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DOI

[10.1016/j.apgeog.2020.102151](https://doi.org/10.1016/j.apgeog.2020.102151)

Publication date

2020

Document Version

Final published version

Published in

Applied Geography

License

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[Link to publication](#)

Citation for published version (APA):

Musterd, S., Hochstenbach, C., & Boterman, W. (2020). Ripples of structural economic transformation: The changing social geographies of Dutch metropolitan regions. *Applied Geography*, 116, Article 102151. <https://doi.org/10.1016/j.apgeog.2020.102151>

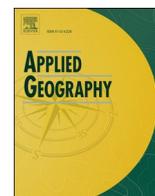
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Ripples of structural economic transformation: The changing social geographies of Dutch metropolitan regions

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A B S T R A C T

Socio-economic inequality across countries and urban regions is on the rise across the Global North. Even in formerly strong welfare states, such as the Netherlands, we now see the effects of sustained marketization and liberalization. Rising social inequality can manifest spatially and become reflected in the changing social geography of urban regions. However, the way in which structural changes affect the social geography of an urban region is highly contingent on the historically grown characteristics of that region, particularly the housing market structure and the labour market. Based on detailed register data on income and wealth of individual households for the four largest Dutch metropolitan areas, this paper describes the shifting spatial inequalities between high and lower status groups, unravelling changing patterns of concentrated affluence and poverty within the metropolitan regions of Amsterdam, Utrecht, The Hague-Rotterdam, and Eindhoven. We demonstrate that spatial patterns and moreover recent trends are quite differentiated between the four urban regions. We argue that these trajectories should be linked to the different urban profiles which are defined by their positions in global networks, the diversity of the economy, and the way in which national and local policies buffered or catalysed demographic and economic trends. Economically multi-layered and well connected cities, such as Utrecht and Amsterdam are most successful economically, spurring gentrification in the core and a push to the periphery of lower status groups. More mono-layered economies such as The Hague and Rotterdam do not experience widespread gentrification and retain poor inner-cities and relatively affluent suburbs.

1. Introduction

The socio-spatial landscapes of many urban regions are changing. Many cities and their surrounding regions across Western countries face similar developments, including intensified urban gentrification, sub-urban decline and increasing spatial divides (Tammamaru et al., 2016). Despite similarities, inter-urban differentiation is highly persistent over time. Once urban-economic and socio-spatial structures have been established, they shape and potentially lock-in future trajectories (Hägerstrand, 1969). That is, changes in the economic base of a city are unlikely to occur overnight, but are more likely to be gradual instead. Likewise, existing population distributions across space inform future residential behaviour, typically reproducing neighbourhood hierarchies (Sampson, 2012; Sampson & Sharkey, 2008).

While changes in the geography of city regions certainly relate to demographic changes and associated shifts in residential preferences (Booi & Boterman, 2019), it would be too simple to reduce urban change as the product of individual behaviour. The urban economy, welfare regime and urban policies crucially influence urban socio-spatial constellations (Musterd & Ostendorf, 1998). Yet, we know little about how contemporary urban-regional patterns and processes relate to structural and historical development trajectories.

To address this lacuna, the aims of this paper are threefold. First, this paper proposes an urban typology based on cities' position in the global economy, economic structure, demographic make-up and local welfare state arrangements. These factors are, in turn, structured by historical development trajectories. Second, we investigate short to medium-term changes in socio-spatial patterns in cities and their surrounding regions. Third, we highlight inter-regional variations to understand the varied influence of historical development trajectories on contemporary socio-spatial outcomes. In so doing, this paper combines quantitative analyses of outcomes at the micro level with structural explanations pertaining to the historical embeddedness and political economy of regions.

We do so by focusing on the four main urban regions of the Netherlands: Amsterdam, Rotterdam/The Hague, Utrecht and Eindhoven. We begin by discussing contemporary socio-spatial patterns and trends, and by developing a framework that conceptualizes the main influencing structural factors. These factors inform the subsequent analysis of the historical development trajectories of the four urban regions, and their main cities. While also boasting similarities, we argue these regions hold different positions in this conceptual framework. Subsequently we draw on household-level microdata from Statistics Netherlands to chart and map recent changes in the geography of

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poverty and affluence, focusing particularly on centre-periphery relations as this is an important element of urban-regional morphology and also one we expect changes in given the intensification of urban gentrification and suburban downgrading. Finally, we confront the urban typology based on historical trajectories with contemporary socio-spatial developments.

2. Theory

2.1. Recent trends in urban-regional inequality

The social geography of many European and North American cities is changing. An important trend is the increase in residential segregation between income groups. Spatial concentrations of both affluence and poverty are increasing, with high-income groups clustering in gentrified urban spaces and homogenous suburbs and the poor relegated to marginalized spaces (Reardon & Bischoff, 2011; Tammaru et al., 2016), while also middle groups find themselves squeezed in many cities (Hulchanski, 2010).

Unequal spatial outcomes, and shifts therein, are spatial manifestations of wider societal inequalities and social hierarchies, for example in terms of income or wealth (Deverteuil, 2009). While residential segregation is one dimension of spatial inequality, another dimension is the degree to which different types of households are able to acquire housing in popular neighbourhoods. Although these concepts are related, they are not the same (see Uitermark, Hochstenbach, & Groot, 2017). This becomes especially apparent when the status of neighbourhoods changes. Neighbourhood centrality was, for decades, suggested as a proxy for spatial disadvantage (Massey & Denton, 1988), but is increasingly considered a locational advantage worthy of a premium. The last two decades hence saw the transformation of gentrification from a small counter process into a dominant force of urban change (Hackworth & Smith, 2001; Smith, 2002). Gentrification is no longer confined to a handful of neighbourhoods in major cities, but can now be observed in a wider range of cities where it affects a larger number of neighbourhoods. Especially in high-demand urban markets, gentrification expands outwards, covering large swaths of the city (Hochstenbach, 2017; Hamnett, 2003).

The flip side of the same coin is an accelerating suburbanization of poverty (Bailey & Minton, 2018; Hochstenbach & Musterd, 2018; Kneebone & Berube, 2013; Kavanagh, Lee, & Pryce, 2016). With the reclaiming of high-value central land through urban gentrification, low-income groups are pushed to marginalized urban peripheries and declining suburbs. This is a highly uneven spatial process though, with many suburbs remaining decidedly middle class and only specific suburban neighbourhoods facing decline. These concurring developments of urban gentrification and suburban decline are part of a blurring of the lines between city and suburb. Suburban spaces are becoming more socially and ethnically diverse in themselves, while their function as satellite from the core city is waning (Charmes & Keil, 2015; Fishman, 1987; Masotti & Hadden, 1973; Tzaninis & Boterman, 2018).

These relational spatial dynamics of population change can be conceived of as *ripple effects*, where increasing demand pressures on central city locations may push groups of lower socio-economic status progressively outwards. While we focus on population compositions, ripple effects on the housing market have mostly been studied in relation to house prices. High and increasing prices in central locations may lead to spill over demand to nearby areas, causing ripples of house-price appreciation across space (Meen, 1999; Teye, Knoppel, de Haan, & Elsinga, 2017; Le Goix, Giraud, Cura, Le Corre, & Migozzi, 2019; Hochstenbach & Arundel, 2019).

2.2. Structural explanations for urban-regional inequality

To understand current socio-spatial trends it is crucial to be aware of cities' historical pathways: the demographic and economic

developments shaping cities are incorporated, filtered and affected by already existing physical, social, and symbolic (infra)structures. While cities follow different trajectories, we may detect some regularities in their development, allowing us to distinguish some *types* of trajectories.

We do not need to extensively discuss urban and economic developments before 1950, which were profoundly driven by the Industrial Revolution. Capital flows were brought together in urban economies, where these could benefit from agglomeration advantages and from the availability of a large labour pool. While all countries in the global North experienced rapid industrialization and urbanization in the first half of the 20th century, there are substantial differences in terms of how new modes of production fitted with their prior and affected their later development trajectories. Although a range of additional nuances could be made, we propose four different types of cities emerging out of the industrial period (cf. Burgers & Musterd, 2002; Kazepov, 2005; Scott, 1988):

- 1) New mono-layered cities, often emerging out of insignificant towns, which rapidly became dominated by firms and institutions that just focused on one type of product, such as cars, steel, or textile such as Manchester;
- 2) Existing cities with a multi-layered economy, depending on a range of different activities, public and private services *and* manufacturing industries such as Boston or Chicago;
- 3) Early global cities, characterised by the fact they were well-connected to and embedded in the world economy. Also often hosting a large manufacturing sector, these cities are command centres of the industrial and colonial world order. London is a prime example;
- 4) Cities that derived their importance primarily from their political and bureaucratic position. This type of cities of which Paris and Berlin are prime examples often attracted new capital flows, while maintaining a strong position in political and cultural terms.

When industrial production shifted to other parts of the globe and new service-based modes of production became more dominant this had variegated repercussions for the socio-spatial trajectories of cities. The globalisation of economic activities implied new international divisions of labour. Much of the labour intensive and polluting production moved to poor, low wage countries. Cities that relied heavily on industrial production were hit hardest, but the majority of major urban centres in the global North experienced serious demographic and economic decline. Mono-layered cities that specialized in manufacturing specific sectors such as Detroit or Pittsburgh encountered severe difficulties adjusting to new economic realities. This transpired into the social structure of those cities that struggled with unemployment and diminishing local budgets (Galster, 2012). Ultimately these dynamics also manifested in their social geographies, of which the 'doughnut city' has become an infamous metaphor. Other cities that were able to muster new economic activities such as high-tech and creative industries and/or consumer, public and advanced business services recovered relatively quickly from the shock of deindustrialization. Those cities often relied on a mixed economy and a strong embeddedness in international networks. At the apex of these cities, some global cities also expanded their capital control functions for managing global economic activity and witnessed strong economic expansion (Sassen, 1991) and emerged as the forefront of the urban renaissance in the late 20th and early 21st century.

Flows of capital investments underpin the economic restructuring of cities and their wider regions. In the post-war era, mass suburbanization took off in many Western countries, enabled by increased auto mobility and expansion of the middle class. Suburbanization opened up new spaces for capital to wash into, as new suburban constructions were able to absorb surplus capital (Harvey, 1985; Walker, 1981). Following the logics of uneven development (Smith, 1984), these capital flows into the suburbs were intertwined with central-city disinvestment. Inner-city

disinvestment in the decades following the Second World War, however, also set the scene for profitable reinvestment through the formation of rent gaps (Smith, 1979). Contemporary capital flows are very much directed towards prime urban real estate, in part an outcome of prior disinvestment. Investments from regular households –often debt fuelled–, small private investors and major institutional investors in urban space add up to a “wall of money” with an appetite for urban real estate, driving up house prices and accelerating gentrification (Fernandez & Aalbers, 2016; Fields, 2018; Ryan-Collins, 2018). For the purpose of our paper, it is important to realise that the ongoing marketization of housing may exacerbate uneven development (Brenner, 2004). Capital flows are increasingly oriented towards first and second-tier global cities, as they are the loci of economic and population growth, and to a lesser extent towards burgeoning regional centres, which structures decline elsewhere (Hochstenbach & Arundel, 2019).

In par with the economic restructuring of the de-industrialization period, demographic changes and new migration dynamics also affected the composition of urban populations. The second demographic transition (Van de Kaa, 1987) as well as new social norms around living alone or co-habiting unmarried radically changed the structure of households. The rise of smaller households meant increased demand for urban living (Buzar, Ogdén, & Hall, 2005). The democratization of (higher) education, leading to a vast increase in the number of people in education, turned out a life line for a number of large university cities (Hochstenbach & Boterman, 2017; Ley, 1996). Educating the labour force of the changing economy, those cities that historically hosted colleges and universities succeeded in attracting and retaining these new urban dwellers. Yet, some industrial cities attracted higher education in efforts to reinvent themselves as knowledge hubs and reverse decline (Hollander 2018).

These changes in demography and economy leading to a different social make up of cities are not just the result of structural forces. Also national and local welfare state arrangements shape socio-spatial patterns in urban regions in multiple ways. Especially social-democratic, but also corporatist welfare states (cf. Esping-Andersen, 1990) may go to great lengths to minimize inequalities through labour-market, welfare programmes, and progressive tax regimes. Minimizing income inequalities is associated with less spatial differentiation and less segregation (Musterd & Ostendorf, 1998; Tamaru, Marciniak, Aunap, Van Ham, & Janssen, 2018). The expansion of the welfare state in the post-war period also included a range of regulations and provisions directly impacting on spatial patterns. The provision of affordable (rental) housing through large social-housing schemes across cities worked directly against segregation. Spatial inequalities were simultaneously countered through integrated restructuring programmes in disadvantaged neighbourhoods. While such urban redevelopment policies have been implemented in countries across the world, the Dutch state has been particularly ambitious in their efforts (Uitermark, 2014).

However, the last three to four decades have seen an increasing dominance of market forces, with many states moving in a more market-liberal direction. This is also evident in the sphere of housing with the advance of private ownership, reduced supply of social-rental housing and the erosion of rent regulation (Musterd, 2014). The introduction of more market forces has given more room for social, economic and spatial differentiation between populations, as economic assets become more important in determining socio-spatial outcomes (Van Gent, Das, & Musterd, 2019). Furthermore, for many local governments, promoting gentrification has become a key urban strategy to boost economic growth and address perceived social problems (Hackworth & Smith, 2001). Some former industrial cities like Glasgow and Rotterdam have engaged in vigorous urban policies stimulating gentrification, which were only partly successful (Doucet, Van Kempen, & Van Weesep, 2011). Global cities such as New York or Amsterdam, which were fostering and experiencing gentrification much earlier, demonstrate more ambivalence in urban policies. While on the one hand unlocking land and housing for private capital still facilitates gentrification, also

efforts to maintain affordable housing have intensified in some cities (Van Gent & Boterman, 2019; Wetzstein, 2019).

2.3. Historical trajectories of the four urban regions

The five largest Dutch cities, in the four metropolitan regions, of this study serve as examples of different types of trajectories urban areas followed in the past decades. All Dutch core cities in this study experienced rapid demographic and economic growth until 1960, followed by significant population and social decline in the 25 years following, mainly due to suburbanization. The economy and population of the metropolitan regions continued to increase during this time period. All urban regions saw an impoverishment of core cities, while the suburbs became more affluent (Musterd & Ostendorf, 1991). From the mid-1980s onwards the core cities started to recover. Nonetheless, while all regions showed similar trends the pace and intensity of growth differed. The next section illustrates the main trajectories of the five cities in the four regions.

Amsterdam was the clearest ‘winner’ and reached a record high number of residents in 2019. This relates to the fact that the city, and metropolitan area can be described as a combined *multi-layered and global city*. This profile is rooted in the city’s position in the 17th century, when it already was a global city *avant la lettre*, characterised by global trade, entrepreneurialism and colonialism. That profile required specific services, such as a stock market, financial institutions, and insurance companies. Although Amsterdam’s strong global position eroded after the 17th century, it could be reignited in the late 20th century, as the city’s characteristics turned out to fit well with the advanced business services dominating the global economy. The city’s historically multi-layered economy in for instance trade and finance, implied that it did not become dominated by manufacturing industry in the second half of the 19th century (Musterd, 2019; Wagenaar, 1993).

In the 20th century, Amsterdam Schiphol airport developed into one of the largest hubs in Europe. In short, Amsterdam’s multi-layered structure and global embeddedness provided a firm base for its current position. In the 21st century the city’s international position, global connections, a well-developed infrastructure and an increasingly liberal conservative entrepreneurial climate gave a new impulse to international economic activity, causing expansion of international financial and advanced business services, creative industries and the knowledge economy. The economic and demographic growth puts pressure on the city’s infrastructure and, not in the least, housing stock. Facilitated by national and municipal governments, housing marketization and privatization were stimulated, leading to a substantial reduction in social-housing provision, skyrocketing house prices and intensified urban gentrification. Among the consequences are the exclusion of weaker population groups such as poor households, housing-market outsiders and young adults (Hochstenbach & Boterman, 2017; Kadi & Musterd, 2015).

The second largest Dutch city, Rotterdam, has developed its profile as a port and manufacturing industry city in the 19th and 20th century. The port served a huge hinterland, including the manufacturing Rhine-Ruhr area in Germany. Its function brought much activity related to ship building and maintenance, also in the metropolitan area, while oil transport by water stimulated the development and expansion of all sorts of chemical industry. In general, the port boosted the entire logistics sector. As a result, Rotterdam built up a very strong profile connected to these activities, although also insurance companies and other spin-offs connected to international trade were developing. More recently, the city has been successful in adding new urban layers, with the expansion of advanced business services, consumer services and public (health) services. Like Amsterdam, also Rotterdam experienced population growth until the mid-1960s, followed by severe decline, and recovery after 1985. Population recovery since then has been much slower and modest in Rotterdam though, partly related to its historical economic profile that can be summarized as *between mono and multi-*

layered. Rotterdam's economic profile has a lasting legacy, as it has resulted in a wide range of institutions and an occupational structure geared towards old industrial activity that both take time to transform and adapt to changing economies (Burgers & Musterd, 2002; Doucet et al., 2011).

The Hague and Rotterdam are part of the same metropolitan region. The city of The Hague has, however, a very different economic and demographic profile compared to Rotterdam. Even though Amsterdam is formally the capital, The Hague developed as the de facto capital city of the Netherlands and the site of national government. National political and bureaucratic activities are clustered in the city and its economic structure is therefore that of a *bureaucratic capital*. In recent decades The Hague also expanded its profile as a 'city of international law', and attracted numerous NGO's and institutions related to law and order such as the International Criminal Court and Europol. The Hague therefore has a substantial share of professional jobs and also substantial international workforce. Although the Hague also experienced substantial suburbanization in the eighties, the concentration of old and new public sector jobs are likely a key explanation for population recovery after 1985, which had an almost similar pace as Amsterdam has shown (a 19 per cent growth rate between 1990 and 2017, compared to 22 percent for Amsterdam, leaving Rotterdam behind with 10 per cent).

Utrecht, the fourth city of the country developed as a *multi-layered centre*, profiting from location and a service and education-based economic structure. Utrecht doesn't serve a global function though, but is rather a *national* hub, e.g. for retail and other functions. It developed as the centre of (rail) transport, has one of the largest national exhibition centres, and is a favourite place for consultancy agencies, especially ICT. The inner city has a well-maintained historical structure, referencing the city's classic and current function as the centre of the Catholic Church in the Netherlands. The historic centre adds to the city's attractiveness as a place to live, while the city's large university and hospital further attract students and highly educated workers. These dynamics add to increasing housing-market pressures similar to Amsterdam though somewhat less intense (Hochstenbach & Arundel, 2019).

Eindhoven is a relatively young urban agglomeration, which mainly developed as an industrial city. Initially, textile and tobacco industries were very important, but these activities were not able to survive in a more global economy in which much of this production moved to low wage countries. Eindhoven, however, continued with manufacturing industry that started with Philips consumer electronics and lightning, currently focusing on medical high-tech products. The focus on manufacturing industries continued, also in other sectors such as car industry and related activity. Most recently, important Philips spin-offs such as ASML and NXP semiconductors continued the manufacturing industry production activities, but currently under the umbrella of the high-tech knowledge intensive industries, supported by the city's technical university and a national *Brainport* policy agenda. This also paved the way for activity in creative industries. In many ways, the Eindhoven economy is mono-layered dominated by manufacturing industries, although they have successfully linked these to knowledge-intensive activities. Hence, the city may be typified as having an economic structure that is *'mono-layered'* that developed into a high-tech creative centre. The brainport region is ranked among the 'smartest regions of the world' (Forbes, 2013).

These trajectories have resulted in cities and regions with differing characteristics. Table 1 draws on various key characteristics to summarize the contemporary social and economic position of cities and regions. It reveals substantial differences but also similarities in the current characteristics of the different cities and their regions.

3. Data and methods

We address the changing social geography of metropolitan regions through the investigation of socioeconomic class changes. The focus is on the issue of whether we see evidence of 'ripple effects' in urban

regions. Ripple effects are expected when gentrification and the influx of higher-class residents in central locations force lower and middle status groups to locate in more peripheral locations. We draw on register data from the System of Social-statistical Datasets (SSD) from Statistics Netherlands. These data contain individual-level, longitudinal and geocoded information for the entire population registered in the Netherlands. We focus on the four largest metropolitan regions of the country; those of Amsterdam, Rotterdam/The Hague, Utrecht and Eindhoven. Our analyses cover the 2007–2015 period for reasons of data availability. Here we will address key decisions made regarding the population we selected; the core concepts we used (socioeconomic status, distance from the core, housing tenure); the criteria for inclusion of neighbourhoods; and the methods we applied.

Population. All analyses in this study are situated at the household level, as this is where resources determining housing-market position are bundled and housing demand is shaped. We only look at households where the main earner is at least 22 years old. We exclude institutional households, households with ten or more members, and households where the main earner is enrolled in education or who received a student bursary.

Socio-economic status. We determine household socio-economic status based on income as well as wealth holdings, both of which are derived from tax registers. For income, we use a measure of annual equalized household income, which corrects for differences in household size and composition.¹ For wealth holdings, we exclude housing wealth and mortgage debt. We do so because housing wealth is not only a predictor of spatial outcomes, but is itself also an outcome of spatial location: where one buys matters for future accumulation (Arundel & Hochstenbach, 2019). The geography of housing wealth is then by definition correlated to the geography of homeownership. Furthermore, as housing wealth is accumulated by paying off mortgage debt over time, it closely correlates with household age. By excluding housing wealth, we thus arrive at a wealth measure which mainly consists of savings, stocks and bonds and that is less sensitive to spatial and temporal dynamics.

For both household income and wealth we have constructed decile groups. These decile groups are relative to the entire Dutch population as this enables direct comparison of patterns and trends between regions, and allows us to document overall metropolitan socio-economic change. Households in the lowest income decile belong to the poorest 10% of Dutch households in terms of equalized income, while those in the top decile are among the richest 10%. Wealth deciles are constructed following the same logic. In both 2007 and 2015, tax data are missing for 1.4% of households. These cases are excluded from the analysis. Our total population in the four regions combined is 2.42 million households in 2007, and 2.62 million households in 2015, which is reflecting metropolitan growth.

While we also ran our analyses separately for income and wealth measures, presented analyses focus on a categorization of socioeconomic status that includes both income and wealth. To be sure, our analyses show that the spatial patterns of income, wealth and socioeconomic status groups are strongly correlated in all four regions (neighbourhood-level correlations of 0.9 and up). In other words, the distribution of these groups across neighbourhoods is rather similar. Nevertheless, we argue it is a fruitful exercise to combine income and wealth for a sharper delineation of socioeconomic status. Disregarding one of the two measures may result in misclassification, as can be illustrated by two examples. First, our data include a (relatively small) group of low income but high wealth households. These may for example be older households in retirement but with substantial accumulated assets. When disregarding wealth, such households would

¹ Equalized household income is derived from gross household income, correcting for the number of adults and children in a household. We follow the scale used by Statistics Netherlands (2018).

Table 1
Selected key characteristics of the cities and their regions.

	City type	Inhabitants (million) ^a	GAWC global city rank (2016) ^b	Share commercial services ^c	Share non-commercial services	Average property value 2018 (€1000) ^d	Share social rental housing	% single person hh
Amsterdam region		2.45		61%	29%	309	31% ^e	44%
Amsterdam city	<i>Multi-layered global</i>	0.86	'Alpha'	64%	30%	340	44% ^f	55%
Rotterdam/The Hague region		2.28		53%	38%	207	35%	41%
Rotterdam	<i>Mono/multi-layered</i>	0.63	'Beta'	55%	34%	166	44%	48%
The Hague	<i>Bureaucratic capital</i>	0.53	'Sufficiency'	47%	49%	212	32%	47%
Utrecht region		0.66		55%	35%	274	28%	39%
Utrecht	<i>Multi-layered</i>	0.35	'Sufficiency'	55%	39%	262	29%	53%
Eindhoven region		0.76		53%	26%	249	29%	37%
Eindhoven	<i>Mono-layered, high tech</i>	0.22	n/a	60%	27%	226	38%	48%

^a OIS, 2018.

^b GAWC (2016) <https://www.lboro.ac.uk/gawc/world2016t.html>.

^c Statistics Netherlands, 2019.

^d Statistics Netherlands, 2019 regions of Utrecht, Rotterdam, The Hague and Eindhoven are based on Corop areas, Amsterdam area on MRA data from OIS, 2018.

^e WIMRA, 2017.

^f Ibid.

incorrectly appear to be of low socio-economic status. Second, we find a relatively large group of high-income but low-wealth households. These may for example be young high-income households who are still paying off considerable student debts. While their high income certainly gives them a housing-market advantage over other groups, their poor wealth position may prevent them from acquiring housing in the most coveted locations, or may prevent them from buying a house at all. To avoid such misclassifications, we adhere to a narrow delineation of socio-economic status groups based on both income and wealth.

We construct three specific socio-economic categories by crossing wealth and income data at the household level: (1) households with a relatively low income, and relatively little wealth; (2) a middle group in terms of both income and wealth; (3) and an affluent group that has a high income but also substantial wealth holdings. In the remainder of this paper, we will refer to these groups as low, middle and high status respectively. Fig. 1 visualizes the distribution of the four regions' population across wealth and income deciles (2015). If the population distribution across income and wealth would be perfectly equal, each cell would represent 1% of the population. Fig. 1 also shows the delineation of the three socio-economic categories. It for example shows that we have classified households belonging to the fourth wealth decile and the bottom income decile as low status. Other households that also belong to the fourth wealth decile, but to the eight income decile are classified as middle status. Households in the eight income decile and the eight wealth decile are in the high status group. Some households are not classified, e.g. those on a low income but with substantial wealth at their disposal. These households are included in total counts though. This approach implies that our analyses focus on strictly delineated status groups. The goal of our analyses is not to describe the (changing) population of the four regions, but rather to illuminate the dynamics of socio-spatial change. A stricter delineation of status groups fits this purpose. We have also experimented with different categorizations though, for example by constructing a class scheme including the *total* population. As may be expected, this returns similar but somewhat less pronounced results (see Appendix A).

Neighbourhoods. Socio-spatial patterns of households are primarily investigated at the neighbourhood level. We follow the official neighbourhood classification of Statistics Netherlands, in which neighbourhoods are typically delineated by major infrastructure or natural boundaries. We have kept the neighbourhood classification and boundaries stable over time. Scarcely populated neighbourhoods (less than 100 households in 2007 or 2015) are excluded from the analyses. Our analyses include a total of 2549 neighbourhoods across all selected metropolitan regions, home to on average 986 households in 2007 and 1068 households in 2015. Privacy regulations stipulate a minimum of ten observations per "cell" (e.g. low status households in one neighbourhood). In those cases where the number of households belonging to a specific class group (low, middle, high) is smaller than ten, we have rounded their total to ten and also increased the denominator with the same number. For low-status households, this was the case in 161 neighbourhoods; for middle-status households in 26 neighbourhoods; and for high-status households in 14 neighbourhoods.

Distance. We have constructed a distance measure to analyse socio-spatial changes, because such a distance measure is particularly suitable to identify outward ripple effects. For each neighbourhood, we have calculated the distance to the centre of the core city. As a consistent reference point, we have taken the neighbourhood in which city hall is located,² as the central point. We used the coordinates of the midpoint of each neighbourhood polygon to calculate the distance 'as the crow flies' to this centre point. In the case of the Rotterdam and The Hague region we used the combined Rotterdam/The Hague metropolitan area (as is

² These neighbourhoods are Waterloopleinbuurt (Amsterdam), Domplein, Neude, Janskerkhof (Utrecht), Uilebomen (The Hague), Stadsdriehoek (Rotterdam) and Binnenstad (Eindhoven).

		Wealth									
		1	2	3	4	5	6	7	8	9	10
Lowest	1	1.0	1.8	1.6	0.8	0.5	0.3	0.3	0.3	0.3	0.6
	2	0.9	2.1	3.1	1.4	0.7	0.5	0.3	0.3	0.3	0.3
	3	0.8	1.3	2.1	1.5	1.1	0.8	0.6	0.5	0.4	0.3
	4	0.8	0.9	1.4	1.5	1.3	1.0	0.9	0.6	0.5	0.3
Income	5	1.0	0.9	1.0	1.3	1.3	1.1	1.0	0.8	0.7	0.4
	6	1.2	0.8	0.8	1.2	1.2	1.1	1.1	1.0	0.9	0.6
	7	1.2	0.6	0.6	1.0	1.2	1.2	1.2	1.2	1.1	0.8
	8	1.2	0.5	0.4	0.8	1.1	1.2	1.3	1.4	1.4	1.1
Highest	9	1.2	0.4	0.3	0.6	0.9	1.2	1.4	1.7	1.9	1.7
	10	0.8	0.2	0.1	0.3	0.5	0.8	1.1	1.7	2.6	4.4

Fig. 1. Schematic delineation of low, middle and high status households based on income and wealth decile groups, with percentage per cell indicated.

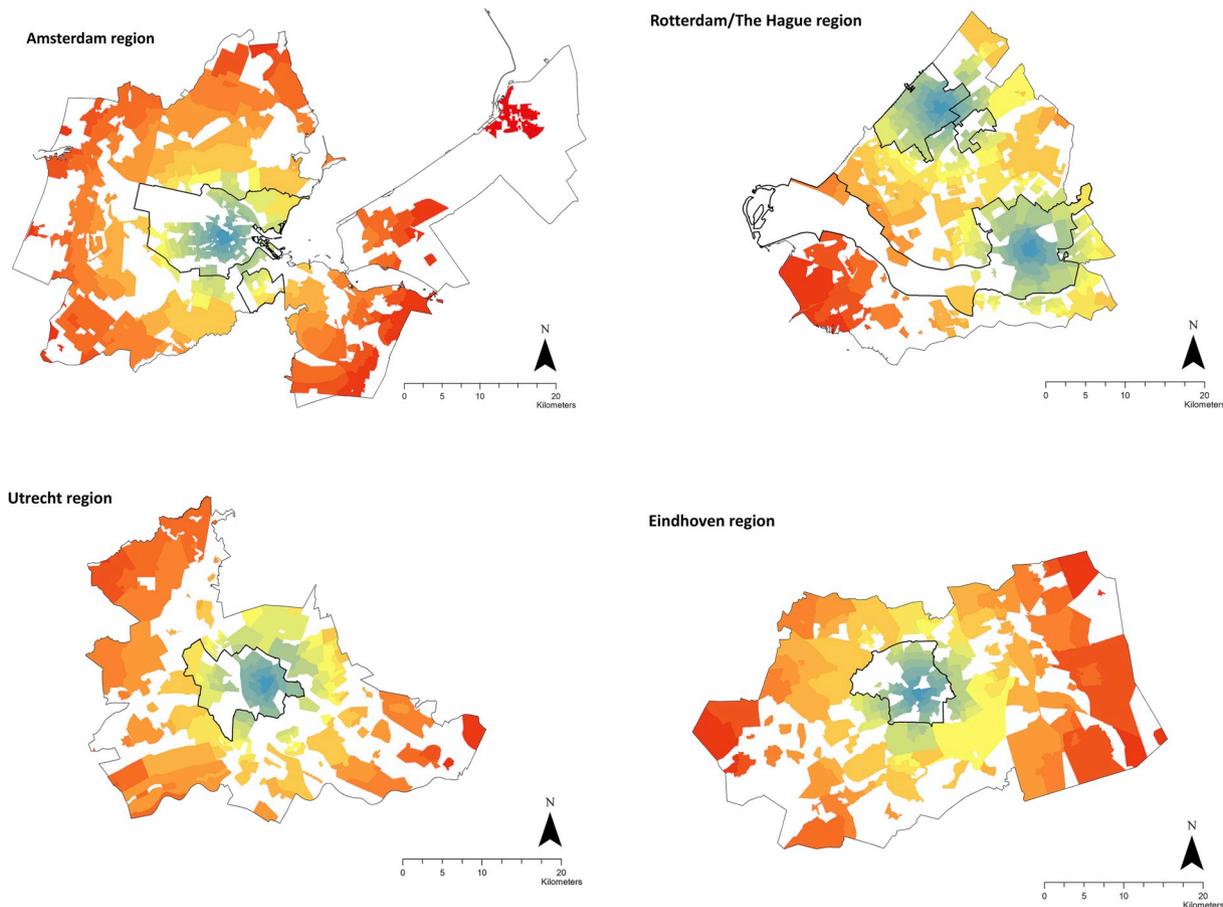


Fig. 2. Operationalized distances from city centre (blue = closer to city centre; red = further away). Source: author calculations. Central-city administrative boundaries are highlighted. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

used in regional governance), but we have calculated the distance to the city hall for Rotterdam and for The Hague separately. We have subsequently created an ordinal variable categorizing distance to city centre (running from 0 to 1 km distance to 35–45 km). Fig. 2 maps calculated distances per metropolitan region. Because distance from city hall is a relatively crude measure of centrality, we also plot average density levels (as measured in number of addresses per km²) by distance. This helps us understand the distribution of urbanity levels across urban regions and its relation to population composition.

Housing tenure. Next to focusing on household socio-economic status, we also look at their housing tenure, distinguishing owner-occupants from tenants. Unfortunately, our data does not include a variable to

reliably and consistently distinguish social rent from private rent. We use housing tenure to further unravel overall socio-spatial patterns and trends. Specifically, the enduring presence of a relatively large de-commodified rental housing stock, particularly in cities, and both in the social rental and private rental sectors, may have dampened overall rates of changes. We therefore expect socio-spatial patterns to be more pronounced within the owner-occupied sector where market forces are more dominant.

We use various methods to unravel socio-spatial patterns and trends. First, we use distance measures to analyse the existence of potential ripple effects – where city-centre gentrification may contribute to metropolitan population shifts further afield. Fig. 2 shows the maps with

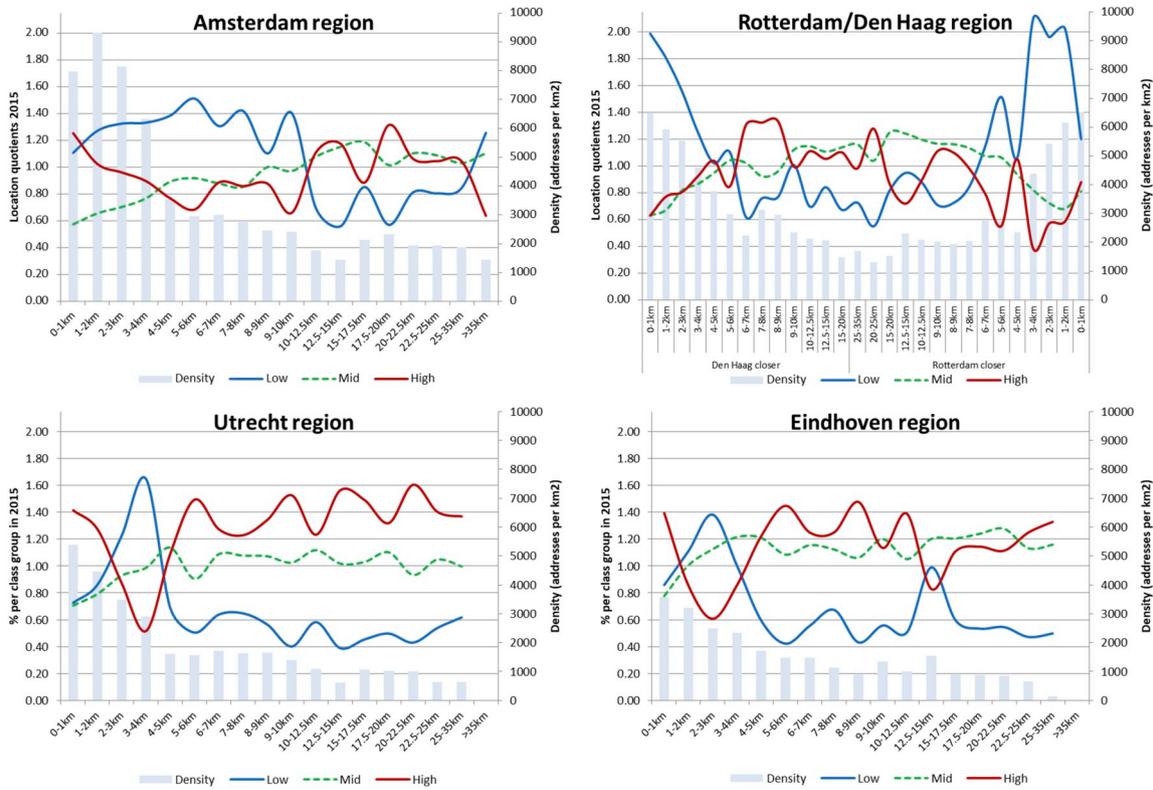


Fig. 3. Class groups (low, mid and high status) by distance to the city centre in location quotients in 2015. Data: SSD, own adaptation.

the operationalized distances from city centre. These have been used to construct Figs. 3 and 4, respectively class compositions by distance from the core; and 2007–2015 changes therein, for each of the metropolitan areas. We use location quotients to chart the relative presence of populations. These location quotients are relative to the population of the

four regions together, enabling inter-regional comparisons. Second, we use GIS to map changes in location quotients, revealing neighbourhood-level trends. Third, we distinguish between tenure types to investigate the geographical effects of changing tenure structures.

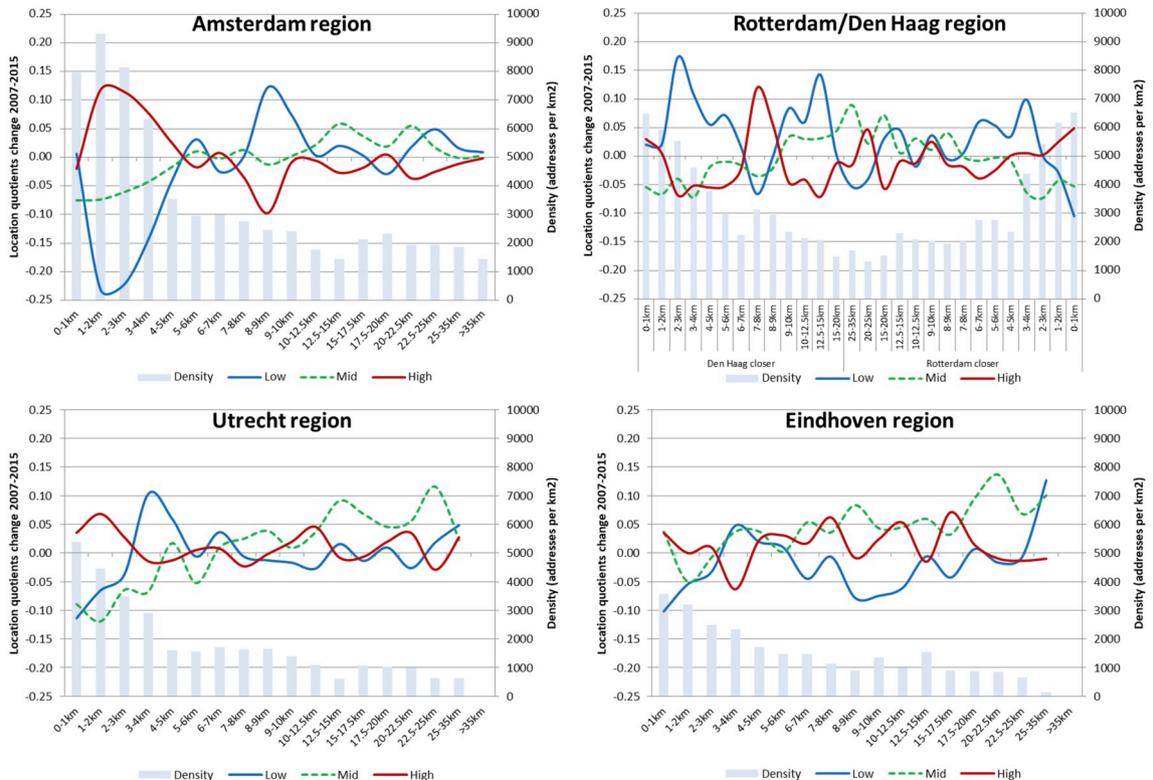


Fig. 4. Class groups (low, mid and high status) by distance to the city centre in location quotients, 2007–2015 change. Data: SSD, own adaptation.

4. Empirical analyses

Before moving to an analysis of the (changing) social geography of the four metropolitan regions, we briefly compare the population composition of the four regions in terms of class (Table 2). The Rotterdam/The Hague region is clearly the poorest region, with a comparatively high share of low-status households (22.1%) and low share of high-status households (19.5%). The Amsterdam region holds an intermediary position, while shares of low-status households are clearly lowest in the Utrecht and Eindhoven regions (13.8% and 14.1% respectively) and shares of high-status households are highest in Utrecht (27.2%). Eindhoven is home to comparatively many middle-status groups (22.7%). For one, these variations in class composition are reflective of differences in the regions' economic profile and performance. They also relate to the fact that Amsterdam, Rotterdam and The Hague as "big cities" have attracted relatively more low-status populations, both domestically and from abroad.

The current social geography of the urban regions can be visualised by plotting the share of low, middle and high social classes in a graph according to the distance from the city centre (Fig. 3). The resulting charts show over and underrepresentation of social groups in specific parts of the metropolitan regions, using location quotients. Amsterdam has an affluent yet quite polarised city centre, with high shares of higher and lower status groups represented and a "squeezed" middle (cf. [Sassen, 1991](#)). With increasing distance from the centre, the share of high status groups declines and that of lower status groups increases. At about 11 km from the centre high and low status groups swap sides. In fact, the outer suburban area between 11 and 25 km from the city centre is dominated by high status and middle status groups; only at remote locations, beyond 35 km, poor households set the scene. This is the new town Lelystad. The presence of middle status groups is relatively small in the central city, but there is an almost linear increase of their share with distance from the centre.

The social lay-out of the polycentric metro area of Rotterdam/The Hague has the appearance of late industrial US cities, even though the economic bases of Rotterdam and The Hague are very different. They both have a poor inner city and an affluent suburban periphery. Industry actually played a moderate role in the Hague, but poor service jobs and low paid employment in green houses resulted in similar social effects. The socio-spatial profiles of the metropolitan areas of Utrecht and Eindhoven resemble each other. The central city is affluent with low shares of lower and middle status groups. The urban (central city) periphery is fairly poor. Suburban rings around the city are dominated by high status groups. The share of middle status groups is fairly similar across space in most of the region except from the most central parts.

In a similar way we can visualize the changes over the 2007–2015 period (Fig. 4). As appears from the chart, there are clear signs of social upgrading in the inner city of Amsterdam. The share of lower status groups has substantially decreased in the 5 km perimeter around the centre. This trend coincides with the increase of high status groups, but interestingly with a decrease of middle status groups too.

Correspondingly, the periphery of the city and most of the suburban area are showing downgrading trends, with a substantial increase in low status groups. Although we do not demonstrate a direct relationship with trends in the core, our analysis suggests a ripple effect and suburbanization of lower status groups, who are being pushed out of the city centre or are not able to settle in the centre anymore; this results in socioeconomic decline in the periphery of the central city, but also in decline in the remote suburban area. The share of middle status groups is in decline in more central locations: the increase of higher status groups in the city centre not only implies less opportunities for the poor, but also for the middle status groups.

With regard to the central area of the city of Utrecht similar patterns can be shown. That part again is marked by gentrification, while poverty is pushed to the urban periphery of Utrecht. Suburban space in the Utrecht metropolitan region, shows much affluence (Fig. 3), yet is characterized by more limited dynamics (Fig. 4). While intermediate (middle) status groups lose substantial ground across the city of Utrecht, they do less so in the region.

The polycentric Rotterdam/The Hague region shows increasing shares of low-status households in much of the central city of both of the core cities. Nevertheless, Rotterdam's centre has seen gentrification – as is evidenced by the increase in high status groups (right hand side of the graph). Increasing affluence can be shown for rather remote suburban areas. We further see a sharp increase in the share of high status groups in the already affluent suburbs of The Hague, which are not too far from the city centre – specifically Wassenaar and the university-town Delft.

Changes in the Eindhoven region do not signal a specific trend – although there is some evidence of a gradual decentralization of lower-status groups from the central city towards the urban periphery, while especially in the very centre some upgrading seems to occur. Here, potential ripple effects appear to be mostly restricted to the core municipality.

The changes may also be shown at detailed neighbourhood level for each of the metropolitan areas. Here we illustrate the dynamics by showing changes in the location quotients for high-status groups across the four regions (Fig. 5), and for the low-status groups (Fig. 6). Patterns for these groups are almost the reverse. Increasing quotients (red shades) indicate an increasing presence. These maps give more detailed and nuanced insights into the changing social geography of the metropolitan regions.

Changing patterns are clearest for Amsterdam, where the share of high-status groups are on the rise and low status groups are in decline in most of the inner city. The periphery of the city of Amsterdam proper reveals an opposite trend. Also most suburbs such as Almere, Lelystad and IJmuiden have declining shares of high-status groups and increasing shares of low-status groups. In Utrecht, high-status groups increased their presence in much of the central city. Their presence decreased in the city's periphery, and in the east of the region. In Rotterdam, affluent groups increased their presence in various central city neighbourhoods, although gentrification remains a very scattered and uneven process in the city (cf. [Hochstenbach & Van Gent, 2015](#)). Their presence also

Table 2

The 2015 class composition of the household population per region. Data: SSD, own adaptation.

		% low	% mid	% high	% other	% tot	N (*1000)
Amsterdam region	2007	19.3	20.6	22.0	38.1	100.0	933
	2015	18.9	19.0	21.9	40.2	100.0	1012
Rotterdam/The Hague region	2007	20.9	21.5	20.1	37.5	100.0	897
	2015	22.0	19.5	19.5	39.0	100.0	967
Utrecht region	2007	13.6	21.6	27.2	37.6	100.0	317
	2015	13.7	19.8	27.1	39.4	100.0	347
Eindhoven region	2007	14.2	23.8	23.9	38.1	100.0	277
	2015	13.9	22.6	23.9	39.5	100.0	301

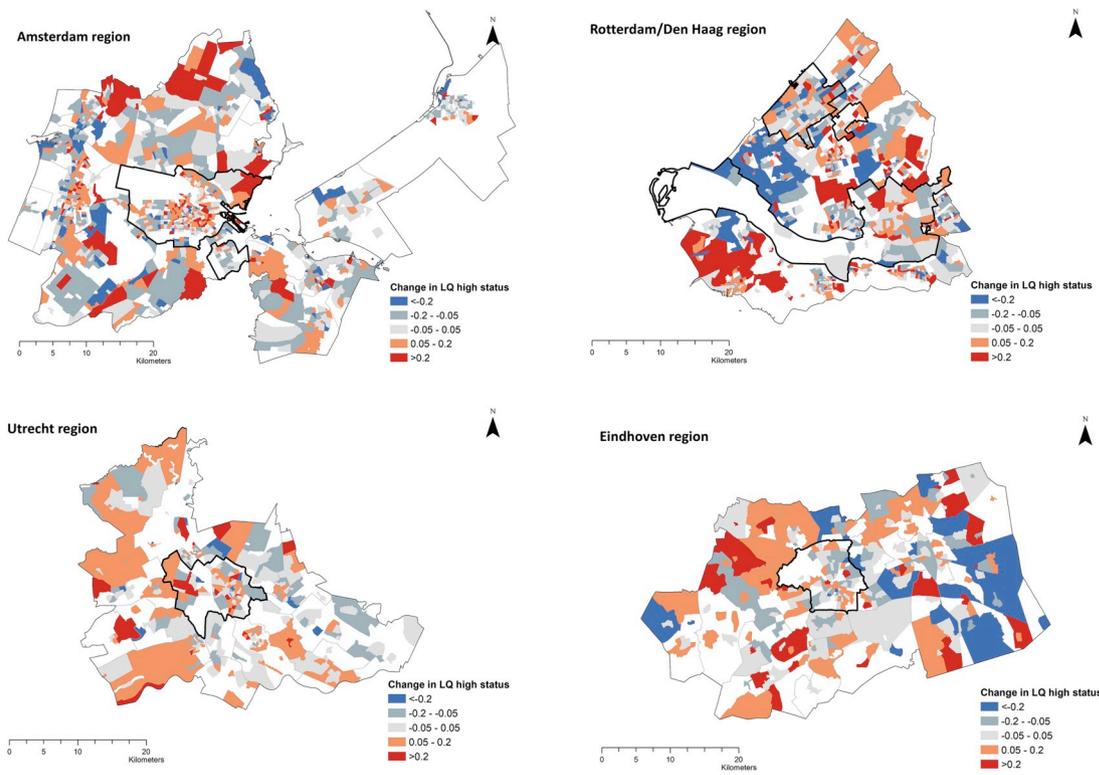


Fig. 5. Change (2007–2015) in the location quotients of high-status groups in the four regions. Data: SSD, own adaptation.

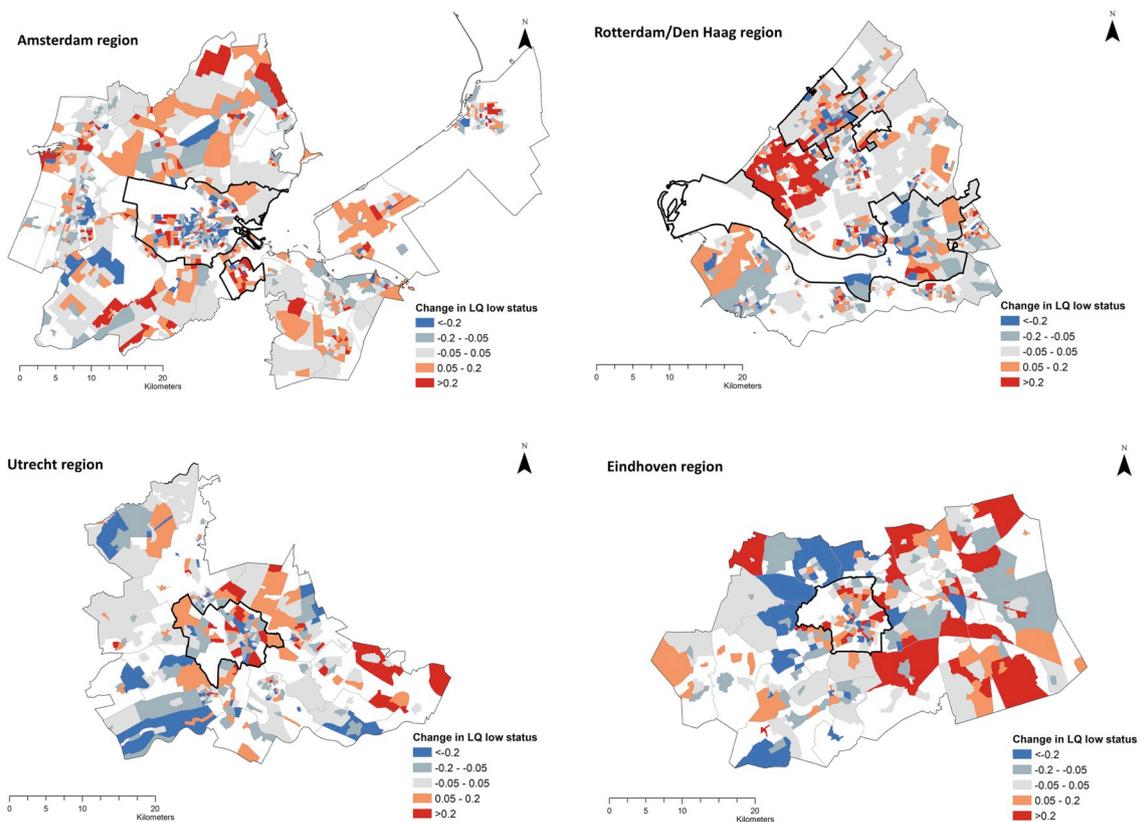


Fig. 6. Change (2007–2015) in the location quotients of low-status groups in the four regions. Data: SSD, own adaptation.

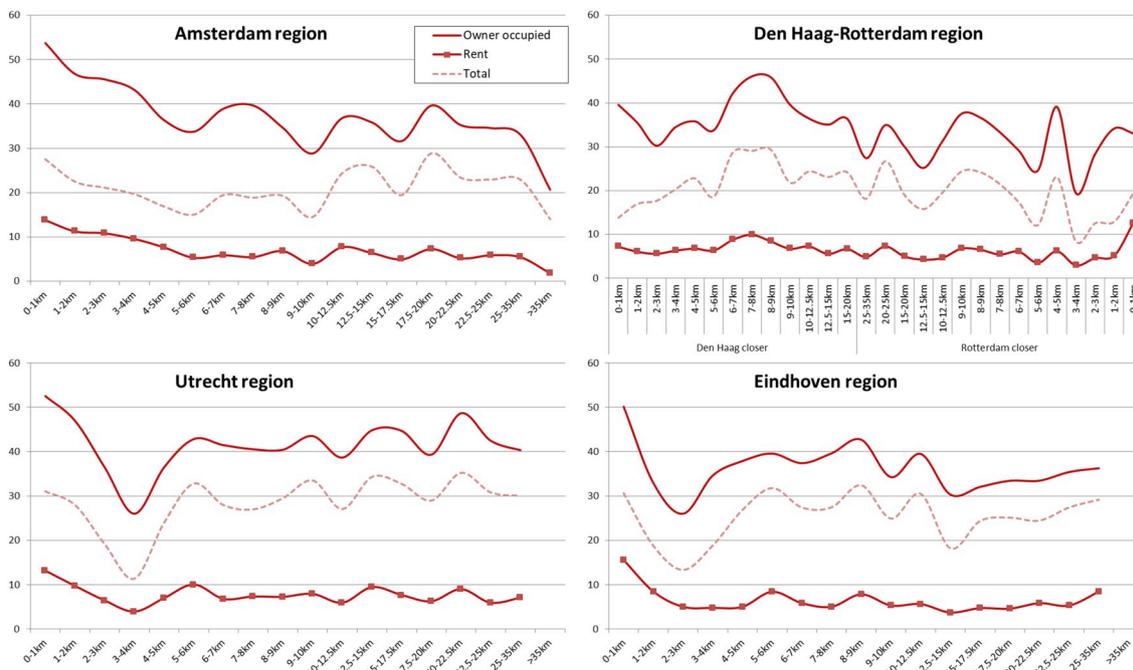


Fig. 7. The share of high-status households per housing tenure and distance in 2015. Data: SSD, own adaptation.

increased in Delft, located in between The Hague and Rotterdam. Their presence clearly decreased in the poorer parts of both major cities, as well as in neighbouring satellite towns such as Schiedam and Capelle aan den IJssel. In Eindhoven, we see an increase of affluent households in the most central neighbourhoods, as well as in parts of the low-density region. In the city’s periphery, their shares decreased. Trends for the low-status groups across the four regions (Fig. 6) are mostly the opposite.

Fig. 7 plots the percentage of high-status groups according to distance from the city centre, but presents their share in different housing tenures. It for example shows that some 54% of owner-occupiers in central Amsterdam belong to the high-status group, while this is only 14% among tenants. Looking at the socio-spatial distribution in the Amsterdam metropolitan region, it is interesting to note that overall shares of high-status households show a double peak in the city centre and the suburbs (17.5–20 km from Amsterdam city centre). When only looking at owners though, we see a more steady drop in the share of affluent households from the centre outwards. In both Utrecht and Eindhoven, shares of affluent households are higher than, but similar to, overall distributions. Yet, the share of affluent groups is clearly highest

among owners living in both cities’ centres. Only in the Rotterdam-The Hague region are shares of high-status owners also highest in the suburbs. These patterns highlight how the presence of rental housing dampens the share of affluent households, but does so unevenly across space. Especially in the core cities comparatively large social-rental sectors provide a counterweight to market trends. Yet, the gradual erosion of this tenure – for example through selected sell-offs in central locations – gives way to stronger future socio-spatial shifts.

5. Socio-spatial trends and structural explanations

This paper has revealed substantial differences in the social geography, and changes therein, of the four largest Dutch metropolitan regions. We postulated that the different patterns and trends should be understood as related to the cities’ position in the global economy, the economic structure, demography and the role of local welfare state arrangements. We also stressed that to understand the current trends it is crucial to be aware of cities’ historical pathways: the demographic and economic developments shaping cities are always incorporated, filtered and affected by already existing physical, social, and symbolic (infra) structures. The five Dutch cities in this study, representing different ‘urban models’ indeed reveal quite different geographies and trends.

5.1. Patterns

Our analyses reveal substantial inter-regional differences in socio-spatial patterns (summarized in Table 3). In multi-layered cities such as Utrecht and Amsterdam, as well as mono-layered high-tech Eindhoven, which all three are economically and demographically growing fast, socio-spatial patterns are characterised by a relatively affluent inner-urban zone; a poorer post-war urban periphery and suburban rings in which middle and higher status groups dominate, albeit the scale is bigger for Amsterdam. The Hague and Rotterdam, representing two different urban models, are however characterised by a predominantly poor inner-city and are separated from each other by a more middle class and affluent suburban zone. While the distribution of different types and tenures of housing also explains some of the variation between the urban regions, the urban model seems more relevant. For instance, Amsterdam, which has a quite similar geography of tenure to Rotterdam, used

Table 3 Summary of the dominant trends per city (region).

	City type	Pattern	Trend
Amsterdam	Multi-layered global	Affluent core; poor urban area; affluent outer suburbs	Gentrifying central urban areas; urban periphery and suburbs impoverishing
Rotterdam	Mono/multi-layered	Poor city; affluent suburbs	Tentative gentrification of core; urban periphery impoverishing
The Hague	Bureaucratic capital	Poor city; affluent suburbs	Poorer city; upgrading urban periphery
Utrecht	Multi-layered	Affluent core; poor urban fringe; very affluent suburbs	Gentrifying core; periphery impoverishing; suburbs stable affluent
Eindhoven	Mono-layered, high tech	Affluent core; poor urban areas; affluent suburbs	Little change

to have a poor inner-urban ring too, but this has changed in the past decades. Utrecht, which has a very different tenure structure, nevertheless quite strongly resembles Amsterdam's social geography, although the suburban rings are much more clearly dominated by high status households. What is also interesting are the stark differences in terms of the middle status groups in the different regions. These groups are very strongly underrepresented in central Amsterdam and Utrecht, while more present in Eindhoven and Rotterdam.

5.2. Trends

While the urban structure of all Dutch cities is heavily influenced by post-war urban planning, manifested in substantial clusters of mainly urban social rental housing built between 1960 and 1995 and single family housing in new towns and urban expansions, recent trends are more differentiated (summarized in Table 3). The multi-layered and high-tech metropolitan areas (Utrecht, Amsterdam and Eindhoven) experiencing economic growth and an influx of highly educated and other skilled (international) migrants, have increasingly tight housing markets. Especially Amsterdam, being the most globally embedded city of the Netherlands, experienced very strong increases in housing prices in the past decade, mainly due to flows of capital into real estate, but also international and domestic demand.

Gentrification processes at central locations are manifest under such circumstances, while lower class households are gradually displaced to the urban periphery and some suburban areas. In the metropolitan area of Rotterdam-The Hague, conditions are different. Even though some gentrification is occurring in Rotterdam, this is quite limited; both central cities remain predominantly domains of the lower classes. The Hague does not even seem to have any substantial gentrification in its core. The affluent and also increasingly upgrading areas are located between 6 and 10 km from the centre. Recent trends therefore seems to reinforce the existing spatial pattern in that region, rather than a gradual inversion of high and low status groups that characterises the gentrifying urban core of Amsterdam and Utrecht.

5.3. Explanations

We argue that the current patterns and trends should be understood in the light of a number of factors that are related to changing demographic, economic, and professional structures, accompanied by changing directions of capital flows. These factors are reflected in the urban region's current position in a national and global economy, but are also embedded in historical path-dependent processes. The role of the local state is also relevant for understanding how economic transitions are managed and mitigated. While all Dutch cities went through a stage of de-industrialization in the seventies, eighties, and nineties the effects on the social and spatial structure of their areas were variegated. Also current processes of more global interconnectedness, financialization and a greater role of new digital technologies affect cities in different ways. In this transition the Amsterdam metropolitan area clearly emerged as the most globally embedded urban area of the Netherlands, but also Eindhoven attracted substantial international capital and migrants. However, economic growth and internationalisation spur inequalities, which are now less buffered by the generous welfare regime that was in place earlier. The formerly relatively strong and universal welfare regime providing relatively equal access to almost all important domains of life, such as education, health care, social security, and affordable housing, has started to change over recent decades, beginning with a transformation of the housing market. The substantial reduction of the volume of affordable social rental housing, especially in the major cities, makes it increasingly difficult for lower class groups to enter parts of the urban core. Many social rented dwellings were sold, or moved into the private rented market, and stimulated rent increases in the same locations (Van Gent & Hochstenbach, 2019). Nevertheless, urban areas that have a relatively weaker

profile, and that have been affected by a less diversified industrial past, and a less thriving urban economy experience less commodification, simply because of a lack of demand. In such contexts, social housing could not be sold for a profitable price. Also the historically grown professional structures are of importance, since they were connected with a range of institutional structures. It takes time to replace these structures.

6. Conclusions

In this paper we have shown that, and tried to understand why, the higher classes are gaining space in some of the core cities of the largest metropolitan areas in the Netherlands, while poorer households find accommodation at the edges of the central city and in the suburban periphery. From our analyses we can derive some more analytical conclusions.

First, our analyses highlight the use of combining both income and wealth measures in delineating class groups. Both dimensions are indicators for broader class position and orientation, along with other indicators such as education. Furthermore, especially in tight housing markets and in the current post-crisis era, having both sufficient income and other assets is increasingly crucial in securing housing (Forrest & Hirayama, 2015). Considering wealth in addition to income, thus paints a fuller and more pronounced picture of socio-economic inequalities in urban and regional space.

Second, our findings highlight "ripples" in population composition changes. The gentrification of inner city environments is linked to the outward push of lower-class population groups (Hochstenbach & Musterd, 2018), creating ripples of population change spreading from urban centres to the urban-regional periphery. Such ripples have mainly been studied in relation to housing-market dynamics (Meen, 1999; Teye et al., 2017) but can also be applied to dynamics of socio-spatial change. The intensity and scale of these ripples differ between regional contexts though. In higher demand contexts such ripples will be stronger and cover larger swaths of the region, while in regions of lower demand or relative stability these ripples will remain more moderate and restricted to a smaller area.

Third, and most fundamentally, our paper is an effort to bridge the gap between quantitative analyses of micro-level data and structural explanations, in this case pertaining to the historical and context-dependent development trajectories of different urban regions. We have shown that such processes are complicated and dependent on a range of structural conditions, not just one. Global embeddedness, the economic structure, the welfare regime, and path dependence all have impact on these social spatial processes through the population structures and professional compositions they engendered (Kazepov, 2005; Musterd & Ostendorf, 1998; Sassen, 1991). Therefore, we cannot show one uniform pattern of change. Because predictions of the future importance of the various dimensions and their population and professional compositions are equally complicated and context dependent, frequent and context sensitive research is required. Even though the Dutch case context may be specific in some ways, it is a suitable context for other urban contexts to learn from. Both the historical trajectories and contemporary structural transformations we discussed in relation to Dutch urban regions, such as the neoliberalization of welfare regimes, can be found in other countries as well. It may thus be the case that the socio-spatial transformations we empirically demonstrated may have broader resonance in other contexts.

CRediT authorship contribution statement

Sako Musterd: Conceptualization, Supervision. **Cody Hochstenbach:** Formal analysis, Visualization. **Willem Boterman:** Formal analysis.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.apgeog.2020.102151>.

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