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RESEARCH ARTICLE

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Spatial dynamics of incoming movers and the state-led gentrification process: The case of Rotterdam

Kyri Maaike Joey Janssen[1] | Clémentine Cottineau-Mugadza[1] | Reinout Kleinhans[1] | Ellen van Bueren[2]

[1]Department of Urbanism, Delft University of Technology, Delft, The Netherlands

[2]Department of Management in the Built Environment, Delft University of Technology, Delft, The Netherlands

Correspondence

Kyri Maaike Joey Janssen, Department of Urbanism, Delft University of Technology, Julianalaan 134, 2628 BL Delft, The Netherlands.
Email: k.m.j.janssen@tudelft.nl

Abstract

Although gentrification and its associated changes in residential mobility have been widely studied, surprisingly little attention has been paid to the changing origin locations of gentrification-related residential moves. In this study, we use fine-grained register data from the Dutch Central Bureau of Statistics to uncover changing residential mobility patterns to and within the city of Rotterdam, the Netherlands. We identify that the state-led gentrification process goes hand in hand with the changing socioeconomic characteristics of in-movers and the changing origin locations of residential moves. The city of Rotterdam increasingly attracts middle- to high-income households from other core cities in the Netherlands, a process that we understand as inter-urban gentrification spillover. In parallel, intra-urban moves by economically vulnerable residents are declining, especially toward and within gentrifying neighborhoods. This represents evidence of exclusionary displacement. We conclude that the spillover effects of contemporary gentrification should be understood beyond an intra-urban metropolitan perspective since gentrification in one city can enhance gentrification in another.

KEYWORDS

displacement, gentrification, housing, residential mobility

1 | INTRODUCTION

In the 21st century, postindustrial cities in the Global North are experiencing population growth and economic prosperity (Glaeser & Maré, 2001). The class transition of the postindustrial era has enabled the rise of middle-class households, subsequently fueling the demand for urban living and driving up housing prices (Rose, 1984; Van Ham et al., 2020). A process that is associated with these city transformations is gentrification, defined by Smith as 'the transformation of inner-city working-class and other neighborhoods to middle- and upper-middle-class residential, recreational, and other uses' (Smith, 1987, p. 462). Over time, scholars have found that gentrification spreads beyond the city center toward city suburbs, metropolitan areas, and even rural environments (Booi, 2023; Charles, 2013). The increasingly expensive core cities push both working-class (Hochstenbach & Musterd, 2018; Van Criekingen, 2008) and middle-class households (Booi, 2023; Mazanti, 2007; Paccoud & Mace, 2018) to seek residence beyond the urban core. This reorientation of households not only extends gentrification beyond the inner city but also amplifies the reconfiguration of spatial inequalities, thereby expanding their impact to broader geographic scales.

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The processes of class transformation and displacement have been the foundation of a large body of literature interested in the socioeconomic characteristics of households moving in and out of gentrifying neighborhoods (e.g., Ding et al., 2016; Freeman & Braconi, 2004; McKinnish et al., 2010). As gentrification spreads within and beyond cities, the implications for households, in terms of both how they are impacted by and contribute to gentrification, take on a spatial dimension. For instance, Hochstenbach and Musterd (2018) determined that gentrification is linked to the suburbanization of poverty since low-income residents are increasingly excluded from inner-city neighborhoods. Simultaneously, scholars have found that the increasingly expensive inner-city areas also drive affluent households into the region surrounding the urban core, enhancing suburban and rural gentrification (e.g., Booi, 2023; Mazanti, 2007; Paccoud & Mace, 2018), or, as Loumeau and Russo (2022) refer to it, 'second-hand' gentrification in neighboring cities.

Although scholars have examined gentrification-related moves beyond gentrifying neighborhoods, most studies capture how the *destinations* of outgoing residents change within metropolitan regions subject to advanced stages of gentrification (e.g., Ding et al., 2016; Dragan et al., 2020). As such, the impact of Inter-urban gentrification spillover on relatively affordable cities (i.e., the *origins* of gentrifiers) remains an understudied phenomenon in the academic literature (Janssen et al., 2023). Hence, this research delves into the evolving origin patterns of residential mobility for a city prone to second-hand gentrification, namely Rotterdam. By relying on large-scale longitudinal register data from the Central Bureau of Statistics (CBS), we finely mapped both intra and inter-urban residential mobility patterns over time and examined these in light of gentrification. By doing so, we not only unveil the changing socioeconomic characteristics of movers but also examine patterns of who moves from where and how these dynamics change over time.

Rotterdam provides an interesting case to study second-hand gentrification since it has adjusted at a slower pace to the demands of the service economy when compared to other core cities in the Netherlands (i.e., Amsterdam, Utrecht, or The Hague), resulting in relatively low real estate prices (Arundel & Hochstenbach, 2020). At the same time, the municipality of Rotterdam actively engages in attracting middle-class individuals and families to the city, aiming to create high-class neighborhoods. These policy implementations by the Rotterdam municipality should be understood as state-led gentrification (Uitermark et al., 2023; Van den Berg, 2012), as they lead to the socioeconomic upgrading of neighborhoods. Together with the fact that Rotterdam is well-connected to other major cities in the Netherlands through a dense and efficient infrastructure network, this suggests that Rotterdam is vulnerable to Inter-urban gentrification spill-overs from cities in more advanced stages of gentrification.

Thus, in this paper we are interested in identifying changing residential mobility patterns toward and within Rotterdam in light of state-led gentrification. We empirically asses: 1. 'Second-hand gentrification', which refers to the phenomenon of increased Inter-urban migration driven by middle-class residents from more gentrified urban areas; 2. 'Exclusionary displacement', which addresses the diminishing intra-urban residential choice of economically vulnerable residents in Rotterdam itself. Notably, we will elaborate on these in the theoretical framework. The central research questions state:

> *"How do residential mobility patterns toward Rotterdam unfold in light of the state-led gentrification process and does this support the hypothesis of second-hand gentrification?"*

And

> *"How does state-led gentrification modify the residential opportunities of the working class within Rotterdam and does this support the hypothesis of exclusionary displacement?"*

Overall, we found that residential moves associated with gentrification operate on multiple scales, such as incoming residents increasingly moving in from other urban cores at the regional level, while residents within Rotterdam are increasingly restricted in their residential choices of different units in the same neighborhood, district, or city altogether. These findings highlight the interdependencies of places and require us to consider gentrification as a process that affects neighborhoods and cities in relation to one another.

The remainder of this paper begins with the theoretical framework, highlighting important characteristics of contemporary gentrification and how gentrification is interconnected to residential mobility patterns. Next, we elaborate on the context of Rotterdam, as well as two hypotheses regarding residential mobility and gentrification in this city. Third, the methodology section provides an outline and explanation of the different origin, mover, and neighborhood categories on which this paper relies. Fourth, the empirical evidence is presented. Finally, we conclude and discuss our findings in light of our two key hypotheses.

2 | THEORETICAL FRAMEWORK

2.1 | Trends in gentrification and inequality

Originally, gentrification was perceived as a primarily market-driven process, where investors aimed to close the rent gap in impoverished inner-city neighborhoods. Presently, it is acknowledged that gentrification and the economic transformation of cities can also be closely tied to policy interventions, which are often referred to as 'state-led gentrification' (Hackworth & Smith, 2001; Lees, 2008). In contemporary Dutch cities, gentrification is a process fueled both by the traditional elements of rent gaps, 'back-to-the-city' movements, and the policies of local and regional authorities, which aim to restructure the housing stock to attract solvent and active middle-class households in previously deprived neighborhoods (Uitermark et al., 2007). In this paper, we define gentrification as "*the transformation of inner-city working-class and other neighborhoods to middle-and upper-middle-class residential recreational, and*

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other uses" (Smith, 1987, p. 462). This definition encompasses gentrification driven by governmental interventions in the housing stock, commonly referred to as state-led gentrification. State-led gentrifying policies, such as social mixing, provoke socioeconomic change in neighborhoods, which aligns with the broader process of gentrification as described by Smith. Given the predominant role of housing policies in gentrification in the Netherlands, this paper focuses specifically on state-led gentrification.

Alongside the emergence of state-led gentrification, contemporary gentrification has transcended from a small, concentrated process toward a dominant force of urban change. Gentrification is no longer restricted to a handful of inner-city neighborhoods in major cities; it now prevails in urban regions (e.g., Booi, 2023; Charles, 2013; Markley, 2018). This expansion is correlated with two noteworthy demographic trends. First, the rise of the knowledge economy, spurred by globalization and increasing competitiveness in cities, is intricately linked to the growing number of high-class workers in globalized urban areas (Glaeser & Maré, 2001). Second, the diversification of households as part of the second demographic transition—marked by delayed marriage and family formation or partnership dissolution—has heightened the demand for city living (Buzar et al., 2005). As a result, many contemporary cities in advanced economies have become increasingly unaffordable for middle-class households (Arundel & Doling, 2017), prompting these households to relocate away from inner-city areas, and thereby spreading gentrification (e.g., Booi, 2023; Paccoud & Mace, 2018).

2.2 | Residential mobility and gentrification

According to the life course theory, moving behaviors are dependent on changes in one's household, education, and/or employment situations. Factors such as fertility and fertility plans, partnership formation and dissolution, and professional career changes (Clark & Davies Withers, 1999; Clark & Dieleman, 1996; Feijten & Van Ham, 2007) are all important triggers for residential moves. The likelihood of an move depends on the micro context of an individual, such as their financial resources and personal preferences. However, relocation is also intricately linked with macro-level opportunities and constraints in areas such as the housing and labor markets (Mulder & Hooimeijer, 1999). Therefore, residential behavior arises from the interplay between individual motives, resources, and constraints on the one hand, and the particular array of options available in the macro context on the other hand (Hooimeijer & Oskamp, 1996).

In the context of gentrification, residential mobility is often examined in light of gentrifiers and displacees. While 'gentrifiers' are drawn to transforming neighborhoods, the incumbent low-income households face growing challenges due to rising prices, potentially resulting in displacement. Whereas studies generally find that gentrification goes hand in hand with the in-movement of households with higher income or education when compared to incumbent residents (Hochstenbach & Musterd, & Teernstra, 2015; Rérat, 2012), several quantitative studies found little evidence that low-income households are increasingly displaced from gentrifying neighborhoods (Freeman & Braconi, 2004; McKinnish et al., 2010). Proponents of the professionalization theory argue that gentrification is less about displacing the lower class and more about an overall class replacement (Butler et al., 2008). However, aligning with Marcuse (1985), Slater (2009) suggests that low-income households are not necessarily directly displaced from their neighborhoods and cities. Instead, increasing housing prices restrict working-class households from moving into neighborhoods that were once affordable but are now undergoing gentrification. The notion of indirect displacement, proposed by Marcuse (1985) in the form of exclusionary displacement, emphasizes that only estimating the likelihood of low-income households relocating from a gentrifying neighborhood offers limited insights into the true impacts of gentrification on low-income communities.

Interestingly, little is known about the origins of those moving into gentrifying neighborhoods and how these change over time (Janssen et al., 2023). Identifying departure locations sheds light on the roles of spatial interactions in the evolving patterns of residential moves and, consequently, who (no longer) moves into gentrifying neighborhoods. Although scholars are increasingly acknowledging how gentrification spreads beyond core cities, most research on gentrification-induced moves focuses on the destination locations of households moving toward metropolitan regions (e.g., Booi, 2023; Mazanti, 2007; Paccoud & Mace, 2018). Exceptions include studies identifying second-hand gentrification in cities, such as the work of Ocejo (2019), which examines the narratives of gentrifiers moving from New York City to Newburgh, gentrifying the receiving city in the process. Another example is a study by Loumeau and Russo (2022), which identifies a similar pattern of second-hand gentrification in Rennes and Bordeaux, resulting from the improved accessibility of these areas to Paris. These studies stress the need to capture the origins of gentrifiers since they identify that gentrification in one city is related to gentrification in another. This highlights the significance of capturing the spillover effects of gentrification, not solely from a destination-based metropolitan standpoint, but also from an origin-oriented perspective beyond the metropolitan scale.

2.3 | Case study: Rotterdam's housing and gentrification context

This paper specifically focuses on gentrification in Rotterdam. In terms of population, Rotterdam is the second-largest city in the Netherlands. Positioned within the Randstad, Rotterdam forms an integral part of the polycentric core of the Netherlands. The Randstad is composed of cities that are intertwined but distinct in their administrative, political, and economic terms, with Rotterdam serving a pivotal role alongside other key cities such as Amsterdam, The Hague, and Utrecht. However, due to the industrial heritage of Rotterdam, the city has struggled to meet the demands of post-industrial society (Van Den Berg, 2017) resulting in greater difficulties related to unemployment compared to other cities in the Netherlands. Additionally, Rotterdam has been known for its large share of

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ethnic minorities and urban poor, who have for a large part been held responsible for the crime and disorganization of the city (Van Swaaningen, 2005). This view has resulted in the justification of rigorous policies that aim to mix ethnically concentrated and poor neighborhoods (Uitermark & Duyvendak, 2008). At present, Rotterdam is widely recognized as an appealing destination for residence and tourism. A surge in real estate prices and an influx of affluent households, particularly in and around the city center, reflect the growing popularity and positive perception of this city (Custers & Engbersen, 2022; Permentier, 2018).

The growing popularity of Rotterdam is partly due to policies implemented by the national and local governments (Permentier, 2018). Rotterdam Municipality actively seeks to attract middle-class households, especially families, to the city (Van Den Berg, 2012, 2017). The focus of the city's policies revolves around housing, including the privatization and restructuring of the social housing stock (Hochstenbach & Musterd, 2018;), the building of family friendly housing (Van Den Berg, 2012, 2017), and—more extraordinarily—the exclusion of unemployed households from specific parts of the city (Uitermark & Duyvendak, 2008; Van Gent et al., 2018). The state-led gentrification of inner-city neighborhoods has been explicit policy goal to attract affluent households and 'rebalance' the city's diverse population (Arkins & French, 2023; Uitermark & Duyvendak, 2008; Uitermark et al., 2023). Consequently, the reduction in social housing combined with significant price increases in the private housing market has led to long waiting lists and fewer new allocations in the social rental sector, increasingly restricting the residential options available to low-income households (Hochstenbach, 2017). Custers and Engbersen (2022) caution that Rotterdam might become a victim of its own success since the sharp rise in housing prices poses a greater challenge not only for lower-income households but also for emerging middle-class families to enter the Rotterdam housing market. A phenomenon already occurring in other major cities in the Netherlands (Arundel & Hochstenbach, 2020; Booi, 2023). For this reason, it is important to investigate whether Rotterdam has drawn gentrifiers from other major cities, particularly those already experiencing significant gentrification, where increasing housing costs have become too high even for them.

2.4 | Hypotheses

In this research paper, we tested two hypotheses regarding changes in residential mobility associated with the state-led gentrification process in Rotterdam.

1. 'State-led gentrifying neighborhoods in Rotterdam will experience heightened residential mobility flows of middle- and high-income households from other core Randstad cities in the Netherlands'– **Second-hand gentrification hypothesis**.

   Following the work of Loumeau and Russo (2022) in Paris and Ocejo (2019) in New York City, we hypothesize that state-led gentrification in Rotterdam will attract households from more gentrified urban areas in the Netherlands. Studies on the Dutch housing stock (Arundel & Hochstenbach, 2020) and the socio-economic composition of Dutch cities (Musterd et al., 2020) identify that Rotterdam is in a relatively early stage of gentrification. In contrast, cities like Amsterdam and Utrecht exhibit the highest income and housing value growth, reflecting more advanced levels of gentrification. Relatedly, middle-income households increasingly struggle to find housing in these advanced gentrified cities, while households endowed with ample financial resources benefit from the rapidly rising housing prices in high-cost urban cores and can significantly improve their housing conditions by moving to Rotterdam. The relatively short distance between cities in the Netherlands—and especially the Randstad—allows for individuals to reside in Rotterdam while commuting daily to another city. In other words, we expect that the different temporalities of gentrification that exist in Dutch cities, results in changing residential mobility patterns between them.

   However, the elevated pressure on the housing market, as well as gentrification overall, also affects intra-urban residential opportunities for incumbent residents—especially those with low incomes.
2. 'The intra-urban residential mobility flows of economically vulnerable households toward and within state-led gentrifying neighborhoods will decline over time' – **Exclusionary displacement hypothesis**.

Building upon the framework presented by Newman and Wyly (2006) and Marcuse (1985), we expect that in the Dutch context, which is characterized by strong tenant rights, households will usually not be subject to direct displacement unless their social rented dwelling is demolished (Kleinhans, 2019). Instead, they primarily face exclusionary displacement. Together with a reduction in social housing, rising housing prices increasingly reduce their residential mobility opportunities. As housing associations and other landlords face rent price regulations, households often do not directly face unaffordability in their current dwelling. Nevertheless, once a new tenant takes occupancy, landlords have the liberty to establish a new rental price (Haffner & Boumeester, 2010). Since short-distance moves are generally triggered by housing and family matters (Clark & Dieleman, 1996), we expect that gentrification proportionally reduces the extent to which low-income households can move upwards in their housing situation. State-led gentrification policies, such as those executed in Rotterdam, accelerate the process of tenure conversion from social housing toward privatized rental units and owner-occupied housing. Thus, households that once had access to affordable housing in the inner city would now find it increasingly out of reach.

3 | DATA AND METHODS

This paper draws on individual-level longitudinal register data from the CBS Netherlands for the 2005–2019 period.[1] In this paper, we identify all residential moves to and within Rotterdam, where a

[1]See Bakker et al. (2014) for more information on the Dutch register data.

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residential move is defined as a change in residential location from 1 year to the next. The residential location of each household was determined on the 31st of December each year, and only observations where households have resided at a location for more than 182 days were considered as a residential location. Furthermore, this analysis focused exclusively on independent moves, excluding relocations such as those into elderly homes. After applying these criteria, our data set comprises 446,990 residential moves.

In this analysis, we compared two periods: pre-gentrification (2005–2010) and gentrification (2014–2019). We acknowledge that this is a simplification of reality since gentrification is an ongoing process. However, we have reason to believe that comparing these two time periods provides valuable insights into the state-led gentrification process in Rotterdam. Although the 2005–2010 period can be characterized by high economic growth, there was limited population growth (Rotterdam Municipality, 2023) and relatively low real estate values in Rotterdam (Arundel & Hochstenbach, 2020). The abundance of social housing (Hochstenbach & Musterd, 2018) and the scarcity of family housing made Rotterdam less appealing to middle-class households (Van den Berg, 2012). In fact, Hochstenbach and Van Gent (2015) found that during this period, low-income neighborhoods surrounding the city center experienced economic decline rather than gentrification.

In the latter period (2014–2019), after the economic crisis, the Rotterdam Municipality implemented several effective housing policies in neighborhoods surrounding the city center (Rotterdam Municipality, 2016), and housing prices increased (Arundel & Hochstenbach, 2020). Arguably these policy implementations should be understood as state-led gentrification, as they were designed to attract highly educated affluent households to neighborhoods that were already prone to gentrification due to their environment and location (Rotterdam Municipality, 2016). The empirical findings by Permentier (2018) show that these policies effectively attracted affluent households to the surrounding inner-city neighborhoods. Consequently, housing prices and transactions in these areas have risen more rapidly than in the rest of Rotterdam. These findings are supported by Custers and Engbersen (2022), who also observed socioeconomic upgrading of the neighborhood composition in and around the city center of Rotterdam in 2017 compared to 2008. As this opposes the economic downgrading of these low-income surrounding inner-city neighborhoods that was identified by Hochstenbach and Van Gent (2015) in the pre-gentrification time period, we argue that in 2014 – 2019, state-led gentrification of low-income neighborhoods was more predominant in Rotterdam compared to 2005–2010.

Notably, we do not include the 2010–2013 period in our gentrification classification. This decision was driven by the notable impact of the economic crisis on the Dutch housing market during this period (Ronald & Dol, 2011). Our analysis of the data reveals a substantial decrease in the number of residential relocations both to and within Rotterdam. Consequently, we have chosen to exclude this period from consideration since it does not align with our focus on (pre) gentrification timeframe.

3.1 | Moving directions

The second-hand gentrification hypothesis concerns changes in Inter-urban residential mobility, where it is expected that gentrifying neighborhoods attract movers from other core cities in the Netherlands. The exclusionary displacement hypothesis focuses on intra-urban moves, where it is expected that gentrification reduces the intra-urban mobility of lower-class households. We distinguish three types of Inter-urban origin locations and four types of intra-urban origin locations.

Inter-urban origin locations were categorized based on their municipal boundaries in 2019. We highlight the importance of the Randstad since these cities are interconnected by a well-developed infrastructure network, making daily commuting between Randstad cities feasible (Goess et al., 2016). Although various definitions of the Randstad exist, we largely rely on the definition of the Randstad from the CBS (CBS, 2024), with the exception that we acknowledge Alkmaar to be part of the Randstad due to its close proximity to Amsterdam. Besides Rotterdam, the other major cities of the Randstad include Amsterdam, The Hague, and Utrecht. In this paper, we categorize these municipalities as core Randstad cities. Other municipalities within the Randstad region with populations exceeding 100,000 and classified as urban by the CBS are categorized as secondary Randstad cities. The remaining cities with populations above 100,000 and classified as urban, but not belonging to the Randstad, are classified as non-Randstad cities. The core-Randstad cities are the focus of the second-hand gentrification hypothesis, as we expect that the later stages of gentrification in these other primary cities will result in the increasing number of households moving to Rotterdam. It is important to note that Amsterdam and Utrecht are in a more advanced stage of gentrification compared to Rotterdam, while the differences between Rotterdam and The Hague are less striking (Arundel & Hochstenbach, 2020; Musterd et al., 2020). Nevertheless, we still include The Hague in our classification of core-Randstad cities, not only because it qualifies as one, but also due to its higher average housing prices and income levels compared to Rotterdam (Arundel & Hochstenbach, 2020; Modai-Snir & Van Ham, 2020), as well as its lower proportion of social housing (Hochstenbach, 2022).

Regarding *intra-urban* moves, we identify four different types of origin locations, of which three are categories within the administrative boundaries of Rotterdam and one is the Rotterdam agglomeration. The first category is in-situ residential moves, which are moves that occur within the administrative boundaries of a neighborhood. The second category, district, is intra-urban relocations that occur within the same administrative urban district but not within the same administrative neighborhood. The third category is all moves that occurred within the boundaries of Rotterdam Municipality but outside the administrative neighborhood or district, which we defined as Rotterdam moves for simplicity. Finally, moves from the agglomeration of Rotterdam to Rotterdam central Municipality are classified as Rotterdam agglomeration. Figure 1 contains a map of the municipalities of the Netherlands and their corresponding assigned categories. An overview of the total number of moves by

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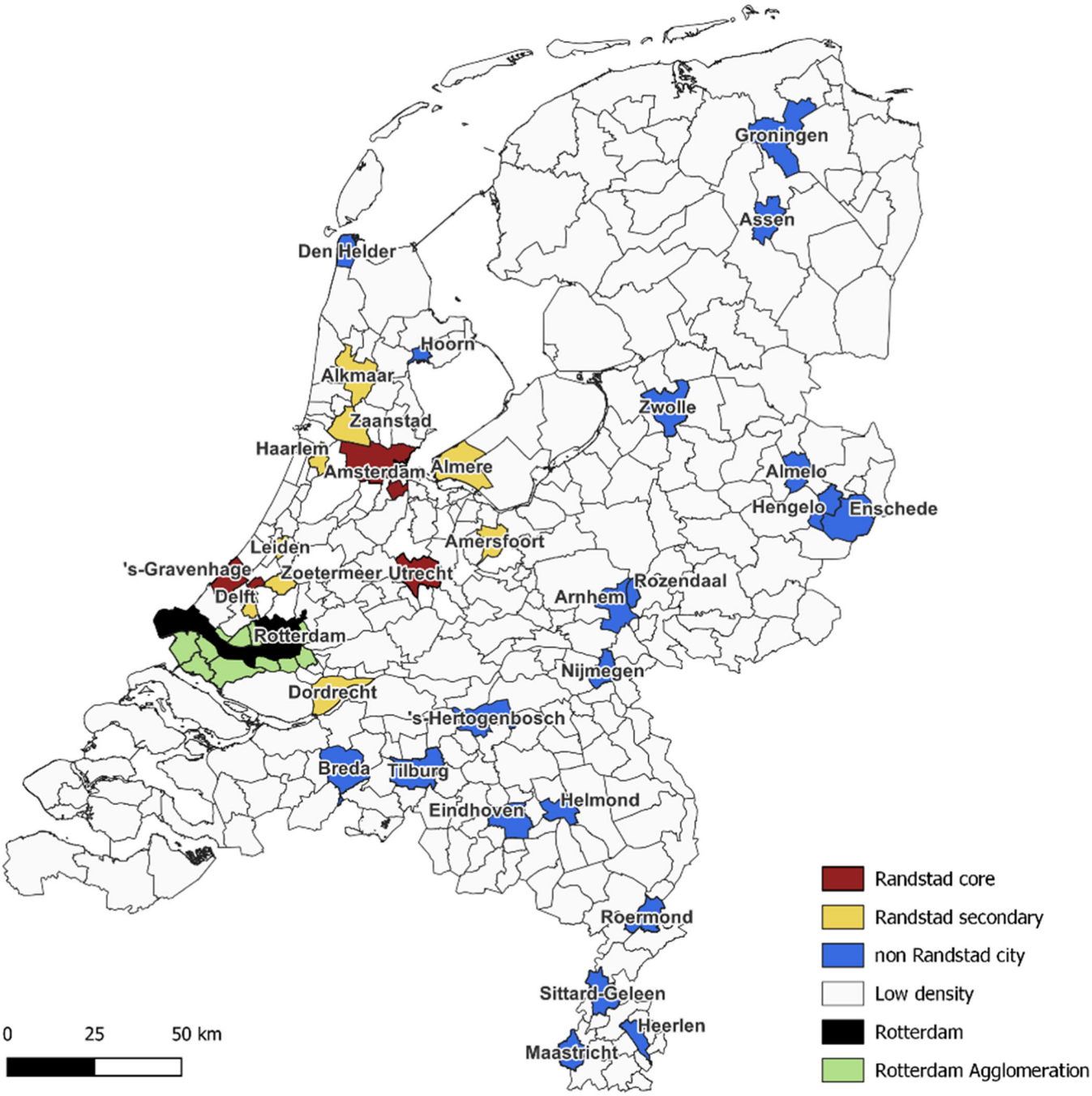

FIGURE 1 Municipal categories in the Netherlands.

origin location can be found in Supporting Information S1: Table A1 of the Appendix.

3.2 | Socioeconomic indicators of households

In this analysis, we distinguished our key mover categories based on household income and employment status. Household income is defined by total household income, corrected for household size. The standardized household income is equal to the disposable household income divided by the household's equivalency factor, as provided by the CBS. A household is considered to have a low income if its standardized income falls below the 30% of the Dutch income distribution for that specific year. High incomes are classified as those at or above the 71% of the Dutch income distribution. Middle incomes encompass those falling between the 31% and 70%. Employment status reflects whether the household relies on government benefits (classified as unemployed) or generates their own income (classified as employed). If the head of the household receives student benefits, their employment status is classified as student. Since a household

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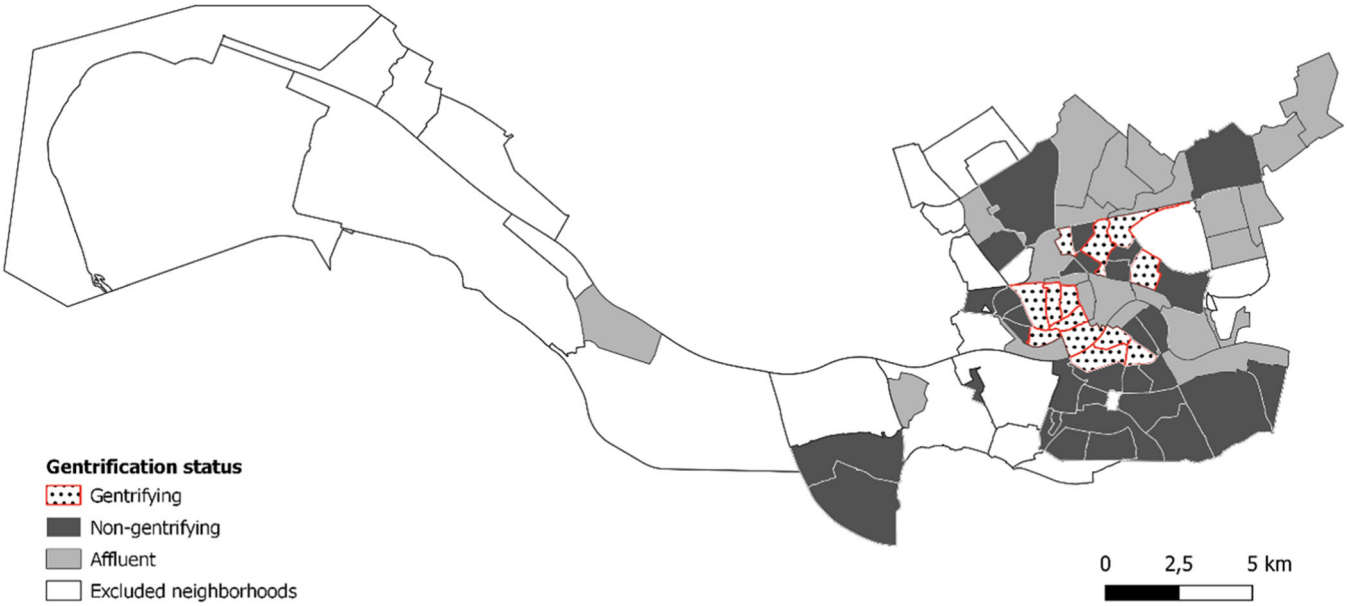

FIGURE 2 Rotterdam's gentrifying neighborhoods–Afrikaanderwijk; Bergpolder; Delfshaven; Dijkzigt; Katendrecht; Kop van Zuid; Kralingen West; Middelland; Nieuw-Crooswijk; Nieuwe Werk; Nieuwe Westen; Oude Noorden; Oude Westen.

may consist of employed and unemployed members, we define household employment status based on the primary source of income of the household.

Our two key hypotheses revolve around income and housing affordability, where we are interested in the moving patterns of middle-income, high-income, and economically vulnerable households. We define middle-income households as those whose primary income is not dependent on government social benefits, and whose overall income is classified within the middle-income level. The same holds for high-income households. Economically vulnerable households are those with a low income, where we make a distinction between employed and unemployed households. Notably, due to the high availability of subsidized student housing, we did not consider students in our hypotheses.

Although not the focus of our hypotheses, we also examined the tenure situation and household composition of movers. We argue that both tenure and household composition are indicators of a household's financial means; therefore, these assist us in understanding changing residential mobility patterns toward gentrifying neighborhoods. For instance, previous homeownership can serve as a facilitator for future homeownership, while tenants encounter growing limitations within the housing market. Additionally, living in a cohabitation arrangement with a partner can enhance the financial circumstances in comparison to single people and single parents due to the potential for dual-earnership. As a consequence of the limitations of the CBS data, one indicator not included in our analysis was the household education level.

3.3 | Mapping gentrification

For this study, we rely on Smith (1987)'s definition of gentrification, and conceptualize state-led gentrification as the economic upgrading of low-income neighborhoods that occurs alongside policy interventions implemented by national and local governments. This operationalization does not encompass the gentrification of middle to high income neighborhoods, nor neighborhood upgrading without governmental interventions in the housing stock. Although we acknowledge that high-income neighborhoods can also gentrify (i.e., super-gentrification), we exclude these from our classification of state-led gentrification. Our focus is on understanding how the residential mobility patterns of former working-class neighborhoods change, rather than how already affluent neighborhoods advance.

In this analysis, a neighborhood is considered to be gentrifying if: 1. In 2005 and 2014, it had an income below 0.5 standard deviations of the median income in Rotterdam; 2. The average income increased by more than 0.5 standard deviations of the median for the 2014–2019 period; 3. These neighborhoods were part of the housing policies that aimed to attract highly educated and affluent residents to the city (Rotterdam Municipality, 2016).[2] In total, we identified 13 state-led gentrifying neighborhoods (see Figure 2). Notably, on average, gentrifying neighborhoods witnessed a 90% increase in the total amount of newly built, demolished, and renovated dwellings for the 2014–2019 period when compared to the 2005–2010 period. This signifies a substantial increase in the number of altered dwellings when compared to Rotterdam as a whole, with the overall number of altered experiencing only a 20% increase during the same period.

Furthermore, neighborhoods that were not classified as gentrifying but had an income lower than 0.5 standard deviations of the Rotterdam median income in 2005 and 2014 were classified as 'nongentrifying'. These neighborhoods are considered low-income

[2]Supporting Information S1: Appendix A2 contains an overview of various housing interventions by neighborhood.

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neighborhoods with potential for gentrification, but where gentrification did not occur during our study period. Neighborhoods with a median income higher than 0.5 standard deviations of the median of Rotterdam in 2005 or 2014 were classified as affluent neighborhoods. Neighborhoods that do not fit into any of these categories—predominantly business and industrial areas characterized by low population density—were excluded.

4 | RESULTS

4.1 | Trends in residential mobility

Figure 3 visualizes the evolving patterns of residential mobility toward and within Rotterdam over time. Since each inter or intra-urban origin location is indexed by the total number of movers in 2005, the lines represent the percentage change in movers annually. Part of the changing number of moves can be attributed to the changing number of people in origin and destination locations. To control for this, Supporting Information S1: Appendix A3 includes results from our gravity model estimation, which contains information on predicted changes in the number of relocations based on changing population sizes and distances. We found that the changing number of moves toward and within Rotterdam differs substantially from the gravity model predictions; therefore, we argue that the changing number of moves toward and within Rotterdam cannot be explained by changes in population size. Additionally, Supporting Information S1: Appendix A3 also includes the percentage changes in the number of households moving away from Rotterdam to other cities and the surrounding agglomeration. It was found that the percentage change in households leaving Rotterdam is not as substantial as those moving to Rotterdam. Further details and reflections on this are provided in the Appendix.

Examining the moves by their origins reveals that the most substantial increase in moves occurred among households relocating from core Randstad cities to Rotterdam over time. Figure 3 further illustrates that households relocating from secondary Randstad cities also increasingly moved to Rotterdam. Additionally, there was an uptick in the number of moves from non-Randstad cities to Rotterdam. However, this increase is less pronounced and does not differ substantially from our gravity model predictions. On the other hand, short-distance intra-urban moves, such as those occurring within districts and neighborhoods, generally decrease over time. Intra-urban moves within Rotterdam, beyond the neighborhood and district scale, remained stable but showed lower growth than predicted by the gravity model. These diminishing short-distance moves contrast the increasing inter-urban residential mobility patterns, suggesting that residential mobility toward and within Rotterdam is reorientating toward increasingly inter-urban flows. This may indicate that intra-urban residential choice might become more restricted over time due to increasing demand from inter-urban movers, among other factors. These findings support both the second-hand gentrification hypothesis and the exclusionary displacement hypothesis.

To visualize the location patterns of these changing inter and intra-urban patterns, Figure 4 maps changes in the proportion of intra-urban and inter-urban moves for all neighborhoods in Rotterdam. These maps illustrate proportional changes in the counts of inter- and intra-urban in-movers relative to the overall number of in-movers for each neighborhood.

Notably, these maps indicate that an increasing proportion of inter-urban moves is largely concentrated in the inner city and state-led gentrifying neighborhoods, which suggests that incoming

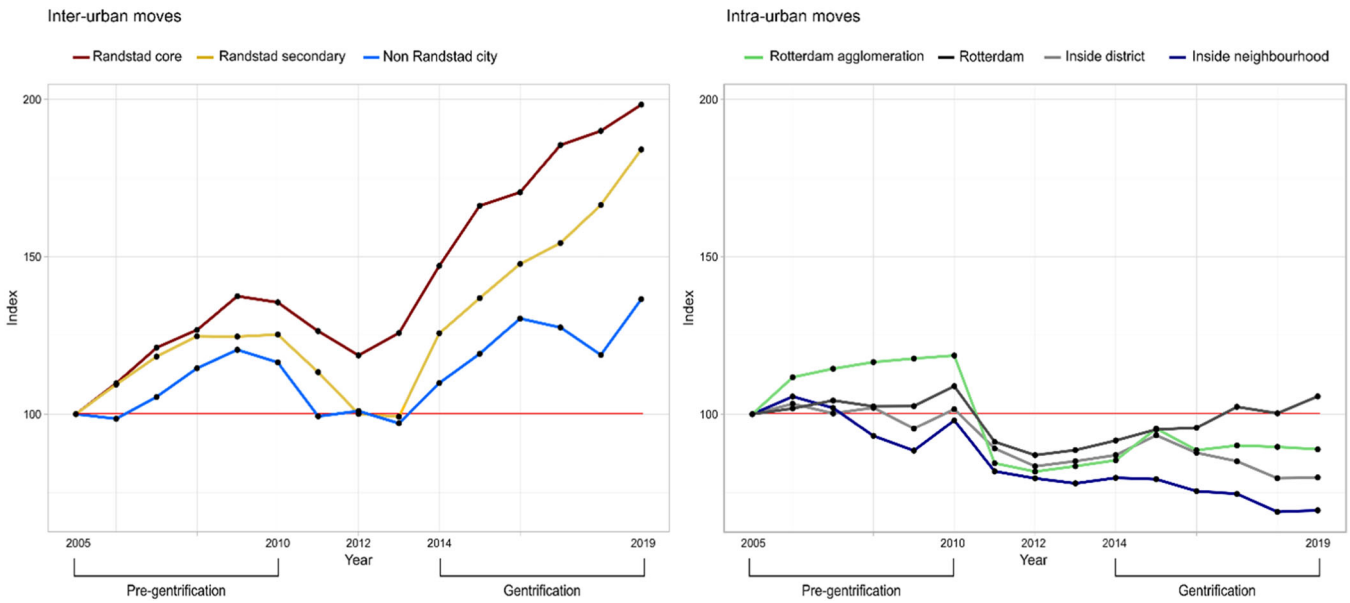

FIGURE 3 Percentage change in the number of moves for each origin location between 2005 and 2019, indexed by the total number of moves in 2005.

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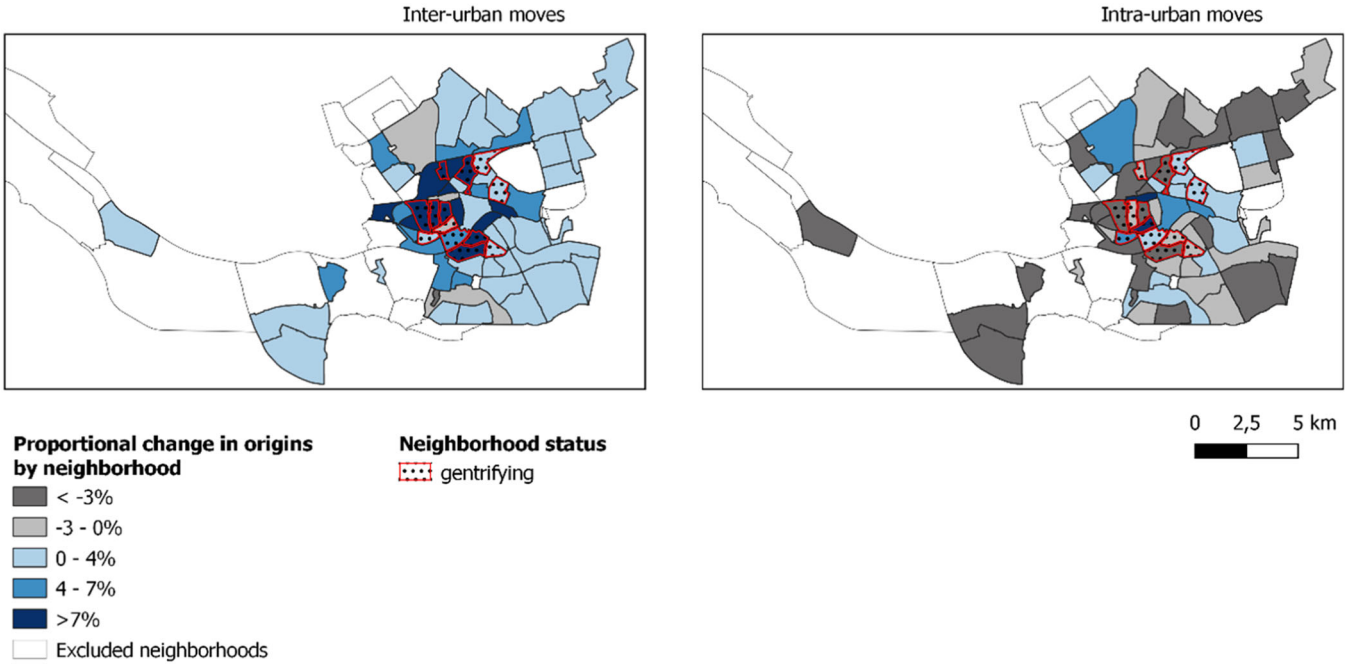

FIGURE 4 Proportional neighborhood change in inter and intra-urban moves for 2014–2019 compared to 2005–2010 in relation to the total number of moves.

inter-urban households are less likely to relocate to the northern and southern parts of Rotterdam. On the other hand, the proportion of intra-urban moves seems to decrease in the city center and within certain neighborhoods around the edges of the city, painting a less concentrated pattern compared to the changes in inter-urban moves. Some inner-city neighborhoods even experience a slight increase in the proportion of intra-urban moves. Important to note here is that the composition of households making intra-urban moves can change over time, potentially resulting in a shift that comes at a cost for low-income households. We will elaborate on this in the following sections.

4.2 | Second-hand gentrification

Concerning the second-hand gentrification hypothesis, we anticipate that recent state-led gentrification in the neighborhoods of Rotterdam will attract middle- to high-income households from other core Randstad cities. Figure 5 shows the percentage point change in the share of different household types among movers between pre-gentrification (2005–2010), and gentrification (2014–2019), while differentiating according to movers' areas of origin. To discern the distinctions between core Randstad origins and other inter-urban origins, we also included both secondary Randstad city and non-Randstad city origins. To enhance our understanding of how inter-urban residential mobility patterns unfold in state-led gentrifying neighborhoods, we distinguished these proportional changes for each type of destination neighborhood (e.g., gentrifying, nongentrifying, and affluent).

As expected, there was a proportional increase in middle-income working households moving from core Randstad cities to Rotterdam, which was prevalent in all destination neighborhoods. This proportional increase is most predominant in state-led gentrifying neighborhoods when compared to nongentrifying neighborhoods and affluent neighborhoods. Gentrifying neighborhoods are also experiencing a proportional increase in high-income working households from Randstad core cities, which is less prevalent in nongentrifying neighborhoods and decreasing in affluent neighborhoods. We argue that these findings are in line with the second-hand gentrification hypothesis since this growing proportion of middle- and high-income working households is nonexistent for the other inter-urban categories. The increase in the number of movers from secondary Randstad cities can mostly be attributed to students. For non-Randstad cities, we observe minimal changes when compared to the other inter-urban origins.[3]

Furthermore, there has been a decrease in the proportion of households moving from rentals to owner-occupied housing over time, which is prevalent for all inter-urban origins. This mirrors the progressively competitive housing market during the later period, indicating that tenants are facing greater challenges in affording to purchase a house. In contrast, there is an increase in the proportion of households moving to Rotterdam who were homeowners in their previous location. This suggests that these households have capitalized on higher housing prices in their former areas, giving them greater opportunities to find owner-occupied housing in Rotterdam.

[3]Following a closer examination of the data, we identified that this increase is largely due to students moving from Delft to Rotterdam.

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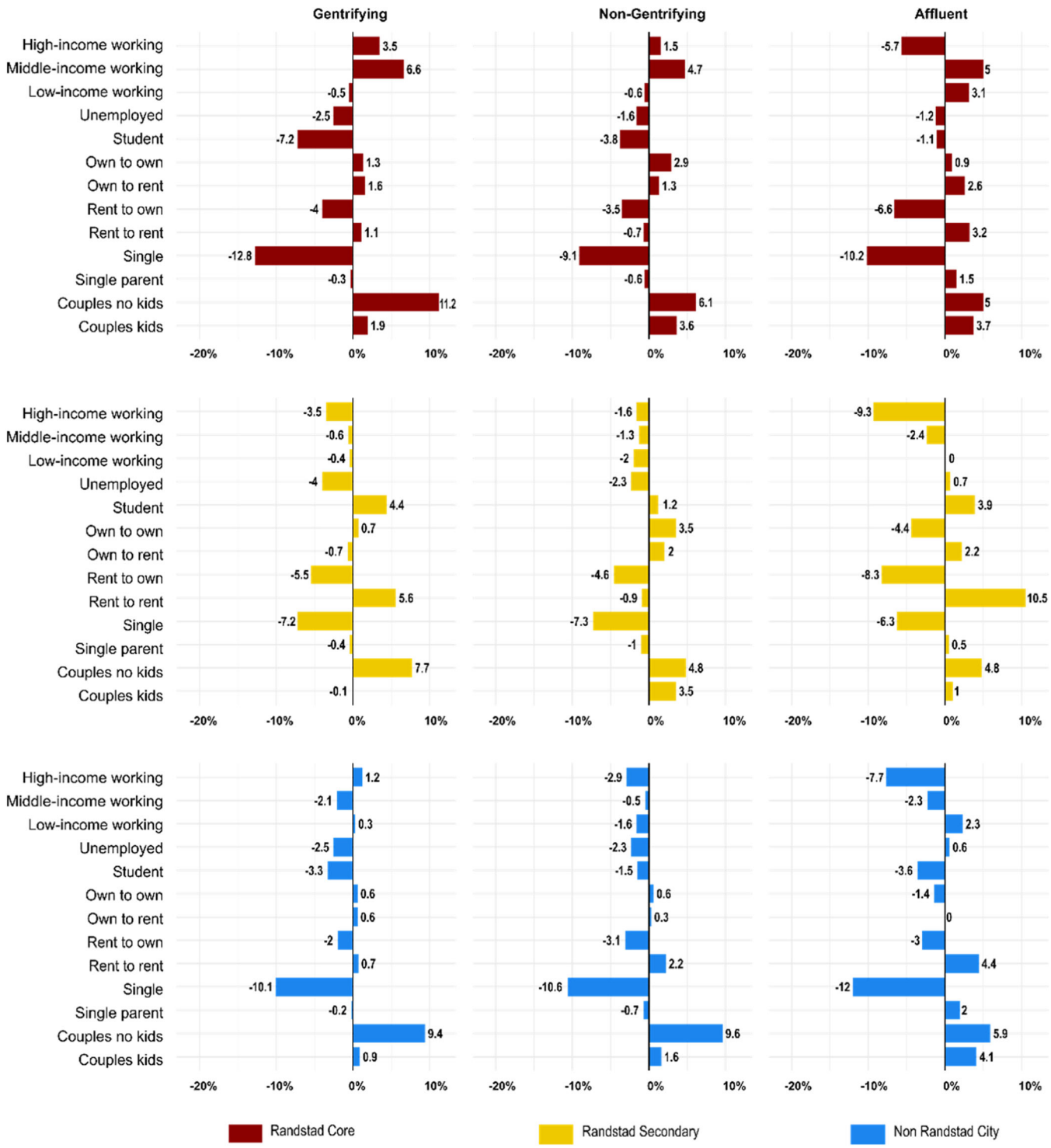

FIGURE 5 Percentage point change between the 2005–2010 and 2014–2019 periods in terms of the share of inter-urban in-movers, segmented by economic status, tenure transition, and household composition. Proportions are divided by area of origin.

Since these proportional increases are observed across all destination neighborhoods, there is no distinctive pattern specific to state-led gentrifying neighborhoods regarding the changing tenure of inter-urban movers. Considering the household composition of movers, it becomes evident that for all inter-urban origins, there has been a proportional decrease in the number of single-person households moving to the city, while the number of couples without children has increased proportionally.

In general, we observe that middle- to high-income working households play a pivotal role in the increasing number of relocations from Randstad core cities to Rotterdam—a trend not mirrored in the case of other inter-urban origins. Since this pattern is heightened in

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the state-led gentrifying neighborhoods, we argue that these findings allow us to corroborate the second-hand gentrification hypothesis. However, it is important to note that although most prevalent in gentrifying neighborhoods, nongentrifying and affluent neighborhoods are also experiencing a proportional increase in the number of middle-income working households from core Randstad cities, suggesting that gentrification spillovers by middle-income households are not solely restricted to gentrifying neighborhoods.

4.3 | Exclusionary displacement

In light of the exclusionary displacement hypothesis, we expect that over time, economically vulnerable households are less likely to make intra-urban moves toward and within the state-led gentrifying neighborhoods of Rotterdam. Figure 6 presents the percentage point changes for different household types among intra-urban movers between the 2005–2010 and 2014–2019 periods. We did not identify any substantial patterns regarding moves from Rotterdam agglomeration toward Rotterdam and thus decided to not incorporate this origin category in this section.

The analysis reveals two striking counter intra-urban patterns. First, low-income working households have experienced the largest proportional decrease in inbound relocations within neighborhoods, districts, and Rotterdam for all neighborhood categories. Unemployed poor households also experienced a widespread proportional decrease in moves within neighborhoods, districts, and Rotterdam. This suggests that intra-urban residential choice is becoming particularly restricted for low-income households, which likely stems from diminishing social housing and the sharp rise in housing prices within the privatized housing sector. For unemployed poor households, this decrease in in-movements is most pronounced for gentrifying neighborhoods, while for low-income working households, this pattern is prevalent in all neighborhood types.[4] Second, the proportion of high-income working households moving from intra-urban origins toward gentrifying neighborhoods has increased. Interestingly, this pattern is limited or nonexistent for the other destination categories. This implies that state-led gentrifying neighborhoods, as opposed to nongentrifying neighborhoods, have become more attractive for high-income households over time.

Regarding the tenure characteristics of moves, all destination neighborhoods have experienced a substantial increase in the number of in-movers moving within the owner-occupied sector. Concurrently, moves within the rental sector, as well as moves from the rental to the owner-occupied sector, decreased. Since these patterns are prevalent for all intra-urban origins, this suggests that the lack of homeownership, and thus wealth, has become a limiting factor for intra-urban residential choice. In other words, when compared to homeowners, tenants face greater challenges in advancing their housing situation within Rotterdam. Regarding the household composition of movers, intra-urban patterns follow a similar trend to inter-urban patterns, where destination neighborhoods have experienced a decrease in the number of single-person households moving in, while the proportion of in-movers that are couples without children increased.

To conclude, the diminishing intra-urban residential moves observed here can mostly be attributed to low-income households, single-person households, and households without prior homeownership. Given the limited financial assets of these mover categories, these findings indicate that economically vulnerable residents relocate less within Rotterdam over time. Although this diminishing proportion of low-income in-movers prevails in all neighborhood types, it is most predominant in state-led gentrifying neighborhoods. This leads us to conclude that economically vulnerable households have become increasingly excluded from gentrifying neighborhoods. Thus, we corroborate the exclusionary displacement hypothesis.

4.4 | Regression analysis

Next, this analysis examines movers' profiles in greater detail by shifting the scale of analysis from the neighborhood to the household level. We employed two multinomial logit models, distinguishing between pre-gentrification and gentrification periods, to identify key indicators that influence the likelihood of moving into gentrifying neighborhoods. The dependent variable represents the likelihood of a household moving to a state-led gentrifying neighborhood or an affluent neighborhood, with nongentrifying neighborhoods included as the reference category. Control variables included household characteristics, prior tenure situation, and the year of the move. In this analysis, we also included the possession of a college degree by the household head as a control variable in the model. Since this variable contains a substantial number of missing values, we included a control for households without education information.

Table 1. includes the model results. In general, both models predict that households with higher education, those born in the Netherlands, and single-person households exhibit a higher probability of moving to a state-led gentrifying neighborhood when compared to a nongentrifying one, all things being equal. More interesting is that in the 2014–2019 model, high-income households are significantly more likely to move to state-led gentrifying neighborhoods compared to low-income households, while in the 2005–2010 model, low-income households are significantly more likely to move to state-led gentrifying neighborhoods when compared to middle-income households. This indicates that over time, low-income households are less likely to move to the state-led gentrifying neighborhoods of Rotterdam compared to the nongentrifying neighborhoods. This aligns with the exclusionary displacement hypothesis, indicating that low-income households are increasingly excluded from the gentrifying neighborhoods that were formerly accessible to them.

[4]To acknowledge the replacement versus displacement debate, we examined whether or not the decreasing number of relocations by economically vulnerable households is due to fewer low-income households residing in Rotterdam overall. We found no evidence for this since the number of low-income households residing in Rotterdam has remained stable over time.

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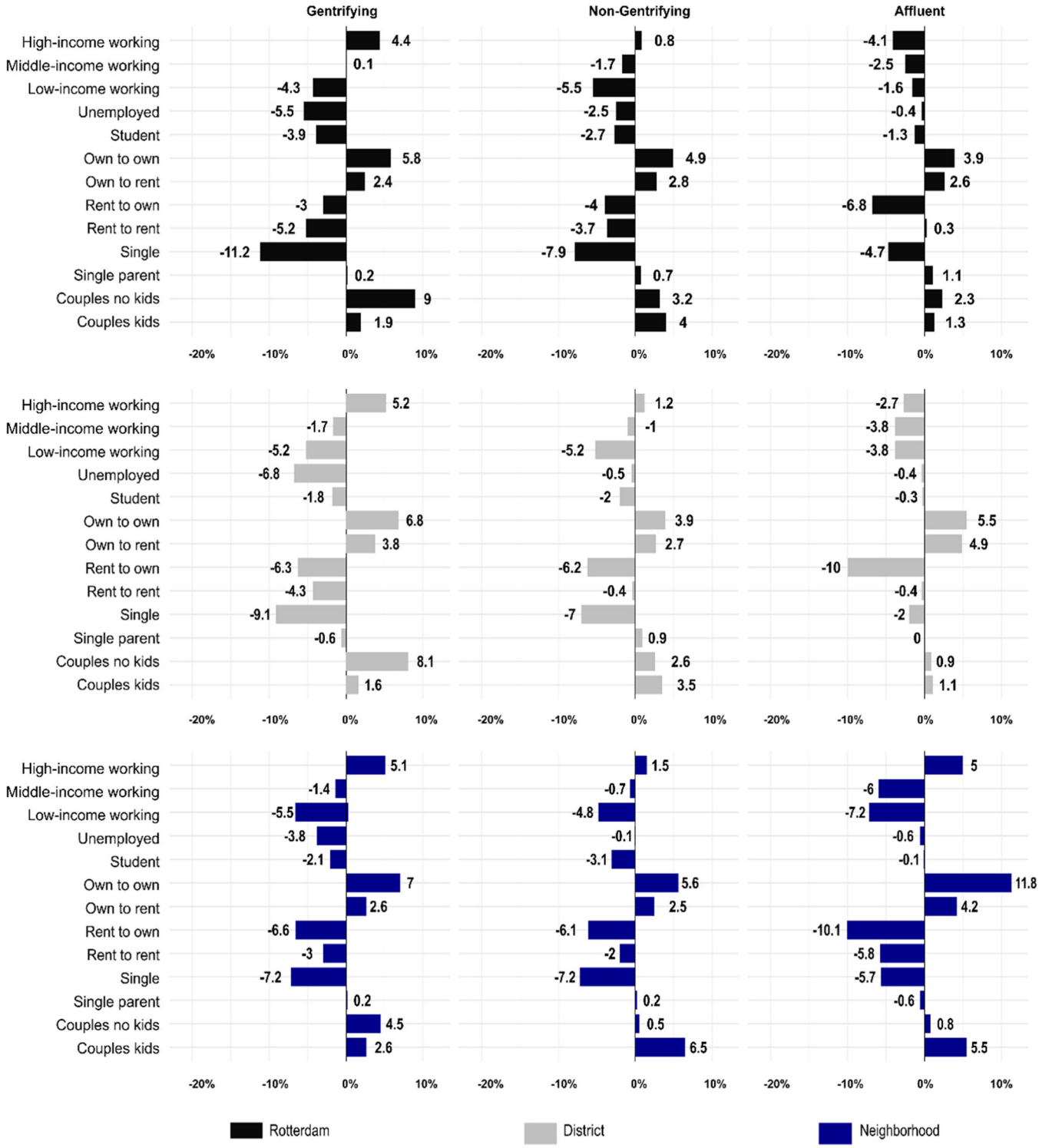

FIGURE 6 The percentage point change between the 2005–2010 and 2014–2019 periods in terms of the share of intra-urban in-movers, segmented by economic status, tenure transition, and household composition. Proportions are divided by area of origin.

Continuing with the varying origin locations, the output of the 2014–2019 model identifies that when moving to a state-led gentrifying neighborhood compared to a nongentrifying neighborhood, holding all other variables constant, one is significantly more likely to have moved from a core Randstad city as opposed to Rotterdam itself (Marginal effect = 1.26). Interestingly, this relationship is not significant for the 2005–2010 model, implying that the gentrification in Rotterdam is subject to core Randstad moves. This pattern also prevails in affluent neighborhoods, yet with a lower marginal effect in the second period. During the 2014–2019 period, households

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TABLE 1 Multinominal logit regression analysis for different periods.

Predictors	Ref = Nongentrifying	Y = Gentrifying Phase 1 (2005–2010)		Y = Affluent Phase 1 (2005–2010)		Y = Gentrifying Phase 2 (2014–2019)		Y = Affluent Phase 2 (2014–2019)	
		Odds ratios	CI	Odds ratios	CI	Odds ratios	CI	Odds ratios	CI
	(Intercept)	0.47***	0.36–0.61	0.55***	0.42–0.73	0.61***	0.54–0.71	0.56***	0.50–0.64
	Age	1.00	0.99–1.00	1.00	1.00–1.00	0.99***	0.98–0.99	1.00	1.00–1.00
Length of last residence Ref = More than 3 years	Less than 1 year	1.01	0.93–1.11	0.86**	0.79–0.94	0.98	0.93–1.04	0.92*	0.87–0.97
	Between 1 and 3 years	1.01	0.93–1.09	0.91	0.85–0.99	1.01	0.97–1.06	0.93**	0.90–0.97
Tenure of last residence Ref = Owner occupancy	Rent	1.43***	1.29–1.57	0.84***	0.77–0.91	1.08	1.01–1.15	0.82***	0.78–0.86
Income Ref = Low income	Middle income	0.89*	0.83–0.96	1.26***	1.17–1.35	0.93	0.88–0.98	1.13***	1.08–1.19
	High income	1.03	0.93–1.13	2.37***	2.16–2.60	1.33***	1.25–1.43	1.93***	1.81–2.05
Household composition Ref = Single-person household	Couples with no children	0.82***	0.77–0.87	0.95	0.89–1.01	0.88***	0.84–0.92	1.02	0.98–1.07
	Couples with children	0.53***	0.47–0.59	1.13*	1.03–1.25	0.48***	0.45–0.51	0.90***	0.86–0.95
	Single parents	0.58***	0.52–0.65	0.88*	0.78–0.98	0.51***	0.48–0.56	0.84***	0.79–0.90
Higher education Ref = No	Yes	2.76***	2.60–2.93	2.40***	2.26–2.55	2.86***	2.72–3.00	2.02***	1.93–2.11
Country of birth Ref = The Netherlands	Dutch Antilles and Aruba	0.69***	0.62–0.76	0.43	0.38–0.48	0.62***	0.56–0.68	0.53***	0.49–0.59
	Morocco	1.00	0.85–1.17	0.55***	0.46–0.67	1.06	0.93–1.20	0.44***	0.38–0.50
	Suriname	0.73***	0.65–0.83	0.51***	0.45–0.58	0.81***	0.73–0.90	0.61***	0.55–0.67
	Turkey	0.76***	0.64–0.90	0.40***	0.33–0.48	0.92	0.80–1.05	0.46***	0.40–0.52
	Other non-Western country	0.75***	0.69–0.81	0.60***	0.55–0.66	0.76***	0.71–0.81	0.75***	0.70–0.80
	Other Western country	0.90***	0.81–1.00	0.77***	0.69–0.86	0.90	0.81–1.00	0.83***	0.77–0.89
Employment Ref = Employed	Social benefit recipient	0.91	0.79–1.05	1.17	1.02–1.35	0.92	0.84–1.01	1.01	0.93–1.09
	Student	1.15***	1.07–1.24	1.19***	1.10–1.29	1.17***	1.10–1.26	1.15***	1.07–1.23
	Retired	0.90	0.65–1.25	1.26	0.93–1.69	1.02	0.86–1.22	1.28***	1.12–1.47
Origin Ref = Within Rotterdam (beyond neighborhood and district)	District	0.88**	0.81–0.94	0.71***	0.66–0.77	0.90**	0.85–0.96	0.77***	0.72–0.81
	Neighborhood	1.23***	1.13–1.34	0.96	0.87–1.05	1.07	1.00–1.15	1.18***	1.11–1.26
	Non-Randstad city	0.92	0.82–1.03	0.78***	0.69–0.88	1.08	0.99–1.18	1.00	0.91 –1.09
	Randstad core	0.96	0.86–1.07	0.90	0.81–1.01	1.26***	1.17–1.36	1.17***	1.09–1.26
	Randstad secondary	0.85*	0.74–0.97	0.93	0.81–1.07	1.37***	1.26–1.49	1.12	1.03–1.22

(Continues)

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TABLE 1 (Continued)

Predictors	Ref = Nongentrifying	Y = Gentrifying Phase 1 (2005–2010)		Y = Affluent Phase 1 (2005–2010)		Y = Gentrifying Phase 2 (2014–2019)		Y = Affluent Phase 2 (2014–2019)	
		Odds ratios	CI	Odds ratios	CI	Odds ratios	CI	Odds ratios	CI
	Rotterdam agglomeration	0.71***	0.64–0.79	0.86*	0.77–0.95	0.62***	0.57–0.68	0.88***	0.82–0.94
	Low-density area	0.89*	0.81–0.98	0.93	0.85–1.03	0.88**	0.81–0.95	1.11*	1.03–1.19
Observations		116,082				209,949			
McFadden's R^2		0.065				0.063			

*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.
Source: SSD, calculations by authors.

relocating from secondary cities within the Randstad also exhibited a significantly higher likelihood of moving to state-led gentrifying neighborhoods when compared to nongentrifying ones, in contrast to the 2005–2010 period. Overall, these changing probabilities are in line with earlier findings suggesting that residential mobility patterns reorientate from an intra-urban to an inter-urban scale during the gentrification process, with low-income households being less likely to move to state-led gentrifying neighborhoods over time.

5 | CONCLUSION AND DISCUSSION

Through an examination of detailed longitudinal register data for the Netherlands, our analyses identified how residential mobility patterns toward and within Rotterdam have changed over time in relation to state-led gentrification. Rather than solely focusing on the demographic shifts inside neighborhoods, as commonly studied in the literature, our focus was on understanding how the different geographical origins of in-movers and households' socioeconomic characteristics shape residential mobility patterns toward and within Rotterdam over time. Two central hypotheses have been presented: 1. Second-hand gentrification; 2. Exclusionary displacement.

For the second-hand gentrification hypothesis, we expected to see an increase in the proportion of middle- to high-income households moving from other core Randstad cities to Rotterdam over time, especially to state-led gentrifying neighborhoods. This hypothesis stems from earlier work by Loumeau and Russo (2022) and Ocejo (2019) who found that the advanced gentrification in core cities enhances gentrification in neighboring secondary cities. In this study, we observed that inter-urban gentrification spillovers are also predominant in Rotterdam, a primary city, due to its relatively early stage of gentrification compared to other major cities in the Netherlands. The recent state-led gentrifying policies of Rotterdam Municipality have set off gentrification in several inner-city neighborhoods, making these neighborhoods—but also Rotterdam overall—more attractive for affluent households. We observed that over time, there was a substantial increase in the number of movers moving from core Randstad cities to Rotterdam, of which the majority is attributed to middle- to high-income households. By distinguishing between destination neighborhoods, we found that this pattern is intensified in state-led gentrifying neighborhoods, implying that these neighborhoods experience the most pronounced impacts of inter-urban gentrification spillover effects from other core Randstad cities. Thus, to answer our first research question—"*How do residential mobility patterns toward Rotterdam unfold in light of the state-led gentrification process and does this support the hypothesis of second-hand gentrification?*"—we find that state-led gentrification in Rotterdam attracts middle and upper-class households from more advanced gentrified core cities, thereby supporting the second-hand gentrification hypothesis. Our findings align with existing theories on gentrification spill-overs (e.g., Booi, 2023; Ocejo, 2019), and further complement them by highlighting that gentrification spill-overs also

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prevail between core cities due to variegating temporalities of gentrification.

Regarding our second hypothesis, we expected that economically vulnerable residents in Rotterdam have becoming increasingly excluded from moving to and within gentrifying neighborhoods. The financialization of the housing stock and decrease in social housing due to urban restructuring policies implies that economically vulnerable residents become stuck in their contemporary residential homes, unable to move toward another residential environment. Our results indicate that predominantly low-income employed and unemployed households, as well as households without a history of homeownership, move less frequently within the city, with this decrease being most pronounced in state-led gentrifying neighborhoods. Thus, to answer our second research question—*"How does state-led gentrification modify the residential opportunities of the working class within Rotterdam, and does this support the hypothesis of exclusionary displacement?"*—we find that state-led gentrification in Rotterdam neighborhoods increasingly restricts economically disadvantaged households from moving in to the gentrifying neighborhood, corroborating the exclusionary displacement hypothesis. The increased unaffordability of Rotterdam was also identified by Custers and Engbersen (2022), who cautioned that contemporary Rotterdam has also become unaffordable for the emerging middle-class. In line with this, we find that middle-income households move less within Rotterdam over time. Among those already residing in Rotterdam, high-income households and homeowners more frequently move toward and within state-led gentrifying neighborhoods, reflecting that these households utilize their capital and mortgage credit to buy housing in upcoming neighborhoods (Aalbers, 2007; Wyly & Hammel, 1999).

In sum, we found that short-distance intra-urban moves declined over time, while inter-urban moves increased substantially. Therefore, we conclude that state-led gentrification in Rotterdam reorientates moves from an intra-urban to an inter-urban scale, where short-distance moves by working-class households are increasingly replaced by long-distance moves by higher socioeconomic classes. Although we are not the first to acknowledge inter-urban gentrification spill-overs, we are, to our knowledge, the first to map changing residential mobility patterns beyond the metropolitan scale with such detail. As our research relies on large-scale detailed longitudinal register data, which is not a given in gentrification research, we build a comprehensive picture of urban transformations in Rotterdam. Additionally, our analysis focuses on the movement of people between core cities, differing from the work of Ocejo (2019) and Loumeau and Russo (2022), who emphasize spill-overs to secondary cities. Thus, our findings reveal that the variegating temporalities of gentrification in Dutch cities matter in light of second-hand gentrification, which in the Dutch context has evolved into gentrification-induced displacement on an inter-urban scale. Noteworthy is that the planetary rent gap literature has long recognized the flows of capital between places on a global level (e.g., Slater, 2018; Smith, 1979). However, those involved in such global spatial fixes represent an elite minority, comprising only a small fraction of society. This research shifts the focus to the movement of people by examining the impact of gentrification on ordinary life-course flows at the national level. This approach aligns with Robinson's (2013) call for recognizing the contributions of ordinary cities to urban theory. Our findings on an "ordinary city" provide valuable insights into global urban processes by highlighting experiences and strategies that challenge dominant narratives, thereby contributing to the scholarship on gentrification.

To further advance our understanding of the spillover effects of gentrification, we propose two avenues for future research. First, since our research has primarily focused on capturing how aggregated moving patterns have changed over time, we provide little insight into how past experiences and life course events affect residential mobility behavior. We propose that future research should capture the sequence of moves used by individuals to identify the varying neighborhood residence pathways of different socioeconomic groups. By implementing an individual-level analysis, one can gain a much deeper understanding of why a household moves between or within cities, thereby capturing aspects such as whether a move should be understood as return migration or the result of housing insecurity. Second, our analysis focused on state-led gentrification in low-income neighborhoods, overlooking the gentrification of nonworking class neighborhoods and super-gentrification. Future research should consider more advanced stages of gentrification when studying second-hand gentrification. This in turn will provide a more comprehensive understanding of how the variegated temporalities of gentrification between cities impact inter-urban gentrification spill-overs.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The raw data used to support our findings belong to the CBS, and are restricted to a confidentiality agreement. As a result, sharing the data is prohibited. This is due to safeguard the privacy of the registered population in the Netherlands.

ORCID

Kyri Maaike Joey Janssen http://orcid.org/0000-0002-4606-9332
Clémentine Cottineau-Mugadza http://orcid.org/0000-0002-2452-3901
Reinout Kleinhans http://orcid.org/0000-0002-5714-2128
Ellen van Bueren http://orcid.org/0000-0002-4375-1192

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