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# Retreat of the Rich? The Impact of High-Income Household Mobility on Income Segregation

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## ABSTRACT

This paper investigates how residential mobility among high-income households shapes income segregation. Drawing on a unique data set covering all household relocations in Vienna between 2011 and 2018, we examine whether the movements of the top income quintile (Q5) reflect a broader 'retreat of the rich' to affluent clusters and, if so, how these mobility patterns influence both citywide and localized segregation. Using a combination of global and local dissimilarity indices, as well as a novel scenario-based approach, we isolate the effects of intra-urban mobility, income status change and in-migration. The results show that Q5 households are consistently the most segregated group, and while they mostly tend to move between affluent areas, their mobility alone does not fully explain segregation trends. Instead, we find that the selective out-migration of lower-income groups from the same areas plays a critical role in reinforcing segregation. Local scenario analyses reveal that Q5 mobility can either increase or reduce segregation, depending on the spatial context, challenging simple narratives of a retreat of the rich. These findings underscore the importance of analysing segregation as a dynamic, multi-scalar process shaped by the intersecting mobility patterns of all income groups, even in cities with inclusive housing regimes like Vienna.

## 1 | Introduction

Residential segregation by income has long been a defining feature of cities (Bischoff and Reardon 2014; Tammaru et al. 2021) and has tended to increase globally over recent decades (McAvay and Verdugo 2021; Reardon et al. 2018; Scarpa 2016). Segregation describes the structured and multi-dimensional separation of social groups (e.g., by income), which can result in unequal access to resources and opportunities within urban areas (Massey and Denton 1988). One mechanism reinforcing this pattern is the neighbourhood sorting of high-income households, who tend to move to residential areas offering high-quality amenities and infrastructure (Gaigné et al. 2022; Lee and Lin 2018; Van Duijn and Rouwendal 2012). Unlike lower-income households, whose residential options are constrained by affordability and accessibility, high-income households have greater financial flexibility to choose neighbourhoods based on their preferences (W. Clark et al. 2006). Analysing the segregation of high-income households is therefore particularly important, given their considerable neighbourhood choice (Galster and Turner 2019). This choice can influence and reinforce the segregation of income groups within urban areas, potentially contributing to increased spatial inequality (Diamond and Gaubert 2022; Morrison 2022).

Residential segregation is a long-standing topic in urban research, with many studies focusing on cross-sectional data to map static patterns of where different social groups live. Although residential mobility has long been recognized as a key mechanism for shaping segregation, going back to the foundational work of the Chicago School (Maloutas 2004), empirical research has lagged behind conceptual arguments about the

need to foreground mobility in analyses of changing segregation levels. The literature on residential mobility has predominantly focused on the varying probabilities of different groups moving to different types of neighbourhoods. This includes work on the relocation patterns of minority/majority ethnic groups (e.g., Bolt and Van Kempen 2010; Hall and Crowder 2014), or studies on the determinants of households relocating to neighbourhoods of different socioeconomic status (e.g., Crowder and South 2005; South and Crowder 1997). These studies demonstrate group-specific differences in mobility patterns but their emphasis on how these differences contribute to changing segregation levels is limited (Hochstenbach and van Gent 2015; but see W. A. V. Clark and Fossett 2008), or they do not fully disentangle the causal links between mobility and segregation levels (Rimoldi et al. 2024). Studies on racial and ethnic groups and their mobilities have made progress in this regard (Crowder et al. 2012; Goyette et al. 2014), but less weight has been attached to socioeconomic dimensions (but see Modai-Snir and Plaut 2019), particularly in the European context (an exception is McAvay 2018). This leaves a gap as to how the residential mobility of different income groups contributes to changing segregation levels and what the specific mechanisms are that link the two in this geographical context.

These issues become particularly relevant in light of recent debates around residential segregation. Whereas segregation research has long focused on the concentration of lower-income groups (Musterd 2023) or ethnic minorities (Boschman 2015; Jarvis et al. 2023; Mägi et al. 2016), growing attention has recently been paid to higher-income households. It has been argued that rich households are retreating to separate spaces in the city and tend to concentrate in upper-(middle-)class neighbourhoods, not least in the European context (Atkinson and Ho 2020; Forrest et al. 2017). However, so far this literature remains empirically thin, particularly with regard to detailed mobility data. Thus, more granular analyses are required to discover whether high-income households are indeed increasingly relocating to affluent neighbourhoods and how this form of neighbourhood sorting impacts income segregation dynamics.

This paper addresses this gap by examining the relationship between the segregation of high-income households and residential mobility in Vienna, Austria. Using a unique data set that tracks moves across the detailed level of census districts by income quintiles from 2011 to 2018, it explores how mobility influences changes in segregation levels, taking into account group-specific residential mobility patterns. By combining the Local Spatial Dissimilarity Index (LSDI) with scenario-based mobility tests, we contribute to the literature that moves beyond describing segregation as a static unevenness of income groups across space. Our focus is not on the individual motivations behind residential moves, but on the structural outcomes they produce. Understanding how different income groups' mobility reshapes the spatial organization of inequality is essential because segregation ensues from the cumulative effect of many individual decisions. Consequently, we analyse which mobility processes generate observed patterns, since identical segregation levels may arise from different underlying mechanisms, such as affluent households concentrating in wealthy districts, or lower-income groups selectively leaving them. We thus link changes in segregation to underlying mobility dynamics and extend the explanatory power of conventional measurements. This means that we add to existing work that explores the link between mobility patterns and segregation of socioeconomic groups in the European context. Our specific contribution lies in providing a structured framework for such an analysis and, in so doing, supplying empirical evidence to current debates around the development of high-income segregation in this context.

Specifically, we pose two questions:

- What role has the residential mobility of the highest income quintile played in reshaping patterns of income segregation between 2011 and 2018 on a census tract level?
- To what extent has the residential mobility of the highest income quintile led to a 'retreat of the rich' into more homogenous urban areas in this period?

Vienna is an insightful case for three reasons: First, compared to other European cities, it has a particularly strong tradition of policy interventions to promote socio-spatial integration and reduce socioeconomic segregation (Hatz et al. 2016)—key features of what is often described as an inclusive housing regime. Such regimes are characterized by comprehensive social housing sectors that are accessible to a broad range of income groups, strong tenant protections and policies aimed at maintaining mixed-income neighbourhoods (Kössl 2022). In this context, Vienna has managed, at least partially, to encourage social integration and avoid the formation of exclusively elite residential areas (Premrov and Schnetzer 2023). This makes it an unlikely case for a 'retreat of the rich' to affluent clusters and hence a particularly useful context for our study. Second, Vienna has, however, faced increasing challenges to socio-spatial integration in recent years. This includes a rapid and spatially uneven rise in rents (Banabak 2024) and house prices, as well as rising income inequality (Kadi et al. 2022). Research has shown that this has led to wider disparities in the socioeconomic status of different neighbourhoods (Hatz et al. 2016; Kadi et al. 2022). Nevertheless, an analysis of high-income segregation and household mobility is still lacking in this regard.

The remainder of this paper is structured as follows. The next section situates the study within two key strands of literature: the segregation of high-income households and the role of residential mobility in shaping segregation. Section 3 introduces the data and methodology, with particular emphasis on the scenario-based approach that enables an analysis of how high-income mobility influences segregation patterns. Section 2 presents the empirical findings, beginning with citywide segregation trends and subsequently focusing on the specific role of Q5 mobility. Finally, Section 5 discusses the results in light of the existing literature, reflects on key limitations and outlines avenues for future research.

## 2 | Income Segregation, Retreat of the Rich and Residential Mobility: Key Insights From the Literature

It is certainly fair to say that high-income households have traditionally not been the primary focus of residential segregation research. Instead, there has been a clear tendency in the

literature to focus on social disadvantage, exclusion and poverty (Atkinson and Ho 2020; Forrest et al. 2017; Musterd 2023). Consequently, researchers have predominantly concentrated on the lower rather than the upper end of the social strata. Nonetheless, there is an important body of literature on higher- and upper-class segregation, exploring how these groups (self-) segregate to establish urban enclaves (Atkinson 2016), citadels (Marcuse 1997) or gated communities (Blakely and Snyder 1997), and the multiple consequences arising from this (Davis 2006). Recent years have seen increased attention being paid to the link between segregation and higher classes in a wider variety of contexts (Burrows et al. 2022; Forrest et al. 2017), reflecting a growing interest in elites in the wider social science literature (Bukodi and Goldthorpe 2021; Hay and Beaverstock 2016; Sayer 2014).

Scholars have identified a number of causes for increased upper-(middle-)class segregation. One line of thought considers it a form of 'avoidance strategy' (Atkinson 2016). Upper-(middle-)class neighbourhoods are seen to provide an escape from the social problems of the city, particularly regarding crime, pollution or noise (Atkinson and Ho 2020). Elite spaces may also provide possibilities for powerful social connections, better services and a sense of symbolic prestige (Atkinson and Ho 2020). Meanwhile, such areas may be perceived to be a means to benefit more directly from rapid house price developments (Bagaeen and Uduku 2010). Forrest et al. (2017) locate the latter in the emergence of residential real estate in cities as 'one of the investments of choice' (p. 276) among (urban) upper classes, as well as in the structural arrangements that have enabled such investment activities.

Segregation research is largely rooted in the North American context, and its models often do not translate neatly to European cities (Pfirsch 2023). Historic dense cores, widespread decommodified housing and mixing policies have supported spatial integration in Europe (Hatz et al. 2016; Bridge et al. 2014). Yet, enclosure and enclavization have increased in Europe too (Atkinson and Blandy 2016; Atkinson and Ho 2020). Across both contexts, upper-(middle-)class households remain the most segregated (Haandrikman et al. 2023; Oberti and Préteceille 2016). The literature suggests a 'retreat of the rich', marked by rising upper-(middle-)class self-segregation in many cities. While studies have clarified its causes and effects, there is still little empirical evidence from household mobility data to verify this trend across different urban contexts.

Recent research has investigated the interconnection between residential mobility and segregation in more detail. For example, Hochstenbach and van Gent (2015) emphasize that affluent in-movers drive gentrification, but their study does not disentangle the effects of specific income groups on segregation. Similarly, studies show that household mobility, often structured by race and life-stage, reinforce residential sorting (Bernelius and Vilkama 2019; Crowder et al. 2012; Goyette et al. 2014). For example, Goyette et al. (2014) find that white households with children frequently leave diverse areas, while Bolt and van Kempen (2010) highlight the role of ethnic minority relocations. Similarly, Rimoldi et al. (2024) show that foreign household mobility in Rome has intensified spatial clustering.

Despite these contributions, the literature still lacks fine-grained, group-specific analyses of how the mobility of socioeconomic groups impacts segregation patterns, particularly in European contexts with inclusive housing regimes. Studies often focus either on ethnic segregation or rely on descriptive methods without isolating the specific role of affluent movers. This study aims to help fill this gap by integrating scenario-based simulations with both global and local dissimilarity indices to analyse how the residential mobility of the top income quintile (Q5) influenced patterns of segregation in Vienna between 2011 and 2018. By disentangling the effects of Q5 from those of lower-income groups, we provide new insights into how elite self-segregation has developed, and whether income segregation stems from a 'retreat of the rich' or broader residential sorting mechanisms involving all socioeconomic strata. Our contribution lies in both the methodological refinement and the empirical focus on high-income mobility in a relatively low-segregation urban context.

## 3 | Methods and Data

To analyse how residential mobility shapes segregation outcomes, this study utilizes a unique data set containing records of all relocations of households in Vienna, including households moving into the city from outside. It tracks aggregated migration flows by income group across 1350 census areas that are nested in 250 census districts. The data combines the resident register with the Integrated Salary and Income Statistics to classify residents into income quintiles based on equivalized household income, which accounts for differences in household size and composition.[1] These quintiles are reassigned annually, prior to any potential relocations. Essentially, the data set provides detailed information on how individuals from specific income groups move between census districts each year.

We begin by calculating the global Dissimilarity Index (DI), which provides a citywide measure of how unevenly high-income (Q5) households are distributed relative to all other income groups. This metric allows us to track general trends in income segregation over time. However, global measures can obscure important spatial dynamics. To capture where segregation occurs and how it varies across the city, we complement this with the LSDI, a spatially explicit extension of the DI. The LSDI enables us to identify local segregation patterns, revealing whether Q5 households cluster in affluent areas. We then employ a scenario-based analysis designed to isolate the role of residential mobility, specifically that of high-income (Q5) households, in shaping segregation. By simulating counterfactual scenarios in which income change, in-migration or residential moves do not occur, we disentangle the distinct contribution of Q5 mobility to segregation dynamics.

### 3.1 | DI

To assess the extent of income segregation across income quintiles between 2011 and 2018, the DI is calculated. This measure captures how unevenly households from a given income group are distributed relative to all other households in the city. It provides a citywide overview of segregation levels and allows for comparison between income groups over time. The DI is defined as:

$$DI = \frac{1}{2}\sum_{c=1}^{C}\left|\frac{N_{cq}}{N_q} - \frac{N_c - N_{cq}}{N - N_q}\right| \quad (1)$$

where $C$ is the total number of census districts with $c = 1, ..., C$ and $q$ indexes income quintiles with $q = 1, ..., Q$. $N$ is the total number of households in the city, $N_c$ is the number of households in census district $c$, $N_{cq}$ is the number of households in income quintile $q$ in census district $c$, and $N_q$ is the number of all households in quintile $q$ citywide.

### 3.2 | LSDI

To examine how segregation patterns play out spatially and whether high-income households are indeed concentrating in specific areas, the LSDI, as proposed by Feitosa et al. (2007), is employed. The LSDI is a localized version of the Spatial Dissimilarity Index (SDI), both of which account for the spatial distribution of population groups within a city, offering more detailed insights than nonspatial measures (like the DI). While the SDI provides an aggregated, citywide measure, the LSDI breaks it down into subunits of analysis, such as census districts. Meanwhile, the LSDI compares the local income composition of a census district to the overall city distribution while simultaneously incorporating the composition of surrounding areas via a distance-weighted kernel. High LSDI values arise when a district is both internally skewed towards one income group and located next to contrasting neighbourhoods, thereby reinforcing citywide segregation. Conversely, districts that resemble their neighbours or feature mixed compositions yield lower LSDI values, as they mitigate unevenness in the urban distribution. Thus, the LSDI captures how segregation emerges not only from within-district homogeneity but also from the relational context between adjacent neighbourhoods.[2]

To account for the population composition of adjacent census districts, the LSDI utilizes a local population intensity function which describes the population composition of a specific census district, considering not just the population within the census district itself but also the influence of surrounding census districts. It is calculated using a kernel estimator, which applies a distance-based weighting to account for interactions between neighbouring units. The local population intensity function ($\check{L}_c$) and the local population intensity function of Q5 ($\check{L}_{cq}$) are given by:

$$\check{L}_c = \sum_{c=1}^{C} k(N_c) \quad (2)$$

$$\check{L}_{cq} = \sum_{c=1}^{C} k(N_{cq}) \quad (3)$$

where $\check{L}_c$ is the local population intensity of a census district $c$ and $\check{L}_{cq}$ is the local population intensity of quintile $q$ in census district c. $k$ is the kernel estimator using a bandwidth of 800 m.[3]

Using these two functions, the LSDI, $\check{d}_c(q)$, is calculated as follows[4]:

$$\check{d}_c(q) = \sum_{q=1}^{Q} \frac{N_c}{2NI}|\check{\tau}_{cq} - \tau_q| \quad (4)$$

$$I = \sum_{q=1}^{Q}(\tau_q)(1 - \tau_q) \quad (5)$$

$$\check{\tau}_{cq} = \frac{\check{L}_{cq}}{\check{L}_c} \quad (6)$$

where $\tau_q$ is the proportion of quintile $q$ in the city and $\check{\tau}_{cq}$ is the local proportion of quintile $q$ in census district $c$.

When aggregating the LSDIs, the SDI can be calculated as follows:

$$\check{D}(q) = \sum_{c=1}^{C}\sum_{q=1}^{Q} \frac{N_c}{2NI}|\check{\tau}_{cq} - \tau_q| \quad (7)$$

### 3.3 | Scenario Analysis

While the LSDI provides insights into the uneven distribution of groups across space, by nature, it remains descriptive. Accordingly, it quantifies outcomes of segregation but does not identify the mechanisms that generate unevenness. Our contribution is to extend the LSDI by means of a scenario-based mobility framework that systematically varies which income groups are allowed to move and under what conditions.

In the scenario analysis, we construct counterfactual segregation outcomes by selectively allowing or preventing specific components of observed residential mobility. This enables us to compare the observed segregation patterns with alternative population distributions in which particular mobility processes are absent. In this way, the LSDI not only captures the spatial end state of segregation but allows us to identify which observed mobility flows contribute to local segregation outcomes. More specifically, the approach makes it possible to assess how much residential mobility contributes to the spatial concentration of high-income households and to evaluate whether a 'retreat of the rich' is indeed driving segregation trends.

The scenario design follows a two-level structure. First, the main scenarios define which types of mobility processes are included, distinguishing between (1) full mobility, (2) only intra-urban moves and (3) income status change and in-migration into the city.[5] Second, each scenario includes three sub-scenarios that specify which income groups are allowed to move or change income quintile: (1) all quintiles are allowed to relocate and change income status; (2) only Q5 households are allowed to relocate or change income status, while Q1–Q4 households are held fixed at their 2011 distribution; and (3) only Q1–Q4 households are allowed to relocate or change income status, with Q5 held constant at its 2011 distribution.

All scenarios are based on the observed magnitudes of household flows recorded in the Statistics Austria data set. For each year, we construct complete origin-destination matrices by income quintile across census districts. In the full mobility scenario, all observed intra-urban moves, in-migration into Vienna and income status changes are applied as recorded. The restricted scenarios are created by fixing selected components of these observed flows at their 2011 levels, while leaving all other components unchanged. In other words, each scenario asks what segregation would have looked like if only specific types of

observed mobility had occurred, while all others were held constant. Accordingly, the scenarios are calculated as follows:

1. Full mobility: In the full mobility scenario, all forms of mobility are considered, including both movements within the city and shifts in income status, along with migration into the city.
   1.1. All quintiles can change: In this case, Equation (4) remains unchanged, referring to the actually observed segregation patterns.
   1.2. Only Q5 can change: In this case, only quintile 5 can change (move home and change income status).

   Here, $\breve{\tau}_{cq}$ for $q = 1, ..., 4$ remain fixed at their levels:

$$\tau_q = \begin{cases} \breve{\tau}_{cq} \text{ at } \quad t_0 \text{ for } q = 1, ..., 4 \\ \dfrac{\sum_c L_{cq}}{\sum_c L_c} \text{ for } q = 5 \end{cases} \tag{8}$$

   where $t_0$ refers to the base year (=2011).

   Equation (4) is adjusted to account for the unchanged shares for $q = 1, ..., 4$

$$\breve{d}_c(q) = \sum_{q=1}^{4} \frac{N_c}{2NI} |\breve{\tau}_{cq}{}^{t_0} - \tau_q{}^{t_0}| + \frac{N_c}{2NI} |\breve{\tau}_{c5} - \tau_5| \tag{9}$$

   1.3. Only Q1–Q4 can change: In this case, only quintiles 1 to 4 can change.

$$\tau_q = \begin{cases} \dfrac{\sum_c L_{cq}}{\sum_c L_c} \text{ for } \quad q = 1, ..., 4 \\ \breve{\tau}_{cq} \text{ at } \quad t_0 \text{ for } \quad q = 5 \end{cases}$$

Equation (4) can be re-written as:

$$\breve{d}_c(q) = \sum_{q=1}^{4} \frac{N_c}{2NI} |\breve{\tau}_{cq} - \tau_q| + \frac{N_c}{2NI} |\breve{\tau}_{c5}{}^{t_0} - \tau_5{}^{t_0}| \tag{10}$$

2. Only intra-urban moves: The *only intra-urban moves* scenario focuses solely on households that move within the city's boundaries, excluding migration from outside the city or changes in income status.
   2.1. All quintiles can change: Similar to the full mobility scenario, all quintiles are free to move, and Equation (4) remains unchanged.
   2.2. Only Q5 can change: In this case, only quintile 5 can move inside the city, whereas the other quintiles remain fixed at their 2011 levels. Equation (9) applies.
   2.3. Only Q1–Q4 can change: In this case, quintile 5 stays fixed at its 2011 level, only allowing quintile 1 to quintile 4 to move inside the city. Equation (10) applies.
3. Status change and moves into the city: This scenario only considers changes in income quintiles (status upgrades) and moves from outside the city, excluding internal residential mobility.[6]
   3.1. All quintiles can change: In this case, all quintiles can change their income status (change quintile allocation) or move into Vienna from outside the city. Equation (4) remains unchanged.
   3.2. Only Q5 can change: In this case, only quintile 5 can change their income status or move from outside. Equation (9) applies.
   3.3. Only Q1–Q4 can change: In this case, only quintiles 1 to 4 can change their income status or move into the city. Equation (10) applies.

## 4 | Results

This section is structured to progressively uncover the role of high-income household mobility in shaping income segregation in Vienna. We begin with an overview of income segregation across all quintiles using the DI as a global measure to establish that the highest income group (Q5) is consistently the most segregated. In the second step, we apply a scenario-based approach to disentangle the effects of Q5 mobility from those of other income groups. We then shift to a spatial perspective by mapping the movement patterns of each income quintile across census districts with varying concentrations of high-income households. To deepen this spatial analysis, we explore how mobility scenarios affect the local distribution of Q5 and then evaluate changes in local segregation levels using the LSDI. Finally, we combine insights into changes in the Q5 share with LSDI to assess whether Q5 mobility leads to more exclusive and segregated areas. This multistep approach allows us to move from general segregation trends to detailed spatial dynamics, capturing the complexity of how high-income mobility shapes urban segregation.

### 4.1 | The Development of Segregation for Different Income Groups, 2011–2018

To gain an initial understanding of how segregation differs across income quintiles, the nonspatial DI was calculated for each quintile from 2011 to 2018, as shown in Table 1. The results indicate that the highest-income quintile (Q5) exhibits the highest level of segregation, while quintile 3 is the least segregated. This

**TABLE 1** | Dissimilarity index for all quintiles, 2011–2018.

| Year | Q1 | Q2 | Q3 | Q4 | Q5 |
|---|---|---|---|---|---|
| 2011 | 0.1932 | 0.1615 | 0.0896 | 0.1150 | 0.2672 |
| 2012 | 0.1949 | 0.1618 | 0.0912 | 0.1173 | 0.2676 |
| 2013 | 0.1937 | 0.1632 | 0.0880 | 0.1161 | 0.2663 |
| 2014 | 0.1955 | 0.1626 | 0.0898 | 0.1196 | 0.2710 |
| 2015 | 0.2004 | 0.1629 | 0.0901 | 0.1220 | 0.2758 |
| 2016 | 0.1992 | 0.1630 | 0.0916 | 0.1225 | 0.2776 |
| 2017 | 0.1979 | 0.1623 | 0.0902 | 0.1218 | 0.2791 |
| 2018 | 0.1932 | 0.1589 | 0.0910 | 0.1169 | 0.2788 |

*Note:* According to Massey and Denton (1993), dissimilarity index values below 0.3 suggest low segregation, scores between 0.31 and 0.6 reflect moderate segregation, and values above 0.6 represent high levels of segregation. However, these thresholds assume the theoretical 0–1 range of the index. In practice, the maximum attainable value is constrained by the relative size of the groups (Del Río and Alonso-Villar 2022; Reardon and Firebaugh 2002). We therefore interpret index values primarily in relative terms, comparing across groups and scenarios rather than against fixed absolute thresholds.

finding underscores the distinct residential patterns of high-income households and raises important questions about their role in shaping overall segregation dynamics.

While Vienna has historically exhibited relatively low levels of residential segregation, our analysis shows that households in the highest income quintile are consistently and significantly more segregated than other income groups. This makes Vienna a particularly interesting case. Its low segregation levels overall provide a clear contrast that highlights emerging patterns of spatial segregation at the top, raising questions about whether even in 'inclusive' cities, the rich are increasingly retreating to homogeneous urban areas.

The global, nonspatial DI remains one of the most widely used measures of segregation and provides an intuitive point of comparison. Applying the scenario design to the DI allows us to assess how overall segregation levels shift under different mobility conditions before considering spatial context. Figure 1, therefore, presents the scenario analysis for the DI, while the subsequent section extends the same design to the LSDI in order to capture local clustering and neighbourhood relations.

Figure 1 reveals three key insights. First, segregation peaks when only Q5 households move (Scenarios 1–2), indicating that high-income mobility contributes more strongly to segregation than Q1–Q4 movements. Second, in Scenario 3, incorporating status changes and external inflows has little impact on the DI, suggesting that segregation is primarily shaped by intra-city mobility. Third, analysing Q5 and Q1–Q4 separately produces higher dissimilarity than when all quintiles are considered together, indicating a counterbalancing effect: simultaneous movements of different income groups can offset each other, which leads to a more even spatial distribution.

These findings raise important questions about how different quintiles move on a finer spatial scale. The DI provides a broad view of segregation trends but does not capture localized patterns of segregation and integration at the neighbourhood level. To address this, incorporating an SDI is essential, as it accounts for spatial clustering, localized segregation dynamics and the geographic distribution of residential mobility.

## 4.2 | Understanding Mobility: Movement Patterns of Different Income Quintiles

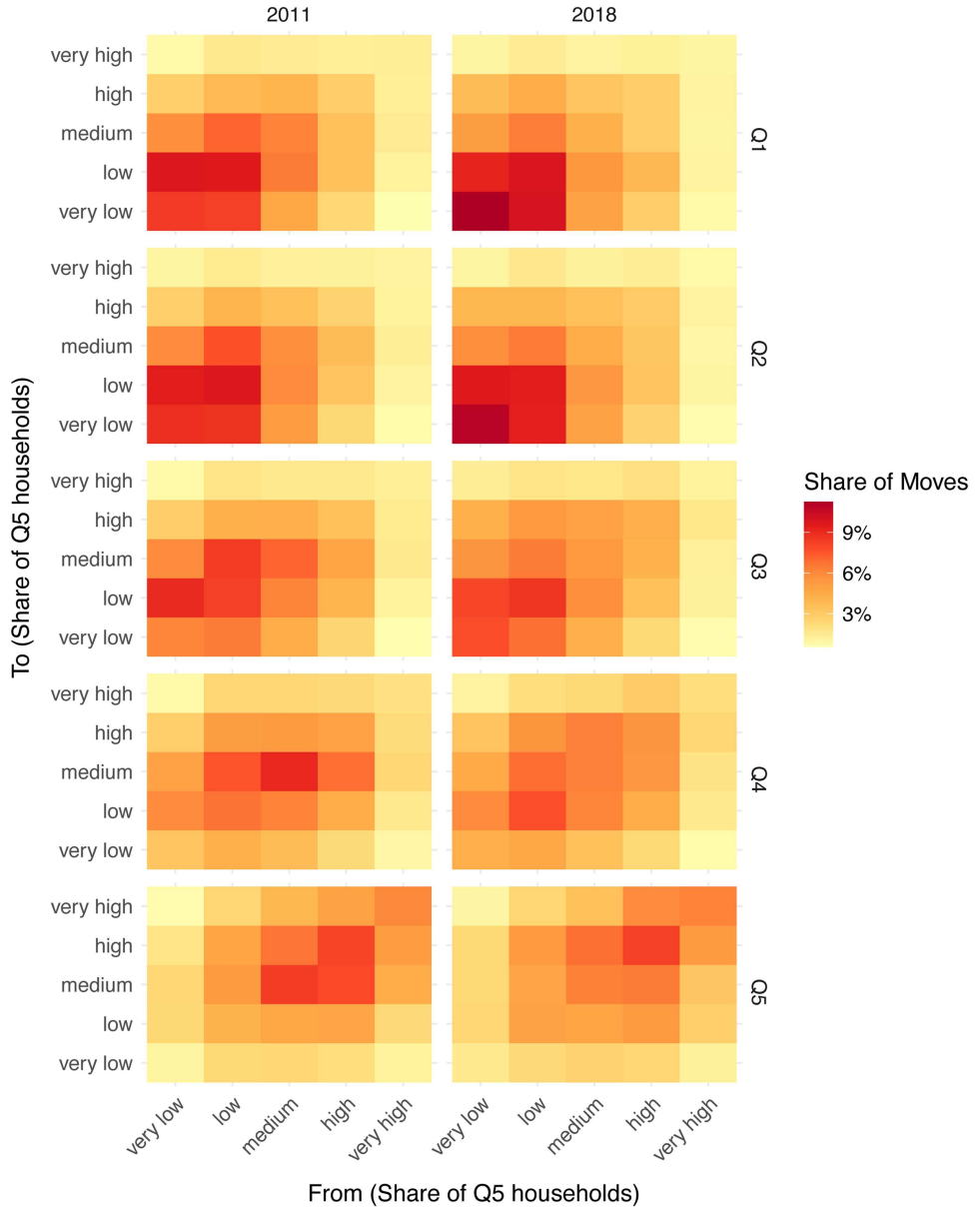
The previous broader analysis has demonstrated the importance of examining the mobility patterns of Q5 in comparison to other quintiles, as well as the need for a finer-grained, more localized approach to understanding segregation dynamics in Vienna. To gain deeper insight into how different income quintiles move at the census district level, we categorize each census district into five classes based on its share of Q5: very low, low, medium, high or very high. By analysing movements across these categories, we can assess whether high-income households are tending to concentrate in affluent areas or whether lower-income groups are increasingly relocating to less affluent areas, both of which have implications for segregation trends. We then calculate the share of moves for each quintile within each census district class.

Figure 2 illustrates that the lowest-income quintiles, Q1 and Q2, move into census districts with low and very low Q5 shares disproportionately often, reinforcing income clustering in lower-income areas. This pattern is less pronounced for Q3 and Q4. In contrast, Q5 exhibits a strong tendency to move into census districts with at least a medium share of Q5, suggesting that high-income households predominantly relocate to areas that are already relatively affluent.

## 4.3 | Local Scenario Analysis: The Role of Mobility in Shaping Q5 Distribution

To further examine the role of mobility in shaping the spatial distribution of Q5 and ultimately segregation, we now turn to a localized scenario analysis. While our previous findings suggest that high-income households predominantly relocate to already affluent areas, it is crucial to assess how different mobility scenarios influence both the distribution of Q5 and local segregation patterns. We focus on the scenario outcomes as observed in the final year of the study period, 2018. This means the scenarios are sequentially updated from 2011 onward, reflecting cumulative changes leading up to the 2018 outcome.


**FIGURE 1** | Scenario analysis for the dissimilarity index, 2011–2018.




Note: "very low" to "very high" refer to the respective quintiles of the Q5 shares in a census district.

**FIGURE 2** | Share of moves by quintile and year, categorized by share of Q5 in census districts.

A key reason for conducting this scenario analysis is that an increase in the share of Q5 in any given area does not necessarily translate into higher segregation. While a rising Q5 share may indicate growing affluence, the effect on segregation depends on the broader income composition of the area. If the increase in Q5 is accompanied by a more balanced distribution of income groups, segregation may not rise significantly. Conversely, if Q5's growth leads to a greater concentration of high-income households and a decline in lower-income groups, local segregation is likely to intensify. This distinction is critical, as segregation is not simply a symptom of Q5's absolute presence but of its relative concentration compared to other income groups. Thus, to fully understand how mobility shapes segregation, we first analyse how different scenarios affect the spatial distribution of Q5 before turning to the LSDI.

Figure 3 presents the scenario analysis of changes in the share of Q5 households across Vienna's census districts in 2018. The map on the top left serves as the reference scenario, showing the actual 2018 distribution, with Q5 households concentrated in the western districts and the city centre. The other maps display percentage point deviations from this baseline, highlighting how the Q5 share increases (blue) or decreases (red) under alternative mobility patterns. When Q5 households are mobile, their share increases across many districts, indicating that their movements strongly reinforce existing spatial concentrations and extend affluent clusters into adjacent areas. When Q5 is held constant and only Q1–Q4 move, the Q5 share declines in several districts, including some affluent ones, suggesting that lower-income mobility can reduce the concentration of high-income groups. When all quintiles are mobile, the shifts remain moderate, reflecting the interplay and partial offsetting between group movements.

Overall, this scenario analysis shows how Q5 mobility acts as the primary driver of spatial concentration, while the redistribution of other income groups shapes its magnitude and

spatial reach. Based on these results, the subsequent analyses focus specifically on the mobility scenarios.

### 4.4 | Local Scenario Analysis: The Role of Mobility in Shaping Local Segregation

To understand how different mobility patterns impact local segregation, we calculate the LSDI following the methodology proposed by Feitosa et al. (2007). As discussed in Section 3, the LSDI provides a finer-grained perspective on segregation by capturing variations in income distribution at the census district level.

Figure 4 presents the outcomes of Scenario 1 (mobility and status change) for the LSDI in 2018. The results for the other scenarios can be found in Figure A1 in Appendix A. The reference map shows the local segregation levels observed across Vienna, with the highest values concentrated in the northwestern districts. The LSDI captures how unevenly income

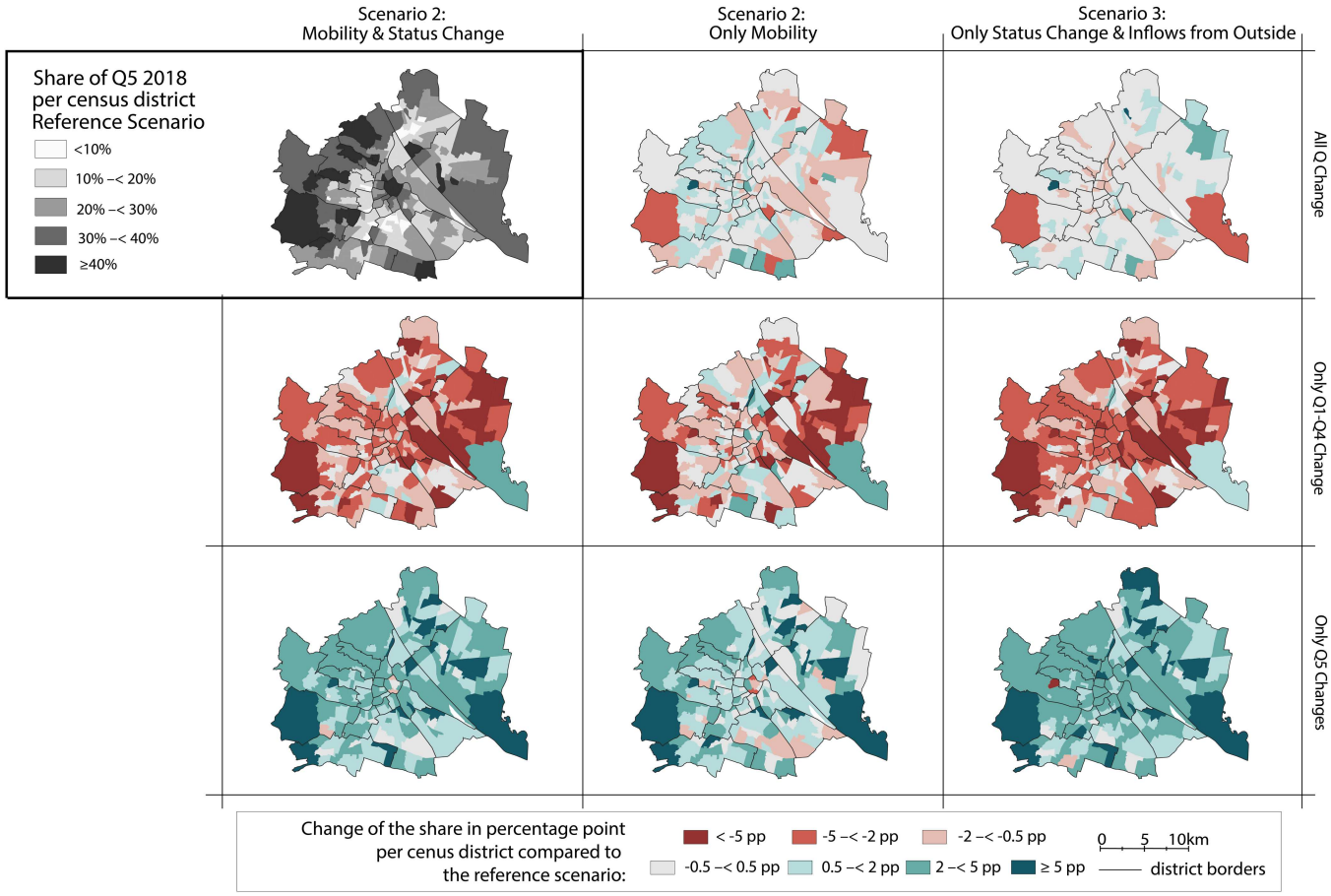



**FIGURE 3** | Local scenario analysis: Changes in the share of Q5 in census districts, 2018.

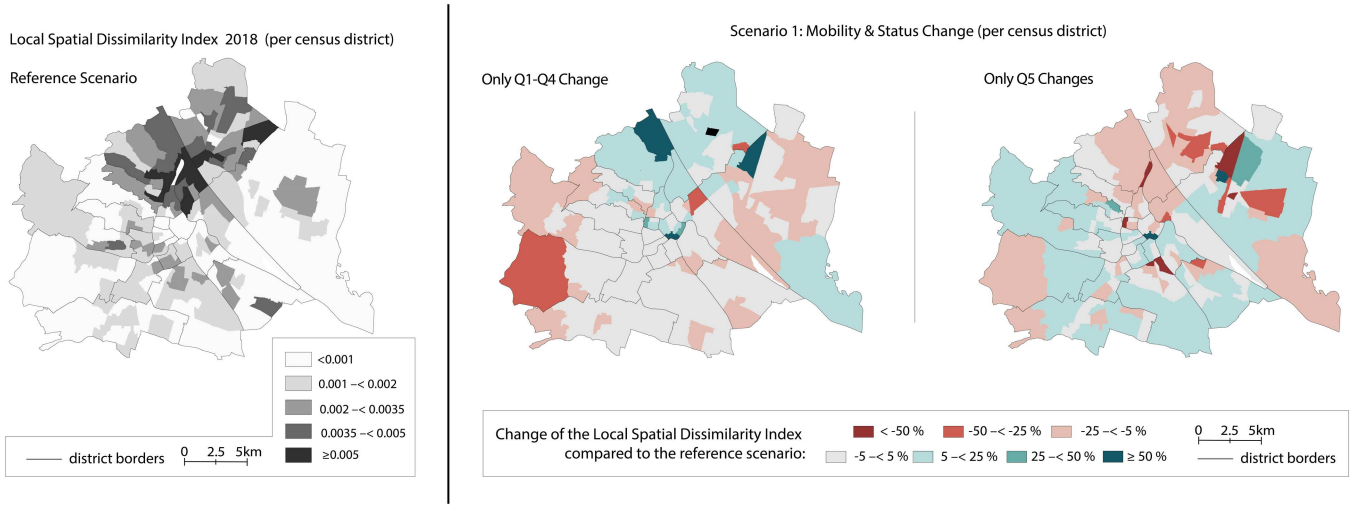



**FIGURE 4** | Scenario analysis: Changes in the local spatial dissimilarity index in Scenario 1.

groups are distributed relative to their surroundings, highlighting spatial contrasts on a fine scale. High values typically reflect sharp income boundaries between adjacent districts, strong clustering of similar income groups or limited internal income diversity within a district. By contrast, central districts, despite hosting a high share of Q5 households, display lower LSDI values. The remaining maps illustrate the percentage change in the LSDI under Scenario 1. The maps for the other scenarios can be found in Appendix A.

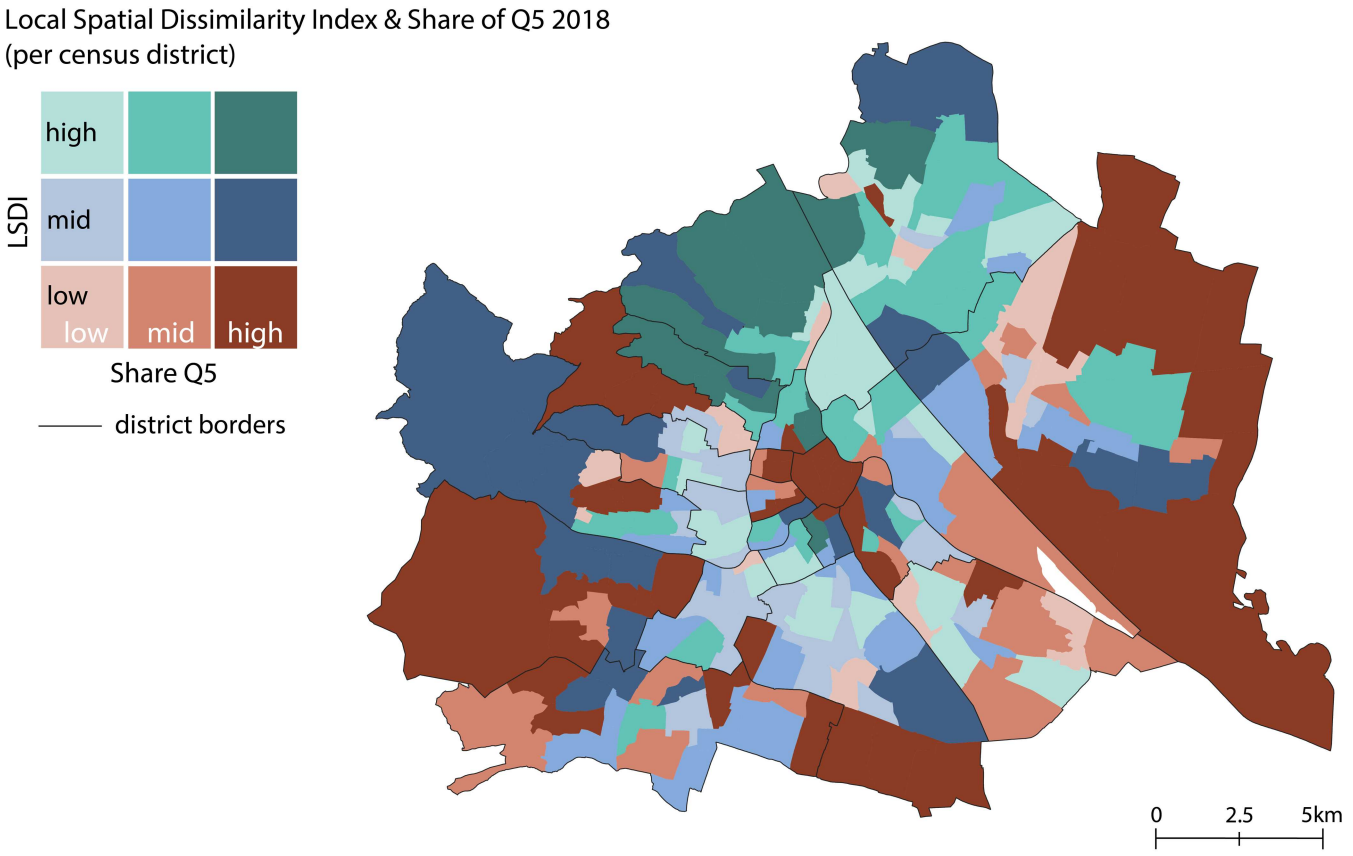
While the LSDI across many census districts remains relatively low, the results reveal the existence of hot spots of localized segregation in specific census districts. These areas exhibit pronounced shifts in segregation depending on the underlying mobility patterns. When Q5 remains fixed and only Q1–Q4 are mobile, the LSDI increases in already segregated districts but decreases in less segregated areas. This suggests that lower-income households tend to relocate away from areas where they were previously integrated into more diverse income backgrounds, leading to a higher concentration of Q5 and reinforcing segregation in these districts.

When only high-income (Q5) households are mobile, the resulting segregation patterns depend strongly on the spatial direction of their movement. In some affluent districts, segregation decreases as Q5 households disperse more evenly across the space, reducing local concentration. In contrast, segregation intensifies where Q5 households cluster together in specific high-status or emerging affluent areas, forming new pockets of income homogeneity.

### 4.5 | Local Scenario Analysis: Connecting Changes in the LSDI to the Share of Q5

Examining Q5 share and LSDI in tandem provides a more nuanced understanding of income segregation, as the two measures capture distinct but complementary dimensions. The LSDI reflects the spatial structure of segregation, highlighting income contrasts between a district and its surrounding areas, but it does not indicate the concentration of high-income households. Conversely, the Q5 share measures this concentration without accounting for spatial relations. An increase in Q5 share may reduce segregation if high-income households relocate to areas with a diverse income mix, but it may exacerbate it if they cluster in already affluent districts. Similarly, a district with a low Q5 share can still exhibit high segregation if it borders areas with sharply different income structures, while a high Q5 share does not necessarily imply high segregation when other income groups are well represented nearby. This combined interpretation clarifies how concentration and spatial distribution interact to shape urban segregation.

Figure 5 shows the overlap between different levels of the LSDI and Q5 shares (low, medium and high). This classification highlights that a high LSDI does not necessarily correspond to a high share of Q5 households. Northwestern districts with both high LSDI and high Q5 shares (dark green) reflect areas where affluent clustering reinforces segregation. In contrast, central and some outer districts show high Q5 shares but low LSDI, indicating that a strong presence of high-income households does not automatically translate into spatial segregation when income




Note: Low, mid, and high refer to the respective terciles of the Local Spatial Dissimilarity Index (LSDI) and the Q5 shares.

**FIGURE 5** | Local spatial dissimilarity index and share of Q5, 2018.

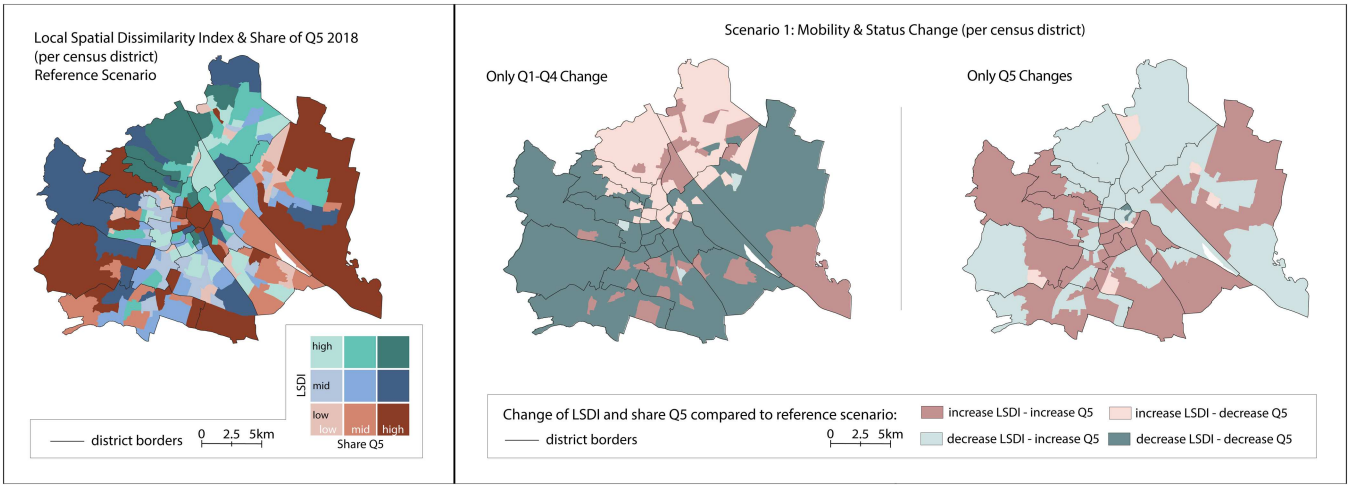



**FIGURE 6** | Scenario analysis: Changes in the local spatial dissimilarity index and share of Q5 in census districts in Scenario 1.

groups are more evenly distributed. Conversely, districts with low to medium Q5 shares but high LSDI (light green) highlight that segregation can also result from pronounced income contrasts with adjacent areas. This suggests that income segregation is shaped not only by the concentration of Q5 but also by the broader income distribution across districts and their neighbours.

The two maps in Figure 6 illustrate the changes in LSDI and the share of Q5 under Scenario 1 when the mobility of Q5 or all other income groups is restricted. The results for all scenarios are shown in Figure A2 in Appendix A. The observed increases and decreases compared to the reference scenario (Figure 5) provide insights into how different patterns of income mobility and status changes affect local segregation dynamics.

The scenario analysis demonstrates that mobility's effects on segregation depend strongly on which income groups move and on the local spatial context in which these moves occur. When only Q1–Q4 households are mobile, most districts show a simultaneous decrease in both Q5 share and LSDI. This suggests that lower- and middle-income households predominantly move between already less and moderately affluent districts (as seen in Figure 2), reflecting constrained neighbourhood choice, slightly increasing diversity within these areas and leading to modest overall declines in segregation. However, in the northern parts of the city, where affluent households are already highly concentrated, the LSDI increases even though the local share of Q5 falls. This occurs because segregation is shaped not only by internal income composition but also by contrasts with neighbouring districts. As lower-income households move away from the areas surrounding these wealthy census districts, the boundaries between rich and poor areas become more marked, producing higher local segregation values.

When only high-income (Q5) households are mobile, this pattern reverses. In the north, segregation tends to decline as Q5 households redistribute more evenly within affluent areas, reducing extreme local concentration. In contrast, in some outer districts, both Q5 share and LSDI increase, indicating that Q5 households have relocated to previously mixed or moderate-income areas but clustered together, potentially forming new pockets of affluence. Together, these findings show that changes in local segregation depend strongly on where income groups move relative to existing spatial boundaries.

The results shown in Figure 6 challenge the hypothesis of a 'retreat of the rich' by showing that Q5 households do not withdraw from mixed-income areas systematically. However, these findings underscore a broader risk: While Q5 mobility can, in some cases, even reduce segregation, it also has the potential to intensify it, especially in areas not previously dominated by affluent groups. The increase in both Q5 share and local dissimilarity in many outer districts suggests that when high-income households move into mixed or less high-income areas, they may do so to an extent that fosters displacement and reinforces spatial disparities. This pattern may indicate early signals of gentrification, where affluent in-movers raise the socioeconomic profile of a neighbourhood. While our scenario analysis captures short-term mobility effects, these patterns may evolve over time into more pronounced long-term gentrification processes (Hwang and Ding 2020; Janssen et al. 2023; Millard-Ball 2002). This reinforces the need to consider not just who moves, but also where they move and how neighbourhood sorting processes affect income segregation.

## 5 | Discussion and Conclusion

This study examines the role of high-income household mobility in shaping patterns of income segregation in Vienna between 2011 and 2018, with a particular focus on whether the mobility of the richest households (Q5) reflects a 'retreat of the rich' to wealthier areas. We find that the mobility of Q5 households has played a mixed role in shaping segregation patterns. Although Q5 households remain the most segregated group according to the global DI, this outcome cannot be attributed solely to their residential moves. Instead, segregation emerges from complex mobility dynamics in which the selective relocation of high-income households interacts with the mobility of lower-income groups.

With respect to whether Q5 mobility reflects a 'retreat of the rich' into more homogeneous urban areas, our findings provide only limited support for this hypothesis. While Q5 households do tend to relocate to already affluent neighbourhoods, reinforcing existing concentrations of income through neighbourhood sorting, their mobility does not lead to a systematic withdrawal from mixed-income areas. In many cases,

segregation is equally shaped by the out-migration of lower-income households from relatively diverse or affluent neighbourhoods. As a result, despite global evidence of increasing self-segregation among high-income households, we do not find clear evidence that such a process intensified in Vienna over the period studied. Taken together, these results indicate that recent changes in income segregation in Vienna cannot be explained by elite self-segregation alone but instead reflect bidirectional mobility processes involving multiple income groups.

These findings contribute to a growing body of literature that has recently begun to revisit the spatial mobility of high-income households. Segregation research has traditionally focused on poverty and exclusion (Forrest et al. 2017; Musterd 2023), while the residential behaviours of the wealthy have remained comparatively underexplored. Where upper-(middle-)class segregation has been discussed, it has often been framed in terms of symbolic or physical enclaves, such as gated communities or citadels (Atkinson 2016; Marcuse 1997), without fully considering the dynamic role of mobility in producing these spatial patterns. Our study addresses this gap by empirically examining whether such a 'retreat of the rich' is detectable in Vienna.

This study advances existing research by providing a more systematic analysis of how residential mobility shapes income segregation. While previous work on residential mobility has acknowledged the role of residential relocations in changing segregation patterns, often focusing on ethnic/racial groups, work that focuses on socioeconomic dimensions has rarely disentangled the distinct contributions of high-income groups to segregation dynamics. For instance, studies like Rimoldi et al. (2024) and Hochstenbach and van Gent (2015) offer valuable insights into the links between mobility, gentrification and segregation. However, their analyses largely remain descriptive and do not systematically distinguish the contributions of different income groups to changing segregation levels. Our study builds on this work by introducing a scenario-based approach that isolates the effects of group-specific mobility.

Overall, our findings underscore the importance of viewing segregation not as a static pattern, but as the outcome of dynamic and unequal mobility processes and neighbourhood sorting. Even in a city with an inclusive housing regime like Vienna, high-income households display distinct spatial preferences and mobility patterns that are beginning to reshape urban segregation. At the same time, the behaviour of lower-income groups, often determined by constraints rather than choice (W. Clark et al. 2006), plays an equally critical role. This reinforces the arguments that segregation research needs to go beyond measuring static residential distributions and centre mobility as a core mechanism of urban segregation.

This spatial scenario analysis provides an effective framework for detecting where and how segregation patterns emerge or intensify. Even though overall segregation levels in Vienna remain comparatively low, persistent income-based spatial divisions may still constrain access to resources and entrench social inequality. Systematic monitoring of these dynamics is therefore crucial for early policy intervention. Moreover, integrating income-based mobility data with fine-grained spatial analyses offers a methodology for comparative segregation research across urban contexts.

An open question that remains from our analysis relates to the drivers of residential mobility. Residential moves are shaped by the complex interplay of residential preferences, housing availability, life-course trajectories and institutional conditions. In Vienna, the structure of the social and cooperative housing sector and the strength of the rental market are particularly influential (Banabak, Kadi, et al. 2024). The observed relocation of high-income households to previously mixed outer districts may indicate the emergence of gentrification processes. Disentangling the factors driving the varying mobility patterns of different socioeconomic groups was not the aim of this paper. Future research should, however, incorporate longitudinal and qualitative approaches to better understand mobility dynamics and assess how they feed into longer-term patterns of residential change.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### Conflicts of Interest

The authors declare no conflicts of interest.

### Endnotes

[1]The quintile thresholds are shown in Table A1 in the Appendix. Table A2 in the Appendix presents summary statistics of the household stock across census districts, as well as the total number of households, in Vienna per year.

[2]One limitation of the LSDI is that it can understate segregation when very large, homogeneous clusters exist, since neighbouring units then appear similar. In Vienna, this risk is limited because census districts are relatively small and internally heterogeneous, and affluent households are not concentrated in single large blocks but dispersed across multiple units.

[3]The bandwidth of 800 m is chosen since it approximates a walkable neighbourhood scale. In Vienna, census districts are predominantly small and closely spaced. Hence, an 800 m kernel typically spans several adjacent units without aggregating across whole districts. Because census districts are denser in the inner city, an 800 m kernel encompasses more units than in peripheral areas. A spatially varying bandwidth would, however, alter the scale of measurement and compromise comparability. We therefore use a fixed bandwidth to maintain consistent comparison of local segregation patterns across space and across scenarios.

[4]Equation (4) expresses the contribution of census district $c$ to the Spatial Dissimilarity Index (Equation 7). The value of the LSDI for each area depends on three elements: (i) the internal income composition of the area, (ii) the degree of contrast between this comrposition and that of its surrounding areas and (iii) the population weight of the area. The influence of neighbouring areas is incorporated via the kernel estimator.

[5]Our analysis distinguishes between segregation arising from the relocation of already affluent households and segregation generated through upward mobility into the highest income quintile. While both processes reduce diversity in origin neighbourhoods and increase uniformity in affluent destinations, only the former can be understood as a 'retreat of the rich'. While upward income mobility and in-migration from outside Vienna represent distinct processes, the available data do not allow us to separate these effects.

[6]Out-migration from Vienna is not included in the scenario analysis, as destinations outside the city fall beyond the spatial reference frame of the segregation measure. Since the LSDI captures contrasts between neighbouring census districts within Vienna, including moves beyond the city boundaries would mix internal spatial processes with broader compositional change.

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## Appendix

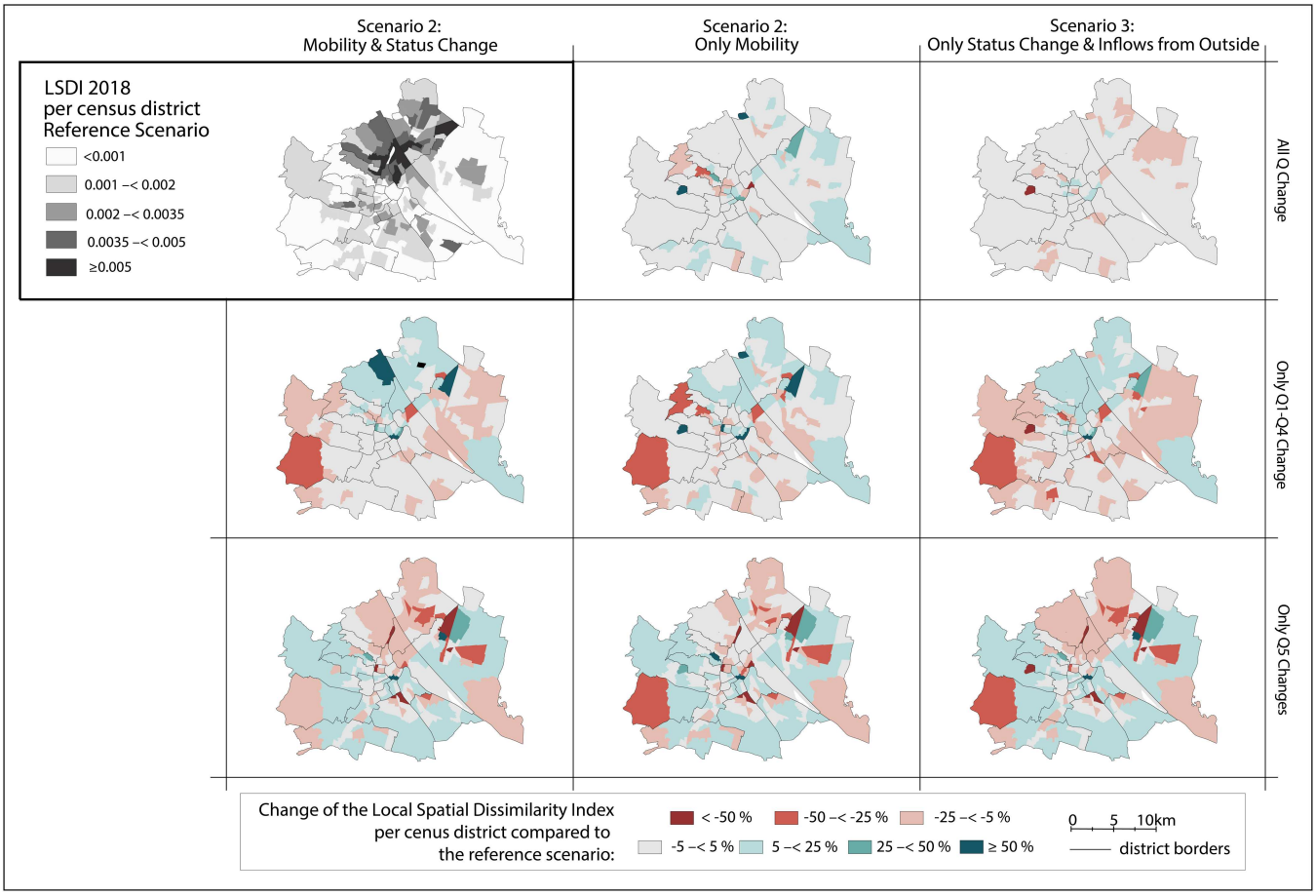


**FIGURE A1** | Scenario analysis: Changes in the local spatial dissimilarity index (all scenarios).

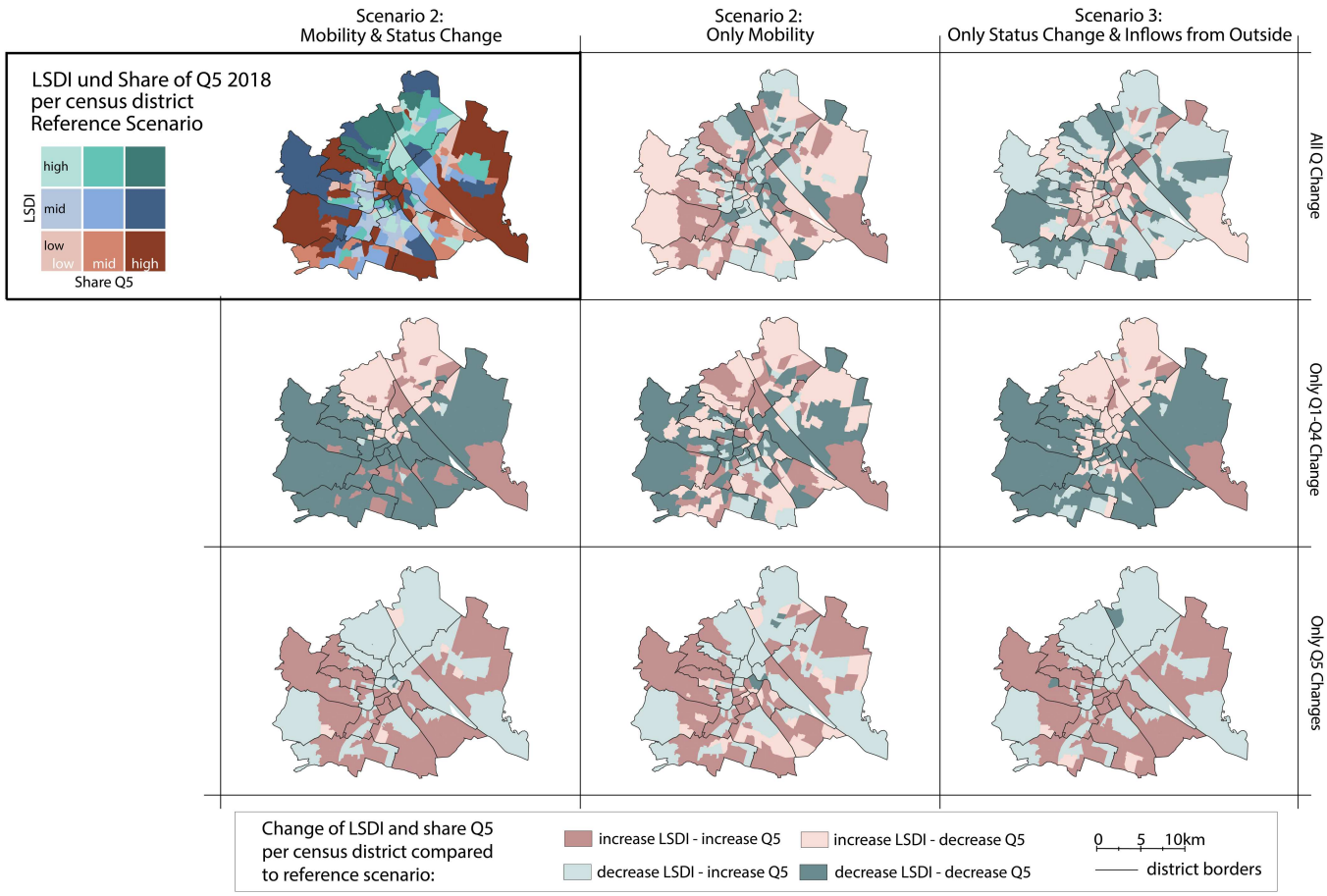


**FIGURE A2** | Scenario analysis: Changes in the local spatial dissimilarity index and share of Q5 in census districts (all scenarios).

**TABLE A1** | Quintile thresholds.

| | Quintile 1 | Quintile 2 | Quintile 3 | Quintile 4 |
|---|---|---|---|---|
| 2018 | 13,105.80 | 21,636.16 | 30,590.30 | 44,229.60 |
| 2017 | 12,496.40 | 20,864.34 | 29,754.89 | 43,058.44 |
| 2016 | 12,225.32 | 20,551.96 | 29,330.30 | 42,472.63 |
| 2015 | 11,972.61 | 20,195.09 | 28,869.31 | 41,772.69 |
| 2014 | 12,106.08 | 20,200.08 | 28,612.80 | 41,187.81 |
| 2013 | 12,065.58 | 20,044.98 | 28,259.65 | 40,612.95 |
| 2012 | 11,977.73 | 19,770.43 | 27,769.32 | 39,963.18 |
| 2011 | 11,915.82 | 19,367.26 | 27,086.96 | 38,911.94 |

**TABLE A2** | Summary statistics of household stock across census districts and total stock of households in Vienna, by year.

| | Minimum | Mean | Median | Maximum | Total number of households (citywide) |
|---|---|---|---|---|---|
| 2011 | 61 | 4920 | 4499 | 17,729 | 1,210,280 |
| 2012 | 55 | 4941 | 4583 | 17,929 | 1,215,510 |
| 2013 | 146 | 4900 | 4566 | 17,842 | 1,205,499 |
| 2014 | 173 | 5043 | 4696 | 18,214 | 1,240,727 |
| 2015 | 181 | 5302 | 4902 | 18,702 | 1,304,315 |
| 2016 | 194 | 5461 | 4994 | 18,944 | 1,343,436 |
| 2017 | 194 | 5535 | 5042 | 19,048 | 1,361,762 |
| 2018 | 27 | 5628 | 5136 | 19,356 | 1,390,142 |