	1.35
Thailand	1,150	1.25	981	1.26
Türkiye	979	1.39	636	1.37
USA	334	1.46	362	1.61
Total	31,811	1.45	39,275	1.50

Source: Own calculations

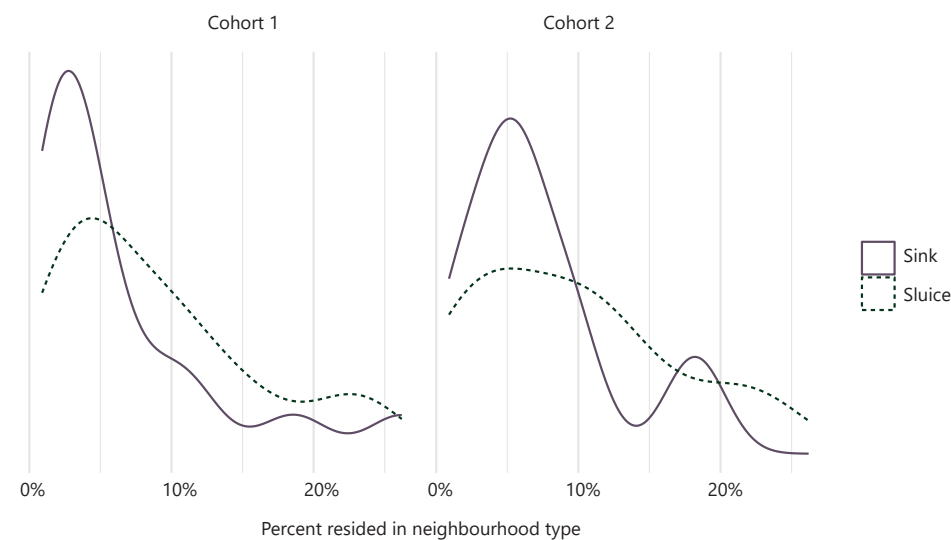
6 Results

As our detection method is deviation-based, the number of identified neighbourhoods varies depending on the immigrant group, including some groups where neither type was identified. As such, our findings are based on identified neighbourhoods across 18 countries of origin out of the included 25 (see Appendix tables A1 and A2 for details).

Neighbourhoods were classified for each immigrant group, meaning that the same parish may be included several times, as it can serve as either sink or sluice for multiple immigrant groups. In total, 173 neighbourhoods were classified for cohort 1 (84 sinks, 89 sluices), and 218 in cohort 2 (109 sinks, 109 sluices).

Table 1 provides an overview of the population of study, including the number of immigrants per country per cohort, as well as the mean number of resettlements within the first three years after immigration. Persons from Poland, Germany, and Romania constitute the biggest immigrant groups across both cohorts, with the number of Romanian immigrants more than doubling from cohort 1 to cohort 2. Immigrants across groups have a mean tendency of resettling at least once within the first three years of residing in Denmark, with the Romanian, Bulgarian, and Lithuanian immigrant groups tending to move more often compared to other immigrant groups across cohorts.

Fig. 1: Distribution of immigrant groups based on share of group residing in neighbourhood type



Source: Own design

Figure 1 displays the distribution of immigrant groups based on the share of immigrants who have resided in sinks and sluices, respectively, within the first three years of immigration. The figure reveals distinct differences in terms of settlement concentration within the sink and sluice neighbourhoods. Immigrant groups are more likely to have settled in sluices rather than sinks, as the share of immigrants having resided in sluices is higher on average compared to the share having resided in sinks. Comparing the distributions of shares in sinks and sluices also reveals high concentration for some immigrant groups (> 25 percent) and low for others (< 5 percent). From cohort 1 to cohort 2, there is an increase overall in the share of immigrants residing in a sluice, as evidenced by the slightly flattening distribution, and an increase in the number of immigrant groups where 15 percent or more resided in a sluice. For sinks, the distribution is moving more to the right, indicating an overall increase in settlement concentration.

Figure 2 displays how the sink and sluice neighbourhoods are distributed geographically across Denmark for cohort 1 and 2. As sinks and sluices are derived per immigrant group, the same neighbourhood (parish) can serve as sink for one group and sluice for another. The same neighbourhood may also function

Fig. 2: Geographic distribution of sink and sluice neighbourhoods for cohort 1 and 2



Note: Upper right of each figure is a zoom onto the Danish capital, Copenhagen. Sinks are marked with circles; sluices with plus-signs. One marker is placed per neighbourhood, per immigrant group. The markers are not to be read as exact locations, but as randomly placed markers within neighbourhood borders in order to illustrate differences in concentration across neighbourhoods.

Source: Own design

similarly for several groups. This is marked on the figure as individual shapes per immigrant group, with one shape within a parish boundary per group, where the parish functions either as a sink or a sluice. The sink and sluice neighbourhoods are mainly concentrated around Copenhagen. Indeed, 246 of the 391 neighbourhoods identified across cohorts are within the larger Copenhagen metropolitan area (counting the neighbourhood each time it acts as either a sink or a sluice for an immigrant group). Other smaller clusters form near the larger port cities. There are also notable exceptions of rural neighbourhoods functioning exclusively as either sink or sluice for single immigrant groups. Interestingly, this pattern intensified from cohort 1 to cohort 2, with both sink and sluice neighbourhoods being more geographically distributed across the country in cohort 2 compared to cohort 1. In the major urban centres, notably Copenhagen, there is a high tendency towards neighbourhoods having dual roles, functioning as sinks for some and sluices for others.

6.1 Settlement patterns and disadvantage

Figure 3 shows the relationship between the neighbourhood type and the disadvantage-reduction score, R_{nb} , denoting the mean disadvantage-reduction score aggregated at the neighbourhood level. As described in the methods section, the score reflects improvements mainly in the in-movers' socioeconomic conditions five years after settlement. While the theoretical upper bound of R_{nb} is 100 (presence of all five disadvantages at time of settlement and none five years later), the observed highest mean value at the neighbourhood-cohort-immigrant group level is 50. Sink neighbourhoods show stronger positive associations with disadvantage reduction, with distributions peaking at higher reduction scores than sluice neighbourhoods across both cohorts. The sinks' distribution extends farther into the upper range of the disadvantage-reduction score, whereas sluices show no observations at the highest score values. A change over time can be observed, as the association is slightly stronger in cohort 2 compared to cohort 1, as indicated by a larger gap in high-peak distributions. This is further reflected in differences in mean disadvantage-reduction score between types. In cohort 1, the mean score is only slightly higher for sinks than for sluices and not statistically significant, with $\hat{R}_{nb,sink} = 18.4$ compared with $\hat{R}_{nb,sluice} = 17.7$. In cohort 2, however, the difference is larger and statistically significant, with $\hat{R}_{nb,sink} = 21.6$ compared with $\hat{R}_{nb,sluice} = 19.1$. This suggests that disadvantage reduction is generally greater among sink in-movers rather than among sluice in-movers; especially in cohort 2. This interpretation should be treated cautiously, as the score depends on disadvantage at time of settlement: immigrants with relatively low disadvantage at settlement have less scope for subsequent reduction and may therefore receive lower scores. However, among in-movers with disadvantage to overcome at settlement, that is, those with $D_0 > 0$, baseline disadvantage is on average lower among those sink in-movers than among their sluice counterparts in both cohorts. In cohort 1, the mean baseline disadvantage score is $D'_{0,sink} = 46.7$ compared with $D'_{0,sluice} = 50.6$. In cohort 2, the corresponding means are $D'_{0,sink} = 49.9$ and $D'_{0,sluice} = 52.2$. Two-

Fig. 3: Distribution of change in disadvantage-reduction score (R_{nb}) across identified sink and sluice neighbourhoods and cohorts



Source: Own design

sided Student's t-tests confirmed statistical significance in both cohorts. Thus, the stronger disadvantage reduction observed for sinks is not immediately driven by higher initial disadvantage among sink in-movers.

6.2 Dual role functioning

As sinks and sluices are primarily identified near the capital, this section focuses on the Copenhagen metropolitan area. The results are limited to the largest immigrant groups that share the greatest number of neighbourhoods across cohorts: immigrants from Bulgaria, Great Britain, Italy, Lithuania, Pakistan, and Türkiye. This allows for a more detailed comparison of how the same or adjacent neighbourhoods may take on different functions across immigrant groups and arrival cohorts. For reference, a map of selected named parishes of Copenhagen is provided in the Appendix (Fig. A1) as the parish names are used to refer to specific locations in Copenhagen throughout the section.

Figure 4 shows the spatial distribution of sink and sluice neighbourhoods for each immigrant group and cohort, together with the neighbourhood-level disadvantage-reduction score, R_{nb} . Rather than treating sink and sluice neighbourhoods as fixed categories with uniform implications, it allows comparison of how neighbourhood functions vary by geographic location, immigrant group, and time. The Copenhagen patterns show that neighbourhood functions vary across immigrant groups and

cohorts. The British and Italian immigrant groups are more strongly concentrated in sink and sluice neighbourhoods close to the city centre than the other groups, especially in cohort 1, where several of the same neighbourhoods function similarly for both groups. Sluices are particularly prominent, suggesting that these central areas often operate as transitional locations rather than prolonged settlement destinations. From cohort 1 to cohort 2, additional sluices appear for the British group while additional sink neighbourhoods appear for the Italian group. Thus, even among groups with relatively similar central settlement patterns, whether neighbourhoods function primarily as transitional or prolonged settlement locations changes across cohorts.

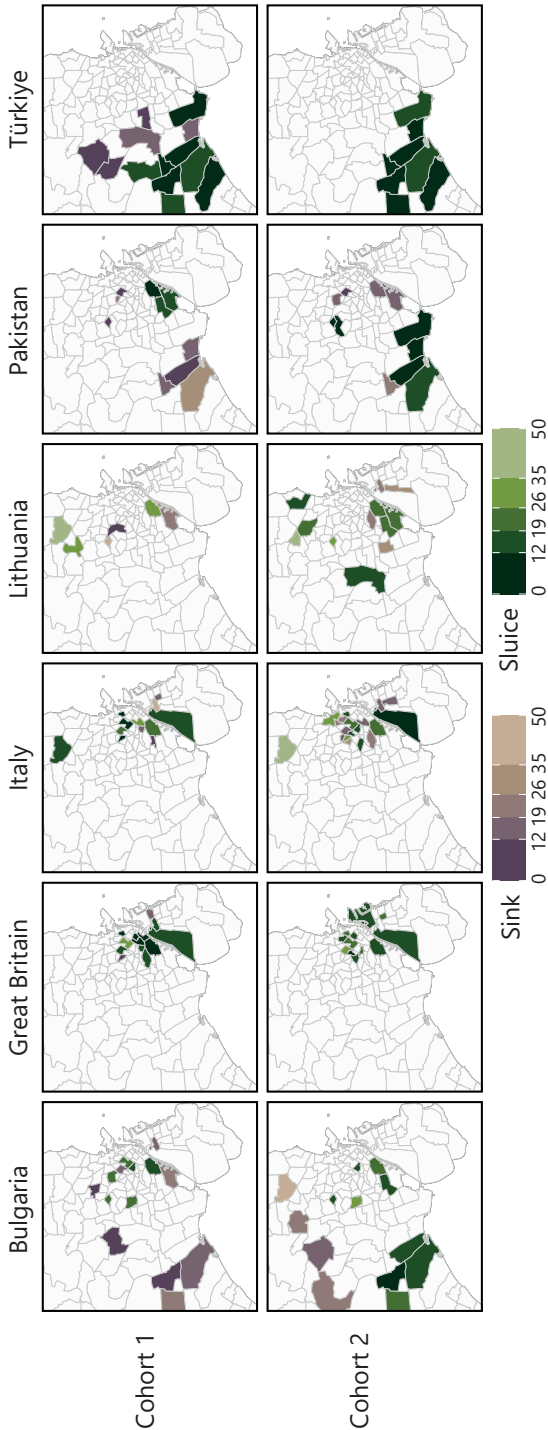
Kongens Lyngby exemplifies how one neighbourhood can take on different roles across groups and over time. In cohort 1, Kongens Lyngby functions as a sluice for both Italian and Lithuanian immigrants, although the disadvantage-reduction score is higher for the Lithuanian immigrant group. In cohort 2, the area no longer functions as a sluice for the Lithuanian group, while the disadvantage-reduction score increases for the Italian group. At the same time, Kongens Lyngby begins to function as a sink for the Bulgarian immigrant group and is associated with a high disadvantage-reduction score. This illustrates how a neighbourhood may become more favourable for one group while losing its transitional function for another.

The Ishøj–Vallensbæk–Brøndby Strand region (southwest) similarly shows how group-specific roles change across cohorts. In cohort 1, this region primarily functions as a set of sink neighbourhoods for the Bulgarian and Pakistani immigrant groups, while serving more often as sluices for the Turkish group. In cohort 2, several of these neighbourhoods instead function as sluices for the Bulgarian and Pakistani groups. For the Pakistani group, there also appears to be a shift between this region and neighbourhoods closer to the city centre: some central areas change from sluices to sinks, while parts of the Ishøj–Vallensbæk–Brøndby Strand region change from sinks to sluices. The Turkish immigrant group shows a more stable pattern, as the same cluster continues to operate primarily as sluices, with low associated disadvantage-reduction scores. At the same time, several areas that function as sinks for the Turkish group in cohort 1 are no longer present in cohort 2, although whether this reflects declining concentration in these neighbourhoods or settlement outside the Copenhagen metropolitan area cannot be determined from the figure alone.

Vesterbro also stands out as a shared neighbourhood across groups. It functions as a sluice for the Bulgarian, British, Italian, Lithuanian, and Pakistani immigrant groups. For all of these groups except the Pakistani group, this function is observed across cohorts. For the Pakistani group, Vesterbro instead functions as a sink in cohort 2. This case again demonstrates that the same neighbourhood can operate as a common point of transition for several immigrant groups while becoming a more destination-like settlement area for another group at a later point in time.

Overall, the Copenhagen results show that the relationship between neighbourhood function and disadvantage reduction is not reducible to a simple distinction between sinks and sluices. Some sluices are associated with relatively favourable trajectories, while some sinks are linked to higher disadvantage-reduction

Fig. 4: Maps of identified neighbourhoods in Copenhagen with one map per immigrant group (labelled as country of origin) and cohort



Note: Each map shows the location of neighbourhoods functioning as either sinks (purple) or sluices (green) for the arriving immigrant group and cohort. Lighter colours indicate higher positive changes in the disadvantage score on average. Colour breaks are based on Jenks natural breaks classification method
Source: Own design

scores, but the opposite is also observed. The meaning of a sink or sluice therefore depends on the specific neighbourhood, immigrant group, and cohort.

7 Discussion

We argued that immigrant settlement should be analysed not only through intrinsic neighbourhood characteristics, but also through the roles that neighbourhoods perform in group-specific settlement patterns. The distinction between *sinks* and *sluices* does not reveal a simple association between neighbourhood function and subsequent integration-related outcomes, but rather shows that particular neighbourhoods function differently for different immigrant groups and at different points in time.

The Copenhagen results illustrate this group- and place-specificity. Some neighbourhoods function similarly for culturally and socioeconomically different immigrant groups, while others serve different roles depending on the immigrant group. Some central urban areas may operate as shared points of transition, while others function differently across groups and cohorts. These findings resonate with earlier work showing that immigrant settlement patterns are strongly group-specific (Benassi/Iglesias-Pascual 2023; Benassi *et al.* 2024; Imeraj/Gadeyne 2024; Vogiazides 2018; Vogiazides/Chihaya 2020), but they also show that group-specificity does not imply complete spatial separation. The same neighbourhood can be shared across groups while still having different meanings in their respective settlement trajectories.

This point is important for how neighbourhood effects are conceptualised. Much existing research links neighbourhoods to integration through indicators such as deprivation, immigrant concentration, income composition, or employment levels (Galster 2012; Sampson *et al.* 2002; Wimark *et al.* 2019). These indicators remain important, but they do not capture whether a neighbourhood functions as a place of arrival, passage, stability, constraint, or opportunity for a specific immigrant group. The sink–sluice distinction therefore shifts attention from average neighbourhood characteristics to the specific geographies in which immigrant settlement unfolds. In this sense, the approach does not replace neighbourhood-effects research, but identifies cases where particular neighbourhoods may warrant closer investigation. Sinks and sluices should be interpreted as empirical pointers to theoretically interesting sites: places where mechanisms such as spatial assimilation, enclave formation, selective mobility, constrained choice, or neighbourhood succession may be operating.

Several limitations follow from the methodological choice to bring neighbourhoods as units of analysis into focus. The analysis does not fully account for differences in immigrants' starting points, including socioeconomic composition, legal status, family structure, education, discrimination, or access to housing. These factors likely shape where immigrants settle and the extent to which disadvantage can be reduced after settlement. The disadvantage-reduction score partly addresses this by measuring change among those with a disadvantage to overcome, but it cannot

identify whether observed differences are driven by neighbourhood conditions, individual resources, selection into neighbourhoods, or broader structural barriers. The score should therefore be interpreted as exploratory. It assumes equal importance of five indicators and captures only selected socioeconomic and household-related dimensions of disadvantage, not integration as such.

Relatedly, our study is subject to the uncertain geographic context problem because of our use of parishes as a proxy for neighbourhoods: administrative boundaries may not correspond to the boundaries within which residents experience neighbourhood life. Future work should therefore examine whether adjacent administrative areas form larger functional communities, and whether sink or sluice roles are shaped by spatial proximity, housing-market structure, transport connections, or spillovers from neighbouring areas.

While our methodology can account for variation in neighbourhood function, the analysis views neighbourhoods through the lens of immigrant in-movement and does not model the responses of existing residents. Selective out-migration, avoidance between immigrant groups, shared mobility patterns across groups, and housing allocation may all affect whether a neighbourhood becomes a sink, a sluice, or neither. Relatedly, the analysis only observes immigrants after arrival in Denmark and does not account for pre-arrival migration histories, later emigration, or Denmark's position in broader international migration systems. Some immigrants may treat Denmark itself as a destination, while others may treat it as a temporary point of passage.

Despite these limitations, our article offers a novel way to identify neighbourhoods that matter in immigrant settlement trajectories. Rather than asking only whether deprived or immigrant-dense neighbourhoods have negative effects, the analysis asks which neighbourhoods function as central destinations or transitional locations for specific immigrant groups. This shift makes it possible to locate sites where theorised mechanisms potentially could be observed. Since the present study is very city-focused, future work may consider the existence of neighbourhoods with a high concentration of specific immigrant groups located in less-studied geographic contexts, which can be identified using the methodology presented here.

8 Conclusion

This study examined how neighbourhoods can be understood through their functional roles in immigrant settlement trajectories. Using internal migration flows, we classified neighbourhoods as *sinks* or *sluices* for specific immigrant groups and cohorts. These concepts are used as analytical relabellings of existing theoretical insights, shifting attention from neighbourhood characteristics alone to place-specific functions influencing group-level settlement, stability, and onward mobility.

The findings do not show a uniform association between sink or sluice functions and integration-related outcomes. Although sink neighbourhoods are, on average, associated with somewhat higher reductions in disadvantage than sluices, this pattern is modest and varies across immigrant groups, cohorts, and neighbourhoods. The

same neighbourhood may function as a site of prolonged settlement for one group, as a transitional location for another. It may also change function over time.

The main contribution is therefore methodological and conceptual. The sink-slucice distinction identifies neighbourhoods that may be of theoretical interest because they occupy central roles in immigrant settlement patterns. These sites can then be examined more closely as potential cases of spatial assimilation, enclave formation, constrained mobility, selective movement, or neighbourhood succession. Understanding immigrant settlement in this way moves beyond general claims about segregation and toward a more differentiated account of how place, mobility, and integration are connected.

Funding

This work was supported by NordForsk through funding for The Network Dynamics of Ethnic Integration, project number 105147.

References

- Andersen, Hans Skifter* 2015: Explanations for Special Neighbourhood Preferences among Ethnic Minorities. In: *Housing, Theory and Society* 32,2: 196-217. <https://doi.org/10.1080/14036096.2015.1012593>
- Andersen, Hans Skifter* 2017: Selective Moving Behaviour in Ethnic Neighbourhoods: White Flight, White Avoidance, Ethnic Attraction or Ethnic Retention? In: *Housing Studies* 32,3: 296-318. <https://doi.org/10.1080/02673037.2016.1208161>
- Anderson, Nels* 1923: *The Hobo: The Sociology of the Homeless Man*. Chicago: University of Chicago Press.
- Andersson, Roger* 2013: Reproducing and Reshaping Ethnic Residential Segregation in Stockholm: The Role of Selective Migration Moves. In: *Geografiska Annaler: Series B, Human Geography* 95,2: 163-187. <https://doi.org/10.1111/geob.12015>
- Athens, Lonnie* 2020: The Renunciation of Robert E. Park: Myths about His Sociological Work. In: *The American Sociologist* 51,1: 76-91. <https://doi.org/10.1007/s12108-019-09430-3>.
- Battu, Harminder; Sloane, Peter J.* 2004: Over-Education and Ethnic Minorities in Britain. In: *The Manchester School* 72,4: 535-559. <https://doi.org/10.1111/j.1467-9957.2004.00407.x>
- Benassi, Federico; Iglesias-Pascual, Ricardo* 2023: Local-Scale Residential Concentration and Income Inequalities of the Main Foreign-Born Population Groups in the Spanish Urban Space. Reaffirming the Model of a Divided City. In: *Journal of Ethnic and Migration Studies* 49,3: 673-696. <https://doi.org/10.1080/1369183X.2022.2067137>
- Benassi, Federico et al.* 2024: Stationarity and Types of Internal Migration of Selected Foreign Groups: Insights from Italy. In: *Social Sciences* 13,10: 506. <https://doi.org/10.3390/socsci13100506>
- Bernard, Aude; Vidal, Sergi* 2023: Linking Internal and International Migration over the Life Course: A Sequence Analysis of Individual Migration Trajectories in Europe. In: *Population Studies* 77,3: 515-537. <https://doi.org/10.1080/00324728.2023.2231913>
- Bolt, Gideon; van Kempen, Ronald* 2010: Ethnic Segregation and Residential Mobility: Relocations of Minority Ethnic Groups in the Netherlands. In: *Journal of Ethnic and Migration Studies* 36,2: 333-354. <https://doi.org/10.1080/13691830903387451>

- Boschman, Sanne; Kleinhans, Reinout; van Ham, Maarten* 2017: Ethnic Differences in Realising Desires to Leave Urban Neighbourhoods. In: *Journal of Housing and the Built Environment* 32,3: 495-512. <https://doi.org/10.1007/s10901-016-9524-3>
- Burgess, Ernest W.* 1925: The Growth of the City: An Introduction to a Research Project. In: *Park, Robert E.; Burgess, Ernest W.; McKenzie, Roderick D.* (Eds.): *The City*. Chicago: University of Chicago Press: 47-62.
- Burgess, Ernest W.* 1928: Residential Segregation in American Cities. In: *The ANNALS of the American Academy of Political and Social Science* 140,1: 105-115. <https://doi.org/10.1177/000271622814000115>
- Carvalho, Rodrigo Coelho de, Charles-Edwards, Elin* 2020: The Evolution of Spatial Networks of Migration in Brazil Between 1980 and 2010. In: *Population, Space and Place* 26,7: e2332. <https://doi.org/10.1002/psp.2332>
- Catney, Gemma* 2018: The Complex Geographies of Ethnic Residential Segregation: Using Spatial and Local Measures to Explore Scale-Dependency and Spatial Relationships. In: *Transactions of the Institute of British Geographers* 43,1: 137-152. <https://doi.org/10.1111/tran.12209>
- Catney, Gemma; Wright, Richard; Ellis, Mark* 2021: The Evolution and Stability of Multi-Ethnic Residential Neighbourhoods in England. In: *Transactions of the Institute of British Geographers* 46,2: 330-346. <https://doi.org/10.1111/tran.12416>
- Chihaya, Guilherme Kenji et al.* 2022: Trajectories of Spatial Assimilation or Place Stratification? A Typology of Residence and Workplace Histories of Newly Arrived Migrants in Sweden. In: *International Migration Review* 56,2: 433-462. <https://doi.org/10.1177/01979183211037314>
- Clark, William A.V.; van Ham, Maarten; Coulter, Rory* 2014: Spatial Mobility and Social Outcomes. In: *Journal of Housing and the Built Environment* 29,4: 699-727. <https://doi.org/10.1007/s10901-013-9375-0>
- Csárdi, Gábor, Nepusz, Tamás* 2006: The Igraph Software Package for Complex Network Research. In: *InterJournal Complex Systems*: 1695 [<https://igraph.org>, 15.06.2026].
- Dinesen, Peter Thisted; Sønderskov, Kim Mannemar* 2015: Ethnic Diversity and Social Trust: Evidence from the Micro-Context. In: *American Sociological Review* 80,3: 550-573. <https://doi.org/10.1177/0003122415577989>
- Eurostat* 2025: Glossary: Equivalised Income. In: <https://ec.europa.eu/eurostat/> [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Equivalised_income,07.10.2025].
- Faris, Robert E. Lee; Dunham, Henry Warren* 1939: *Mental Disorders in Urban Areas: An Ecological Study of Schizophrenia and Other Psychoses*. Chicago: The University Chicago Press.
- Fischer, Peter A.; Malmberg, Gunnar* 2001: Settled People Don't Move: On Life Course and (Im-)Mobility in Sweden. In: *International Journal of Population Geography* 7,5: 357-371. <https://doi.org/10.1002/ijpg.230>
- Fosdick, Bailey K. et al.* 2018: Configuring Random Graph Models with Fixed Degree Sequences. In: *Society for Industrial and Applied Mathematics Review* 60,2: 315-355. <https://doi.org/10.1137/16M1087175>
- Galster, George C.* 2012: The Mechanism(s) of Neighbourhood Effects: Theory, Evidence, and Policy Implications. In: *van Ham, Maarten et al.* (Eds.): *Neighbourhood Effects Research: New Perspectives*. Dordrecht: Springer Netherlands: 23-56. https://doi.org/10.1007/978-94-007-2309-2_2

- Imeraj, Lena; Gadeyne, Sylvie* 2024: Trapped in Place? Ethnic and Educational Heterogeneity in Residential Mobility and Integration of Young Adults in Brussels. In: *European Journal of Population* 40,5. <https://doi.org/10.1007/s10680-023-09690-3>
- Kleinberg, Jon M.* 1999: Authoritative Sources in a Hyperlinked Environment. In: *Journal of the ACM (JACM)* 46,5: 604-632. <https://doi.org/10.1145/324133.324140>
- Kracke, Nancy; Klug, Christina* 2021: Social Capital and Its Effect on Labour Market (Mis) Match: Migrants' Overqualification in Germany. In: *Journal of International Migration and Integration* 22,4: 1573-1598. <https://doi.org/10.1007/s12134-021-00817-1>
- Landesco, John* 1929: *Organized Crime in Chicago*. Chicago: University of Chicago Press.
- Malmberg, Bo et al.* 2018: Residential Segregation of European and Non-European Migrants in Sweden: 1990-2012. In: *European Journal of Population* 34,2: 169-193. <https://doi.org/10.1007/s10680-018-9478-0>
- Manning, Christopher D.; Raghavan, Prabhakar; Schütze, Hinrich* 2008: *Introduction to Information Retrieval*. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9780511809071>
- Massey, Douglas S.; Denton, Nancy A.* 1985: Spatial Assimilation as a Socioeconomic Outcome. In: *American Sociological Review* 50,1: 94-106. <https://doi.org/10.2307/2095343>
- Massey, Douglas S.; Gross, Andrew B.; Shibuya, Kumiko* 1994: Migration, Segregation, and the Geographic Concentration of Poverty. In: *American Sociological Review* 59,3: 425-445. <https://doi.org/10.2307/2095942>
- McAvay, Haley; Safi, Mirna* 2018: Is There Really Such Thing as Immigrant Spatial Assimilation in France? Desegregation Trends and Inequality Along Ethnoracial Lines. In: *Social Science Research* 73: 45-62. <https://doi.org/10.1016/j.ssresearch.2018.03.005>
- Meijer, Mathias et al.* 2013: A Socioeconomic Deprivation Index for Small Areas in Denmark. In: *Scandinavian Journal of Public Health* 41,6: 560-569. <https://doi.org/10.1177/1403494813483937>
- Nieuwenhuis, Jaap et al.* 2020: Does Segregation Reduce Socio-Spatial Mobility? Evidence from Four European Countries with Different Inequality and Segregation Contexts. In: *Urban Studies* 57,1: 176-197. <https://doi.org/10.1177/0042098018807628>
- Park, Robert Ezra* 1936: Human Ecology. In: *American Journal of Sociology* 42,1: 1-15. <https://doi.org/10.1086/217327>
- Park, Robert E.* 1952: *Human Communities: The City and Human Ecology*. Glencoe, IL: Free Press.
- Park, Robert E.; Burgess, Ernest W.; McKenzie, Roderick D.* 1925: *The City*. Chicago, Ill.: The University of Chicago Press.
- Peach, Ceri* 1996: Good Segregation, Bad Segregation. In: *Planning Perspectives* 11,4: 379-398. <https://doi.org/10.1080/026654396364817>
- Pitoski, Dino; Lampoltshammer, Thomas J.; Parycek, Peter* 2021: Network Analysis of Internal Migration in Croatia. In: *Computational Social Networks* 8,1. <https://doi.org/10.1186/s40649-021-00093-0>
- Portes, Alejandro; Manning, Robert D.* 1986: The Immigrant Enclave: Theory and Empirical Examples. In: *Olzak, Susan; Nagle, Joanne* (Eds.): *Competitive Ethnic Relations*. Orlando: Academic Press: 47-68.
- Portes, Alejandro; Zhou, Min* 1993: The New Second Generation: Segmented Assimilation and Its Variants. In: *The ANNALS of the American Academy of Political and Social Science* 530,1: 74-96. <https://doi.org/10.1177/0002716293530001006>

- Putnam, Robert D.* 2007: E Pluribus Unum: Diversity and Community in the Twenty-First Century The 2006 Johan Skytte Prize Lecture. In: *Scandinavian Political Studies* 30,2: 137-174. <https://doi.org/10.1111/j.1467-9477.2007.00176.x>
- Reckless, Walter C.* 1933: *Vice in Chicago*. Chicago: University of Chicago Press.
- Sampson, Robert J.* 2013: *Great American City: Chicago and the Enduring Neighborhood Effect*. Chicago, IL: The University of Chicago Press.
- Sampson, Robert J.; Raudenbush, Stephen W.; Earls, Felton* 1997: Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. In: *Science* 277,5328: 918-924. <https://doi.org/10.1126/science.277.5328.918>
- Sampson, Robert J.; Morenoff, Jeffrey D.; Gannon-Rowley, Thomas* 2002: Assessing 'Neighborhood Effects': Social Processes and New Directions in Research. In: *Annual Review of Sociology* 28: 443-478. <https://doi.org/10.1146/annurev.soc.28.110601.141114>
- Sampson, Robert J.; Sharkey, Patrick* 2008: Neighborhood Selection and the Social Reproduction of Concentrated Racial Inequality. In: *Demography* 45,1: 1-29. <https://doi.org/10.1353/dem.2008.0012>
- Sapiro, Philip* 2019: Understanding the Spatial Trajectories of Minority Groups: An Approach That Examines Their Demographic, Cultural and Socio-Economic Characteristics. In: *Comparative Population Studies* 44. <https://doi.org/10.12765/CPoS-2019-13>
- Schofield, Peter et al.* 2017: Ethnic Density, Urbanicity and Psychosis Risk for Migrant Groups – A Population Cohort Study. In: *Schizophrenia Research* 190: 82-87. <https://doi.org/10.1016/j.schres.2017.03.032>
- Shaw, Clifford R.* 1930: *The Jack-Roller: A Delinquent Boy's Own Story*. Chicago: University of Chicago Press.
- Shuttleworth, Ian et al.* 2021: Residential Mobility in Divided Societies: How Individual Religion and Geographical Context Influenced Housing Moves in Northern Ireland 2001-2011. In: *Population, Space and Place* 27,2. <https://doi.org/10.1002/psp.2387>
- Simpson, Ludi; Finney, Nissa* 2009: Spatial Patterns of Internal Migration: Evidence for Ethnic Groups in Britain. In: *Population, Space and Place* 15,1: 37-56. <https://doi.org/10.1002/psp.497>
- Statistics Denmark* 2013: Indvandrerne i Danmark. 2013. Danmarks Statistik [<https://www.dst.dk/da/Statistik/udgivelser/VisPub?cid=17961>, 15.06.2026].
- Thrasher, Frederic M.* 1927: *The Gang: A Study of 1,313 Gangs in Chicago*. Chicago: University of Chicago Press.
- Toft, Maren* 2018: Enduring Contexts: Segregation by Affluence throughout the Life Course. In: *The Sociological Review* 66,3: 645-664. <https://doi.org/10.1177/0038026117741051>
- Tubergen, Frank van; Maas, Ineke; Flap, Henk* 2004: The Economic Incorporation of Immigrants in 18 Western Societies: Origin, Destination, and Community Effects. In: *American Sociological Review* 69,5: 704-727. <https://doi.org/10.1177/000312240406900505>
- Vaalavuo, Maria; van Ham, Maarten; Kauppinen, Timo* 2019: Income Mobility and Moving to a Better Neighbourhood: An Enquiry into Ethnic Differences in Finland. In: *European Sociological Review* 35,4: 538-551. <https://doi.org/10.1093/esr/jcz017>
- Van Der Laan Bouma-Doff, Wenda* 2007: Involuntary Isolation: Ethnic Preferences and Residential Segregation. In: *Journal of Urban Affairs* 29,3: 289-309. <https://doi.org/10.1111/j.1467-9906.2007.00344.x>
- Vogiazides, Louisa* 2018: Exiting Distressed Neighbourhoods: The Timing of Spatial Assimilation among International Migrants in Sweden. In: *Population, Space and Place* 24,8. <https://doi.org/10.1002/psp.2169>

- Vogiazides, Louisa; Chihaya, Guilherme Kenji* 2020: Migrants' Long-Term Residential Trajectories in Sweden: Persistent Neighbourhood Deprivation or Spatial Assimilation? In: *Housing Studies* 35,5: 875-902. <https://doi.org/10.1080/02673037.2019.1636937>
- Wald, Steven; Fang, Tony* 2008: Overeducated Immigrants in the Canadian Labour Market: Evidence from the Workplace and Employee Survey. In: *Canadian Public Policy / Analyse de Politiques* 34,4: 457-479. <https://doi.org/10.3138/cpp.34.4.457>
- Wessel, Terje et al.* 2017: Spatial Integration of Immigrants in Nordic Cities: The Relevance of Spatial Assimilation Theory in a Welfare State Context. In: *Urban Affairs Review* 53,5: 812-842. <https://doi.org/10.1177/1078087416638448>
- Wimark, Thomas; Haandrikman, Karen; Nielsen, Michael Meinild* 2019: Migrant Labour Market Integration: The Association between Initial Settlement and Subsequent Employment and Income among Migrants. In: *Geografiska Annaler: Series B, Human Geography* 101,2: 118-137. <https://doi.org/10.1080/04353684.2019.1581987>
- Zorbaugh, Harvey W.* 1929: *The Gold Coast and the Slum: A Sociological Study of Chicago's Near North Side*. Chicago: University of Chicago Press.

Date of submission: 08.10.2025

Date of acceptance: 23.07.2026

Kristian Gade Kjellmann (✉), Prof. Dr. Anja Jørgensen. Aalborg University. Aalborg Øst, Denmark.

E-mail: kgk@adm.aau.dk, <https://orcid.org/0000-0001-7994-735X>;

anjaj@society.aau.dk, <https://orcid.org/0000-0003-3864-2458>

URL: <https://vbn.aau.dk/en/persons/kgk/>
<https://vbn.aau.dk/en/persons/anjaj/>

Appendix

1 Detailed descriptive results

Tables A1 and A2 show further descriptive results for sluice and sink neighbourhoods, respectively. Immigrant groups vary greatly in terms of how much of the immigrant population resides in either of these neighbourhood types, as well as in terms of geographical spread. Sink neighbourhoods were most prominent for Pakistani and Turkish immigrants in cohort 1. In cohort 1, 26.2 percent of Pakistani immigrants and 18.6 percent of Turkish immigrants resided in sink neighbourhoods, compared with 11.4 percent of Romanian and 10.2 percent of Bulgarian immigrants. This pattern changed in cohort 2. For Pakistan, the share in sinks declined to 18.2 percent, while Türkiye fell more sharply to 5.7 percent. Iran, by contrast, increased from 7.0 percent in cohort 1 to 18.2 percent in cohort 2, making Iranian and Pakistani immigrants the groups with the highest shares in sink neighbourhoods in cohort 2.

Sluice neighbourhoods show a partly different pattern. In cohort 1, the highest shares were found among Turkish and Bulgarian immigrants, with 23.8 percent and 22.3 percent, respectively, residing in sluice neighbourhoods, followed by Pakistani immigrants at 16.2 percent and Romanian immigrants at 13.5 percent. In cohort 2, Turkish immigrants again had one of the highest shares in sluice neighbourhoods at 23.1 percent, closely followed by Pakistani immigrants at 22.4 percent and Bulgarian immigrants at 19.1 percent. Compared with the sink results, this suggests that some groups, particularly Turkish and Bulgarian immigrants, were more consistently associated with neighbourhoods characterised by onward mobility, while Pakistani immigrants shifted from a stronger sink profile in cohort 1 toward a more pronounced sluice profile in cohort 2.

The descriptive results also show substantial variation in the geographic spread of sink and sluice neighbourhoods. Standard distance, which is analogous to a standard deviation around the mean coordinate centre of the relevant neighbourhoods, ranged from highly localised patterns to distributions spanning more than 100 kilometres. Pakistani sink neighbourhoods were especially concentrated, with a standard distance of approximately 7 km in both cohorts. By contrast, sink neighbourhoods for groups such as Bulgaria, Romania, Lithuania and Poland were spread over much larger distances, often exceeding 100 km. Sluice neighbourhoods also varied geographically: some group-specific sluices were tightly clustered, such as those for Pakistan, Great Britain, Italy, and Türkiye, whereas others, including Iran, Hungary, Lithuania, and Poland, were far more spatially dispersed.

Tab. A1: Descriptive results for sink neighbourhoods

Country of origin	Cohort 1 (2007-2009)			Cohort 2 (2010-2012)		
	Number of nb type	% in	Standard distance (km)	Number of nb type	% in	Standard distance (km)
Austria	0	-	-	0	-	-
Belgium	0	-	-	0	-	-
Bulgaria	8	10.2 %	105.1	11	9.8 %	103.8
Czech Republic	0	-	-	0	-	-
Estonia	0	-	-	0	-	-
France	5	3.6 %	48.9	9	6.1 %	95.6
Germany	10	3.8 %	95.2	11	3.7 %	81.4
Great Britain	4	2.5 %	61.8	2	1.2 %	85.6
Hungary	1	1.6 %	98.9	1	0.9 %	103.4
Iran	2	7.0 %	111.1	11	18.2 %	96.0
Italy	4	3.7 %	87.5	10	9.7 %	97.6
Latvia	1	1.4 %	111.8	3	2.6 %	102.9
Lithuania	5	3.4 %	111.8	12	5.3 %	79.5
Netherlands	1	1.6 %	86.2	0	-	-
Pakistan	7	26.2 %	7.1	5	18.2 %	7.0
Philippines	0	-	-	0	-	-
Poland	10	4.9 %	101.8	11	4.9 %	109.7
Portugal	0	-	-	0	-	-
Romania	11	11.4 %	112.6	10	5.8 %	106.2
Russia	0	-	-	0	-	-
Spain	3	1.8 %	89.2	10	8.3 %	88.5
Switzerland	0	-	-	0	-	-
Thailand	1	1.4 %	86.9	0	-	-
Türkiye	11	18.6 %	100.9	3	5.7 %	94.6
USA	0	-	-	0	-	-

Source: Own calculations

Tab. A2: Descriptive results for sluice neighbourhoods

Country of origin	Cohort 1 (2007-2009)			Cohort 2 (2010-2012)		
	Number of nb type	% in	Standard distance (km)	Number of nb type	% in	Standard distance (km)
Austria	0	-	-	0	-	-
Belgium	0	-	-	0	-	-
Bulgaria	10	22.3 %	80.1	10	19.1 %	50.2
Czech Republic	0	-	-	0	-	-
Estonia	0	-	-	0	-	-
France	3	3.3 %	1.7	2	2.0 %	1.0
Germany	10	4.2 %	58.4	10	6.7 %	2.6
Great Britain	11	10.9 %	3.1	12	14.0 %	2.8
Hungary	3	6.4 %	76.6	8	10.5 %	109.7
Iran	3	10.3 %	103.8	2	2.6 %	105.2
Italy	8	8.7 %	5.2	10	12.1 %	4.2
Latvia	0	-	-	1	0.9 %	69.9
Lithuania	5	4.3 %	73.8	12	9.4 %	78.0
Netherlands	0	-	-	1	1.8 %	6.6
Pakistan	3	16.2 %	2.5	6	22.4 %	5.7
Philippines	0	-	-	0	-	-
Poland	10	8.2 %	95.7	10	9.7 %	77.6
Portugal	1	3.3 %	5.5	1	3.9 %	4.5
Romania	10	13.5 %	10.6	11	13.2 %	47.2
Russia	0	-	-	0	-	-
Spain	1	1.4 %	0.0	3	4.0 %	2.4
Switzerland	0	-	-	0	-	-
Thailand	2	1.8 %	7.3	0	-	-
Türkiye	8	23.8 %	13.9	8	23.1 %	5.3
USA	1	3.6 %	2.9	2	6.9 %	2.3

Source: Own calculations

Comparative Population Studies

www.comparativepopulationstudies.de

ISSN: 1869-8980 (Print) – 1869-8999 (Internet)

Published by

Federal Institute for Population Research
(BiB)
65180 Wiesbaden / Germany



2026

Editor

Prof. Dr. Roland Rau
Prof. Dr. Heike Trappe

Managing Editor

Dr. Katrin Schiefer

Editorial Assistant

Beatriz Feiler-Fuchs
Wiebke Hamann

Layout

Beatriz Feiler-Fuchs

E-mail: cpos@bib.bund.de

Scientific Advisory Board

Kieron Barclay (Stockholm)
Ridhi Kashyap (Oxford)
Anne-Kristin Kuhnt (Rostock)
Mathias Lerch (Lausanne)
Eleonora Mussino (Umeå)
Natalie Nitsche (Canberra)
Alyson van Raalte (Rostock)
Pia S. Schober (Tübingen)
Sergi Vidal (Barcelona)