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# Neighbourhood change and spatial polarization: The roles of increasing inequality and divergent urban development

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A B S T R A C T

Most studies of neighbourhood and urban change do not distinguish between different underlying processes. This study distinguishes between the effect of increasing inequality between neighbourhoods and the effect of exchanges in their relative positions which can be attributed to urban development processes. The paper identifies the relative roles of these processes in generating neighbourhood socioeconomic change in the Tel-Aviv metropolitan area in Israel, and analyses how they interacted in reshaping its socio-spatial structure. Tel-Aviv is an interesting case study because of a persistent north-south socioeconomic divide. During the research period (1995–2008) inequality in Israel has risen substantially following the integration in the global economy; at the same time, the metropolitan area went through extensive urban development and expansion to the rural fringe. To examine the contributions associated with increasing inequality and urban-development processes to neighbourhood income change we use a method that was originally presented in the context of individual income mobility and recently applied in the context of neighbourhood change. The results show that urban processes and inequality intensified the historical divide in different ways, and each factor can be associated with a typical spatial pattern. The interaction between the factors is diverse; in some places they reinforced each other, whereas in some they operated at opposite directions and offset each other.

## 1. Introduction

One of the greatest concerns regarding contemporary cities is the decades-long upsurge in their internal socio-spatial inequalities. Globalisation processes during the last decades have been associated with increasing social inequality and polarization (Sassen, 1991), and many scholars claimed that these processes translated into intensified spatial divisions within cities. Especially, this has been claimed to affect cities that have dominant roles in the global economy. Emerging patterns have been conceptualized as "Dual city" (Castells & Mollenkopf, 1991), "Divided city" (Fainstein et al., 1992), and the "new age of extremes" (Massey, 1996), referring to the rich and poor becoming further apart spatially and socially and to the middle class hollowing out. Other scholars challenged the role of globalisation in shaping socio-spatial structures. They contended that increasing inequalities due to globalisation may have an effect on urban areas, but that this discourse overstates the importance of such macro processes (van Kempen, 2007; Marcuse & Van Kempen, 2011). In their view, urban-development processes, historical circumstances and contextual factors may still be

more influential in shaping the socio-spatial structure.

The way socio-spatial divisions are produced and intensified is complex and hard to resolve in empirical research. The specificity of context and circumstances plays an important role in the struggle to fully understand dynamics of socio-spatial structures. But more importantly, the literature to date has failed to address this complexity because the relative contributions of two generators of socio-spatial change, *increasing urban inequality* and *urban-development processes,* have not been considered separately. Consequently, the extent to which they distinctly affect urban socio-spatial divisions and how, is obscured. It is straightforward to envisage the effect of increasing inequality on the urban socio-spatial structure. Increasing inequalities intensify existent socio-spatial disparities; they draw well-off neighbourhoods of the city further apart from poorer neighbourhoods. Processes of urban development, which are related to social dynamics, the aging of the housing stock, metropolitan expansion, planning and policies, have a more ambiguous effect. They change the relative attractiveness of neighbourhoods, and make them move upward or downward in relative socioeconomic positions.

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This paper will examine the roles of increasing inequality and urban-development processes in reshaping the socio-spatial structure, using the Tel-Aviv metropolitan area in Israel as a case study. This case study is specifically interesting due to a long-lasting north-south socioeconomic divide. The divide originally stemmed from the ethno-national conflict that accompanied the development of Tel-Aviv as a Jewish suburb of the old Arab city of Jaffa, but evolved also due to socioeconomic disparities among Jewish ethnic groups. Thus, as in many other places, ethnic inequality is a salient mechanism that perpetuates spatial divisions. On top of this deeply-rooted mechanism, economic restructuring and urban dynamics, on which this paper focuses, are assumed to have exacerbated the north-south divide. Israel's integration into the global economy came with significant increases in inequality. At the same time, the Tel-Aviv metropolitan area went through a period of extensive urbanisation and expansion. We seek to investigate how, and to what extent each of these processes distinctly affected existent socio-spatial divides in Tel Aviv.

In this paper, we take advantage of a recent methodological application in the context of neighbourhood change which can offer insight into two different factors that generate changes among neighbourhoods and the socio-spatial structure. This method was introduced by Van Kerm (Van Kerm, 2004) in the context of income mobility, and applied to the context of neighbourhood change by Modai-Snir and van Ham (Modai-Snir & van Ham, 2018). Our approach is based on examining changes in absolute average incomes of metropolitan neighbourhoods through the research period. We distinguish between the contributions of two different factors of change to the total amount of change observed: The one is the change in neighbourhoods' socioeconomic urban-relative positions, which we relate to urban processes. The other is the change in neighbourhoods absolute socioeconomic conditions, regardless of positional changes, due to increasing inequality among urban neighbourhoods. We quantify the amount of change related to each factor using a mobility measure, and analyse patterns of socio-spatial change by disaggregating factor contributions according to spatial classifications that typify the existent divide and its progression.

## 2. Background

### 2.1. The dynamics of socio-spatial structures

The socio-spatial structure of cities and metropolitan areas changes over time. One approach in analysing these dynamics is to observe change at the level of individual neighbourhoods, in terms of socio-economic positions [for example, (Hulchanski, 2010)]. Neighbourhoods, in the context of this study are the basic spatial units at which change processes evolve but the focus is on how patterns of change cluster spatially and transform the urban socio-spatial structure.

Throughout the history of modern urbanism, the literature has documented typical patterns of neighbourhood change which occurred across metropolitan areas and countries. During the second half of the twentieth century we have seen the decline of North-American inner-city neighbourhoods due to the increasing attractiveness of suburbs (Wilson, 1987); in many European cities deprived neighbourhoods emerged in suburbs due to the development of large affordable housing estates (Hohenberg & Lees, 1995; Kesteloot, 2005). Towards the end of the century, many inner cities became popular again and went through gentrification processes that generated socioeconomic increases (e.g. (Zukin, 1987)). In some places, the regained attractiveness of inner cities led to the creation of extreme concentrations of wealth (McFarlane, 2006). As a result of the renewed appeal to city-centre living, city housing became increasingly unaffordable to lower-income households, and so there is growing evidence on the outward dispersion of poverty from city cores (Cooke & Marchant, 2006; Hochstenbach & Musterd, 2017; Hulchanski, 2010; Jargowsky, 2013; Lee & Leigh, 2007). At the same time, many urban areas have experienced increases in the numbers of high poverty neighbourhoods (Hulchanski, 2010;

Quillian, 1999) and decreases in those of middle income neighbourhoods (Booza, Cutsinger, & Galster, 2006; Hulchanski, 2010; Wei & Knox, 2014). Altogether, two types of change processes in the socio-spatial structure can be distinguished: Changes in the metropolitan distribution of neighbourhood socioeconomic characteristics, and changes in the way socioeconomic groups are spread out across metropolitan space. The former are related to increasing inequality within urban areas due to economic restructuring that occurs beyond the urban level. The latter are related to urban processes that change the attractiveness of places relative to each other, and consequently affect local housing prices and income compositions. The next two sections provide a more detailed explanation of the two types of processes.

### 2.2. How increasing inequality affects neighbourhoods and urban socio-spatial structures

Increasing inequality affects urban areas by changing their income distributions. This follows from the change in incomes of those living in the urban area but also from the change in characteristics of those leaving and entering the urban area.

During several decades, globalisation processes intensified economic competition and the spatial concentration of economic activities in large agglomerations, which resulted in increased inter- and intra-regional disparities (Krugman, 1999). The urban low-income class expanded due to labour-market restructuring and global immigration flows, and the high-income class became richer, profiting from economic restructuring; these trends were particularly evident in global cities (Sassen, 1991; Soja, 2000). At the same time, reduced government intervention and weakening of the welfare state have also contributed to increasing urban inequalities (van der Wusten & Musterd, 1998; Soja, 2000). The global era has become identified with rising inequality up to extreme levels, resulting in continuously growing urban inequality and segregation (Bischoff & Reardon, 2013; Fry & Taylor, 2012; Glaeser et al., 2009; Marcińczak et al., 2015), although these consequences vary across different welfare regimes (van der Wusten & Musterd, 1998; Tammaru et al., 2016).

Increasing individual-level inequality has affected the socio-economic distribution of neighbourhoods in urban areas. Booza, Cutsinger, and Galster (Booza et al., 2006) claimed that decline in the proportion of middle-income neighbourhoods in the US corresponded to a similar decline in proportions of middle-income families in the overall population. Such decline was also evident in Toronto, coupled with an extreme increase in the number of low-income neighbourhoods (Hulchanski, 2010). The link between change in the distribution of individual incomes and change in that of neighbourhood average incomes is straightforward. If there are more low-income people in an urban area there will have to be more low-income neighbourhoods to accommodate them; if there are less middle income people, the number of middle income neighbourhoods will shrink to reflect that proportional decrease. This distributional trend implies that to some extent, many middle-income neighbourhoods are likely to decline or increase just because there are no longer enough middle-income households to accommodate, and low- and high- income households gradually take their place. Apart from changes in the proportions of low- middle- and high-income neighbourhoods, increasing inequality can draw these different neighbourhood positions further apart, as reflected in both average incomes and housing prices. The increasing affluence of the richest strata has been found to translate to a similar pattern at the neighbourhood level, with the richest neighbourhoods becoming richer than before and the poorest ones stagnating (Chen et al., 2012).

Increasing proportions of high- and low- income groups (on the expense of middle-income), and increasing social disparities between them in absolute terms, reflect a process of polarization (Hamnett, 2001). The polarization process is likely to deepen urban socio-spatial divisions in two ways: the proportions of low- and high-income neighbourhoods can increase in the poorer and better-off parts of the

city, respectively. Also, the social distance between these two parts, in absolute terms, can become more extreme.

### 2.3. Urban processes: what affects the intra-urban locations of income groups

Urban processes affect locations of different income groups within the city or metropolitan area, by changing the attractiveness of neighbourhoods relative to each other. Primarily, the local housing market shapes the spatial distribution of income groups through the differentiation of land and housing values across neighbourhoods. This differentiation reflects disparities in housing quality, housing tenure, accessibility, amenities, public services, and local population composition [for a review see (Rosenthal & Ross, 2015)]. Changes in neighbourhood attributes can drive upward or downward socioeconomic change. A prominent example is the deterioration of housing quality as it ages. The decline in quality is associated with the departure of high-income households and the filtering of housing to lower-income ones (Muth, 1973; Rosenthal, 2008). At the other end of this decline process there is regeneration and socioeconomic increase, when decayed neighbourhoods are identified as investment opportunities. Neighbourhoods often decline and increase in sync, because their housing stocks are usually developed at the same time. Due to the development of urban areas from the core outwards, neighbourhoods' matched transitions are likely to take a corresponding concentric pattern (Brueckner & Rosenthal, 2009). Other neighbourhood features can also change over time, and drive change in their relative attractiveness. Accessibility can change if, for example, new transportation infrastructure is introduced. Amenities and public services can improve and increase the socioeconomic status of neighbourhoods; for example through the implementation of urban regeneration projects (Van Criekingen & Decroly, 2003), or through

environmental improvements (Banzhaf & Walsh, 2008). By the same token, levels of amenities and services can decline and give way to socioeconomic decline. Planning and policies intervene in the housing market in many other ways that can influence socioeconomic makeups. For example, by directing the development of social and affordable housing to specific neighbourhoods. Also the devising of plans and policies that limit the local housing supply can generate increases in housing prices (Dawkins & Nelson, 2002; Glaeser & Gyourko, 2003), and consequently neighbourhood socioeconomic statuses.

Finally, housing markets are dominated by social dynamics that have an important role in producing and reinforcing socio-spatial divides. The preference of people for living among people similar to themselves generates sorting on the basis of socioeconomic status and ethnic origin (which is often correlated with status), as demonstrated in Schelling's seminal segregation model (Schelling, 1971) and in various empirical analyses (e.g. Bruch & Mare, 2006; Clark, 1991; Hedman et al., 2011). The reinforcing nature of these dynamics can accelerate neighbourhood socioeconomic changes or cause status persistence (Rosenthal, 2008; Rosenthal & Ross, 2015).

To summarize, processes that operate at the urban level generate changes in the map of relative attractiveness of neighbourhoods and differentiated housing prices. As a result, neighbourhoods can move upwards and downwards in their socioeconomic positions relative to other neighbourhoods in the urban area. Changes in neighbourhood relative socioeconomic positions are likely to follow spatial patterns that correspond to urban development, but many influences can distort this pattern. Increasing inequality can change neighbourhoods absolute incomes, regardless of any positional change they experience due to urban processes.
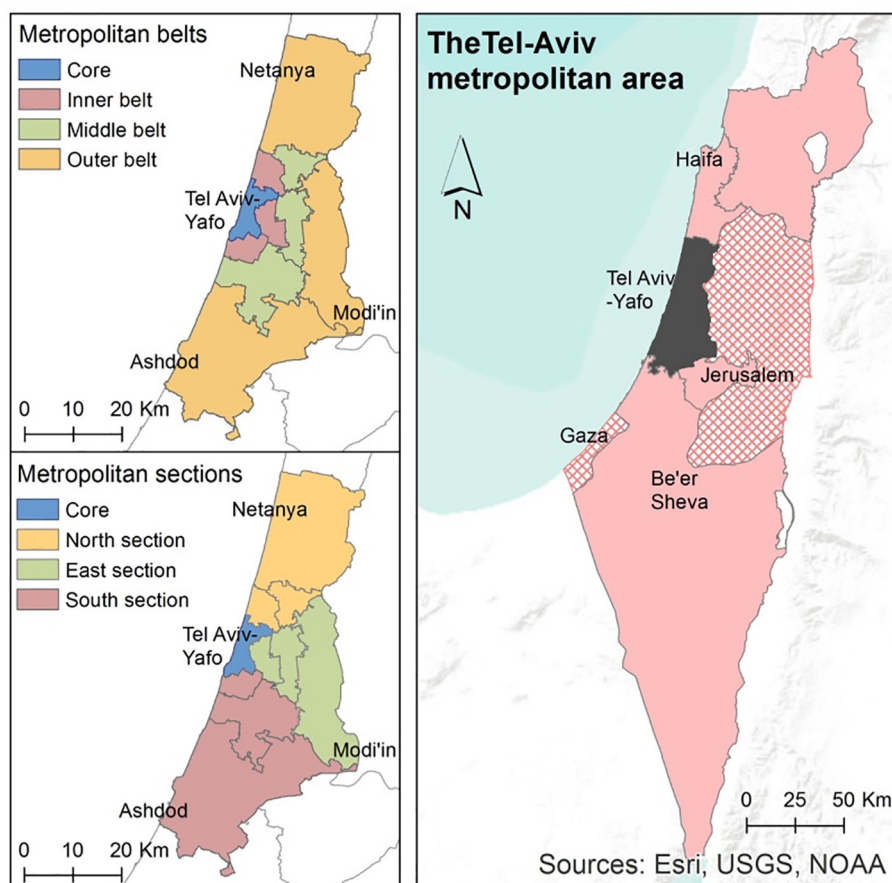


**Fig. 1.** The Tel-Aviv metropolitan area: location (right panel) and divisions to belts (upper left panel) and sections (lower left panel) according to CBS.

## 2.4. Metropolitan Tel-Aviv: a restructuring polarized metropolis

The Tel-Aviv Metropolitan Area (TMA) is the financial and cultural centre of Israel, which by 2008 contained about 43% (3.2 million) of Israel's total population. According to the Israeli Central Bureau of Statistics' (CBS) delineations, it stretches between the "Hefer Valley" regional council in the north (bordering the city of Netanya) and the city of Ashdod in the south (Fig. 1). In the east-west axis it stretches from the Mediterranean seashore to the "Green line" (pre-1967 border). The TMA includes 30 cities and towns, and 183 rural settlements.

The metropolitan core is the city of Tel Aviv-Yafo. Tel-Aviv was established in 1909 as a Jewish suburb of the historical Arab city of Jaffa (Yafo). Since its establishment, ethno-national tensions between The Jewish and Arab populations have driven a wedge between Jaffa and Tel-Aviv, which has also developed along ethnic and class divisions among the Jewish population. Immigrants from eastern and central Europe (*Ashkenazi* origin) who settled in northern Tel-Aviv were mostly middle-income; poorer immigrants from Africa and the middle-east (*Mizrahi* origin) settled in Jaffa and its surrounding poor neighbourhoods (Golan, 2002; Helman, 2010). The old railroad to Jerusalem turned into a symbolic border between the impoverished south and the affluent north (Margalit & Vertes, 2015). Jaffa was united with the city of Tel-Aviv in 1950, after the depopulation of most of its Arab residents during the 1948 war (Golan, 2002). Low-income Jewish refugees were housed in former Arab areas (Golan, 2002), and socio-spatial divisions continued to deepen despite the unification.

Planning initiatives exacerbated the north-south divide by imposing divergent schemes and land-uses; the north has been planned as a residential "garden city", whereas the south has been designated mixes of industrial and residential uses (Golan, 2010; Marom, 2014). Unbalanced planning and resource allocation undermined the few attempts to address urban inequality (Margalit & Vertes, 2015). Developments with negative environmental impact such as large public-transport stations, were also located in the south, further compromising living conditions in adjacent residential areas (Cohen & Margalit, 2015). New modern neighbourhoods continuously expanded the city to the north due to the abundance of developable land (Cohen & Margalit, 2015).

The polarization between the northern and southern parts of the city expands to the metropolitan scale (Hasson & Choshen, 2003). In part, the divide was sustained by historical settlement patterns beyond the city boundaries and the continuous association between ethnicity (*Mizrahi* vs. *Ashkenazi*) and socioeconomic status, which hardly diminished over time (Hasson & Choshen, 2003; Omer, 2010). More recent international migration has also influenced the metropolitan socio-spatial structure. During the 1990s the metropolitan area has received a large share of immigrants of Jewish origin from the Former Soviet Union. Immigrants tended to first settle down in the southern parts of the core and the inner belt, but their spatial distribution gradually shifted to large cities at the metropolitan fringe, with a prominent concentration in the city of Ashdod in the metropolitan south.[3] Also during the 1990s, there has been a substantial inflow of legal and illegal labour migrants in Israel, followed by asylum seekers in the 2000s. Many of them have settled down in deteriorated southern neighbourhoods of Tel-Aviv, exacerbating their already poor conditions (Cohen & Margalit, 2015).

Since the 1980s, the TMA has rapidly expanded outwards following the decline of agriculture as a dominant activity in the rural fringe and the removal of barriers in the conversion of agricultural lands to residential use (Bittner & Sofer, 2013; Razin, 1996). The extensive development of the high-tech industry in the TMA since the 1990s and the consequent concentration of financial and administrative functions in its core led to Tel-Aviv's emerging status as a world city (Kipnis, 2004). The concentration of high-technology firms in the metropolitan north attracted knowledge workers (Frenkel et al., 2013), adding to the relative advantage of the north. The integration with the global economy fuelled economic inequality and polarization in Israel. During the period 1995–2008, the Gini index of income inequality has increased by 9.8%.[4] Income residential sorting in the TMA has intensified during that period, increasing the segregation of the most affluent (Modai-Snir & Plaut, 2015).

This background reveals a combination of historical circumstances, urban processes and macroeconomic processes that shaped and reproduced the north-south divide through decades. Within the prevalent research approach in neighbourhood change research, observed change reflects the joint effect of urban processes and increasing inequality, so their relative importance is unknown. In order to reveal their distinctive effects, they have to be considered separately. In this paper we aim at distinguishing between the effects of increasing inequality and urban processes on neighbourhoods and on the urban socio-spatial structure. We seek to understand to what extent and how they interacted in re-shaping the existent divide, as illustrated at the starting point of the study.

## 3. Data

This paper investigates dynamics of the metropolitan socio-spatial structure through examining patterns of socioeconomic change among all metropolitan neighbourhoods. We use Israeli census data from the years 1995 and 2008, which were aggregated to the level of census tracts by the Israeli Central Bureau of Statistics (CBS). Census tracts are used as close approximations of neighbourhoods, in both urban and non-urban localities. Tract's per-capita gross income (referred to hereafter as neighbourhood average income), expressed in 2008 ILS, serves as an indicator of neighbourhood socioeconomic status; the variable was computed on the basis of each tract's workforce population whose monthly income exceeded 100 ILS, including all employment statuses. Income data in 1995 census were collected from a 20% sample using a mandatory long form. The 2008 census data were collected for the whole population from administrative sources. It is important to note that our data only relates to the employed population. In addition, undocumented population, such as illegal immigrants and foreign workers are not included in census data.

Metropolitan boundaries correspond to the definitions of the CBS from 1995 which apply to both censuses, including the division to belts and sections (Fig. 1). The CBS defined the "core" as a unified area in relation to the division to sections (Fig. 1, lower left panel), but we distinguish between the northern and southern parts of the core. That distinction traces the route of the old railway to Jerusalem (that is no longer in use since 1949), which can be identified as a borderline between the richer and poorer parts of the core (Fig. 2, right panel). Analyses that refer to the north and south sections include the respective parts of the core.

To analyse socioeconomic change among neighbourhoods, their boundaries should be consistent over time. In our data some census tract boundaries changed between the two censuses. In order to ensure spatial consistency we merged contiguous tracts where necessary. Non-residential tracts, tracts that comprised large shares of people living in residential institutions, and a few tracts with missing data were excluded from the analysis. Thirty tracts were built after 1995 and were missing 1995 attribute values. Of these tracts, five were entire localities for which yearly average income data was available from the National Insurance Institute. We used these data to estimate hypothetical 1995 values for the five respective tracts; the first average income
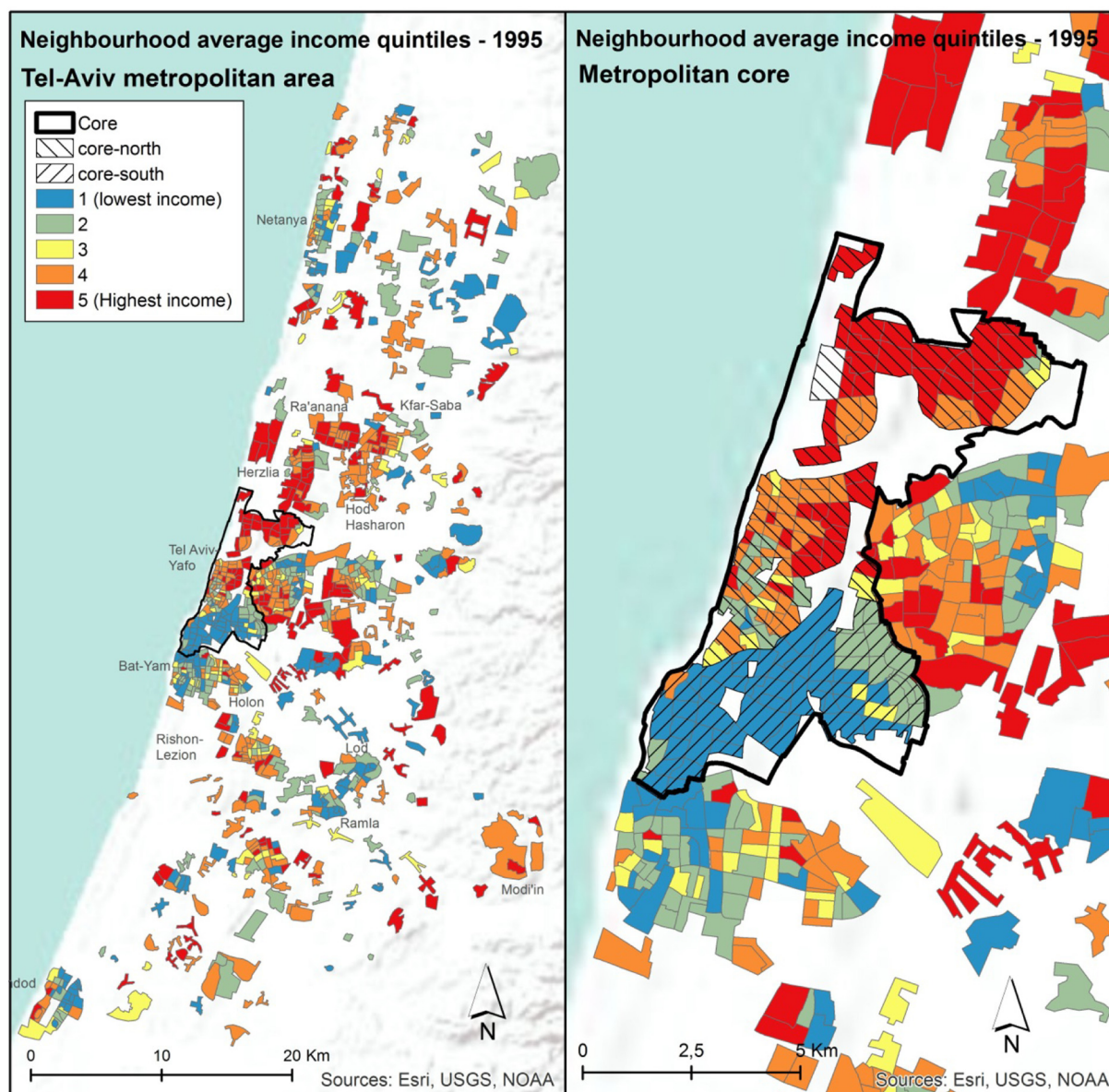
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**Fig. 2.** The spatial distribution of neighbourhood average incomes (in quintiles) in the Tel-Aviv metropolitan area (left panel) and in the metropolitan core (right panel).

observation and the 2008 observation were used to compute the neighbourhood income growth rate, which was then inflated to represent a hypothetical income growth rate for the whole research period. The rest of new tracts were excluded from the analysis. In total, 869 tracts are included, of which 351 (40.4%) tracts are located in the southern section, 312 (35.9%) in the northern, and 206 (23.7%) in the eastern.

## 4. Method

The prevalent approach in neighbourhood change research measures neighbourhood change based on neighbourhood incomes relative to the average of all metropolitan neighbourhoods' incomes. This measure eliminates the effect of overall income growth or decline in a metropolitan area, such that it focuses on its internal social organization. However, the observed change, when using relative measures, incorporates the change generated by both increasing inequality and urban-development processes (Modai-Snir & van Ham, 2018). In order to show how these two factors separately affected metropolitan

neighbourhoods, we need to quantitatively distinguish between them.

We use a method that was presented by Van Kerm (Van Kerm, 2004) in the context of income mobility, which has been recently applied in the context of neighbourhood change (Modai-Snir & van Ham, 2018). The method quantifies the contributions of three factors to the total change in neighbourhood absolute incomes: (a) the exchange of relative positions within the distribution, which is related to urban processes (b) the changing dispersion of the distribution, which is related to increasing inequality and (c) the overall growth or decline of incomes among all neighbourhoods in the metropolitan area. In the context of this paper, we are only interested in the first two factors, because those are the factors related to socio-spatial disparities within the metropolitan area. The third factor refers to a uniform spread of income increases, therefore it does not affect the internal socio-spatial organization.

Income change is measured (as a standard practice and regardless of the unit investigated) by relating to two different income observations, at different time points, for each unit followed. In the context of this study the units investigated are neighbourhoods within a single urban

area. Each neighbourhood includes two observations of average income at two different time points, t and t + 1. As such, socioeconomic change within the single urban area can be summarized by relating two vectors of neighbourhood average incomes: one representing the array of neighbourhood average incomes at time t and the other at time t + 1. In the context of this paper, neighbourhood average incomes are in absolute terms.

The method we apply in this paper is based on the construction of hypothetical neighbourhood income vectors, each reflecting how the array of neighbourhood incomes would look like at time t + 1, if only one specific factor of change (a or b, as listed above) had an effect. The first hypothetical vector demonstrates the isolated effect of positional exchanges (factor *a*); it reflects how the array of neighbourhood incomes would look like if they followed the same exchange of relative positions observed in the data, net of the other influences on neighbourhood incomes (the overall growth or decline in income across all metropolitan neighbourhoods and the increasing inequality among them). It is constructed by ordering the observed vector of initial neighbourhood average incomes according to the rank orders of the vector of final incomes. The second hypothetical vector demonstrates the effect of increasing inequality (factor *b*) among neighbourhoods; it reflects how the array of neighbourhood average incomes would look like if they were only influenced by the increasing inequality, but not by overall income growth (or decline) nor by exchanges of relative positions. This hypothetical vector applies the Lorenz curve of the observed vector of final incomes (at time t + 1) to the observed vector of initial incomes [See more detailed explanations of the original method in (Van Kerm, 2004), and the explanation related to the application in the urban context in (Modai-Snir & van Ham, 2018)].

Then, the amount of change associated with the transition between the initial vector and each hypothetical vector is computed using a mobility measure that was proposed by Fields & Ok (1999):

$$C(x,y) = \sum_{i=1}^{n} |\log y_i - \log x_i|$$

where $y_i$ and $x_i$ refer to the incomes of neighbourhood $i$ at a time t + 1 and time t, respectively. In computing the measure using the hypothetical vector related to factor *a* instead of the observed incomes at time t + 1 we derive the total change in the urban system that can be attributed to the exchange of relative positions among neighbourhoods. Similarly, using the vector related to factor *b* we derive the total change attributed to the increase in inequality among neighbourhoods. Because the measure aggregates individual units' contributions, sub-group contributions might as well be aggregated to indicate the impact of each factor on different neighbourhood groups (in that case the measure is used without the absolute-value notation); also, the average change for each sub-group can be computed. The measures reflecting the contribution of each factor are not additive, but represent the relative size of each effect.[5]

The analysis is based on comparing total income change and change attributed to each factor ("exchange" and "inequality") among neighbourhoods in each metropolitan section. Pairwise tests of the equality of means were performed; although the tables show means for three metropolitan sections (north, south and east), our focus is on comparing northern and southern sections.

**Table 1**
Average neighbourhood incomes in 1995 (ILS) and average growth in neighbourhood incomes through 1995–2008 in metropolitan belts and sections[*].

|  |  | East | North | South | Total |
|---|---|---|---|---|---|
| Core | Average income 1995 |  | 9,950$_a$ | 5,389$_b$ | 8291 |
|  | Average income growth |  | 27.5%$_a$ | 27.9%$_a$ | 27.7% |
| Inner | Average income 1995 | 7,967$_a$ | 11,146$_b$ | 7,246$_a$ | 8219 |
|  | Average income growth | 16.2%$_a$ | 26.3%$_b$ | 8.6%$_c$ | 14.9% |
| Middle | Average income 1995 | 8,576$_{a,b}$ | 9,396$_a$ | 7,958$_b$ | 8449 |
|  | Average income growth | 22.8%$_a$ | 37.8%$_b$ | 14.4%$_a$ | 22.0% |
| Outer | Average income 1995 | 8,269$_a$ | 7,516$_a$ | 7,733$_a$ | 7730 |
|  | Average income growth | 42.1%$_a$ | 41.1%$_a$ | 29.5%$_a$ | 37.3% |
| Total | Average income 1995 | 8209 | 8970 | 7340 | 8131 |
|  | Average income growth | 24.5% | 34.9% | 19.2% | 26.1% |

[*] Values in the same row not sharing the same subscript are significantly different at p < 0.05.

## 5. Results

### 5.1. Increasing north-south disparities and polarization

Our analysis focuses on how socioeconomic changes across the whole array of metropolitan neighbourhoods shaped the metropolitan socio-spatial structure, and how urban processes and increasing inequality distinctly contributed to these changes. First, we examine the disparities between northern and southern neighbourhoods in 1995, the starting point of the study (Table 1). In total, neighbourhood incomes in the north were 22% higher than in the south. But north-south disparities diminished outward from the core: in the core, northern neighbourhoods had 85% higher incomes than southern ones whereas in the inner and middle belts they had 54% and 18% higher incomes, respectively. In the outer belt southern neighbourhoods had slightly higher incomes (insignificant at the 0.05 level) than northern ones. The figures for neighbourhoods in the eastern metropolitan section lie in between those of the north and south sections.

The spatial polarization is evident in maps that show how neighbourhood average incomes (quintiles) were spread in 1995. At the level of the whole TMA (Fig. 2 left panel), clusters of affluent tracts are prominent in the north, especially in the core, and in inner and middle belts (where they represent independent municipalities). The south presents a more patchy pattern with higher prevalence of low-income areas (Fig. 2 left panel). A striking pattern of spatial polarization is in the metropolitan core, the city of Tel Aviv-Jaffa (Fig. 2 right panel), with a prominent divide between the middle/high-income north and poor south, stretching along the foregone railway. The eastern section is also quite differentiated by income levels, but does not follow the north-south pattern of divergence. By 2008, all metropolitan neighbourhoods experienced income increases by an average of 26.1% which reflects both a 14.3% national increase in real incomes[6] during that period and an additional increase in real incomes in the central region. However, the growth in average incomes has not been evenly spread throughout the metropolitan area. Northern neighbourhoods experienced the highest average increase of 34.9% compared to 19.2% of the southern neighbourhoods (Table 1). The southern part of the metro has therefore only slightly surpassed the national increase while the north shows a marked increasing advantage. The north-south income gap in 2008 was, therefore, 17 points higher than that of 1995. Average increases among eastern neighbourhoods were lying in between those of northern and southern neighbourhoods. The north-south divergence in income increases has expanded outward from the core. In the core itself the difference in increases between the north and south was negligent and insignificant. In the inner, middle and outer belts the difference

mounted to 17.7, 23.4, and 11.6 points respectively. Average increases for the core and outer belt in whole exceeded significantly those of the inner and middle belts, indicating patterns of suburbanization towards the rural outer belt, in parallel with gentrification in core neighbourhoods.

Our data suggests that the TMA has become more polarized during the research period. Controlling for the overall increase in incomes, it appears that average incomes of the lower-income (deciles 1–5) neighbourhoods decreased by 2–5%, whereas those of the higher-income ones (deciles 7–10) increased by 2–5%. If we apply absolute cut-offs that define the two lowest and two highest income deciles in 1995 to the distribution of 2008 neighbourhood incomes, we see that the number of neighbourhoods belonging to the low-income classification increased from 174 to 211, and those which belong to the high-income classification increased from 174 to 205. The increasing proportions of these ends were on the expense of the contracting middle income range. Breaking down these figures by metropolitan section reveals a substantial escalation in the north-south polarization. The net increase of 31 "high-income" neighbourhoods is combined of 29 northern neighbourhoods and 8 eastern neighbourhoods which were added to that classification and 6 southern neighbourhoods which were excluded from it. The net increase of 37 low-income neighbourhoods includes 29 southern neighbourhoods and 15 eastern which were added to that category, and 7 northern which were excluded from it. These findings highlight the strong north-south pattern of the polarization process.

### 5.2. The roles of urban processes and increasing inequality in driving north-south polarization

In this part of the analysis we computed the contributions of two different factors: The exchange of relative positions among metropolitan neighbourhoods, and the increase in inequality among them (Table 2). It is important to note that the components of change do not sum up to the total change but they do reflect the relative importance (see methods section). The effect of positional exchanges was more important than increasing inequality in deepening the north-south divide. The average change due to positional exchanges for all neighbourhoods is 0 due to its zero-sum nature; increases in relative positions are associated with decreases elsewhere. On average, neighbourhoods in the north increased their positions and those in the south decreased, but there is large variation among neighbourhoods within each section. The "inequality" factor indicates that increasing disparities among neighbourhoods within the metropolitan area did have an effect on the north-south polarization, but also here, the variation within sections is considerable.

The previous section showed that north-south polarization followed a concentric spatial pattern related to the outward expansion of the metropolitan area. Therefore we also examined how northern and southern neighbourhoods were affected by the two factors of change in each belt (Table 3). As we move outward from the core, disparities in positional changes between northern and southern neighbourhoods increase. In the core, southern neighbourhoods increased, on average, their positions more than northern (difference not statistically significant). This finding indicates that the poor southern core went through gentrification processes. In the inner belt, northern
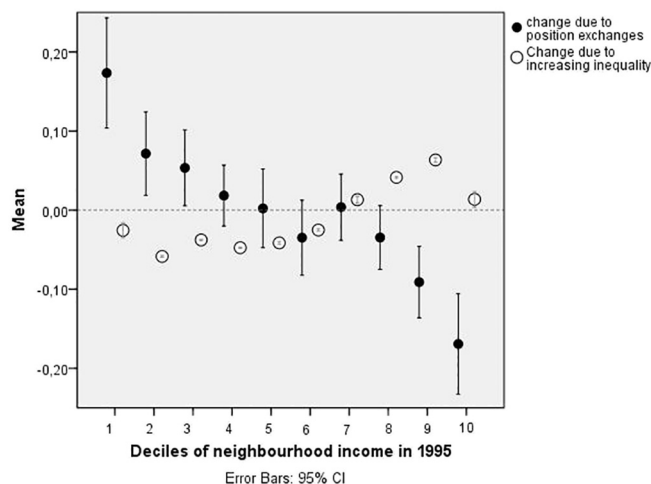
**Table 3**
Average neighbourhood income change in metropolitan belts and sections due to positional exchanges and increasing inequality among metropolitan neighbourhoods*.

| | | East | North | South | Total |
|---|---|---|---|---|---|
| | | Mean | Mean | Mean | Mean |
| Change due to positional exchanges | Core | | $.01_a$ | $.05_a$ | 0.03 |
| | Inner | $-.05_{a,b}$ | $.01_a$ | $-.11_b$ | $-0.06$ |
| | Middle | $-.01_{a,b}$ | $.07_a$ | $-.08_b$ | $-0.03$ |
| | Outer | $.09_a$ | $.09_a$ | $.00_a$ | 0.06 |
| Change due to increasing inequality | Core | | $.00_a$ | $-.04_b$ | $-0.01$ |
| | Inner | $-.01_a$ | $.01_b$ | $-.03_a$ | $-0.02$ |
| | Middle | $-.01_a$ | $.01_b$ | $-.02_a$ | $-0.01$ |
| | Outer | $.01_a$ | $-.01_b$ | $-.01_{a,b}$ | $-0.01$ |

* Values in the same row not sharing the same subscript are significantly different at $p < 0.05$.

neighbourhoods did not increase in positions substantially but southern ones experienced decreases. The gap is more significant in the middle belt; northern neighbourhoods experienced important positional upgrades whereas southern ones moved downwards. In the outer belt, northern neighbourhoods gained the most in terms of positional change and southern ones stagnated. The "inequality" factor affected north-south disparities in an opposite manner. Its diverging effect was greatest in the core and diminished outward. The effect of inequality on neighbourhoods is tied to their location in the income distribution. When income inequality increases, low-income neighbourhoods typically decrease and high-income ones increase, and this exact pattern is demonstrated in our data (Fig. 3). The effect of inequality follows the uneven spatial distribution of neighbourhood positions at the initial period. The negative effect of increasing inequality was more pronounced in the south which hosted 58.6% of neighbourhoods of the lowest income quintile (compared to 21.8% in the north), whereas the positive effect was more pronounced in the north which hosted 51.7% of neighbourhoods of the highest income-quintile (compared to only 23.6% in the south). Given that existent disparities at the starting point (1995) were diminishing outwards, the effect of increasing inequality followed the same direction.

The figures in Table 3, however should be interpreted with some caution. The effect of inequality is not tied to places but to the positions they occupy within the metropolitan distribution of neighbourhoods. As specific neighbourhoods change their positions over time, assigning place-specific contributions to the inequality factor is not completely

**Table 2**
Average neighbourhood income change in metropolitan section associated with each contributing factor.

| | | East | North | South | Total |
|---|---|---|---|---|---|
| Change due to positional exchanges | Mean | $-0.01$ | 0.06 | $-0.05$ | 0.00 |
| | SD | 0.23 | 0.25 | 0.26 | 0.25 |
| Change due to increasing inequality | Mean | $-0.01$ | 0.00 | $-0.02$ | $-0.01$ |
| | SD | 0.04 | 0.05 | 0.04 | 0.04 |



**Fig. 3.** The effect of two different factors of change (positional exchanges and increasing inequality) on neighbourhoods across the metropolitan distribution of neighbourhood incomes.

**Table 4**

Positional changes in northern and southern neighbourhoods according to income level: the proportion of increasing and decreasing neighbourhoods and the mean positional change[*].

| | | Decreasing neighbourhoods | | Increasing neighbourhoods | | Total | |
|---|---|---|---|---|---|---|---|
| | | Mean positional change | N % | Mean positional change | N % | Mean positional change | N % |
| Highest income quintile | North | −0.20 | 64.4% | 0.12 | 35.6% | −0.09 | 100.0% |
| | South | −0.36 | 92.7% | 0.28 | 7.3% | −0.31 | 100.0% |
| Lowest income quintile | North | −0.03 | 18.4% | 0.38 | 81.6% | 0.31 | 100.0% |
| | South | −0.12 | 43.1% | 0.22 | 56.9% | 0.07 | 100.0% |
| Middle income quintiles | North | −0.13 | 37.5% | 0.19 | 62.5% | 0.07 | 100.0% |
| | South | −0.16 | 62.5% | 0.13 | 37.5% | −0.05 | 100.0% |

[*] All means and proportions for north and south categories of each cell are significantly different at $p < 0.05$.

accurate. The contribution of inequality to a neighbourhood follows from the position it held at the initial time-point, 1995. In case of important exchanges of positions during the research period, the results can over- or underestimate the effect of inequality on neighbourhoods in specific places (such as the north or south sections). For example, the rural places in the northern outer belt increased their positions substantially. Therefore, the overall effect of inequality through the research period is overestimated because it doesn't take into account changes in relative positions that occurred over time. Usually, however, extreme position exchanges are rare, especially over a period of around one decade which is considered short in the context of neighbourhood change. Taking this reservation into account, it would be accurate to say that the most important effect of inequality is in low-income places that did not substantially improve their relative positions, such as those in the inner and middle belt.

As for positional exchanges, there is a negative association between neighbourhoods' initial socioeconomic positions, and the socioeconomic change they experienced (Fig. 3). typically, high-income neighbourhoods decrease and low-income increase, as expected due to processes of housing filtering (Rosenthal, 2008) and due to ceiling and floor effects. However, metropolitan sections show divergent patterns of positional changes within neighbourhood income groups (Table 4). Low-income neighbourhoods in the north were more likely to increase and less likely to decrease than in the south; among increasing low-income neighbourhoods those in the north improved their average positions much more and among decreasing ones those in the south did much worse (Table 4). High-income neighbourhoods in the north were less likely to decrease than those in the south, and also showed lower average decreases. Middle-income neighbourhoods in the north were more likely to increase, while those in the south were more likely to decrease.

To get the full picture of how socioeconomic changes due to the different factors were spatially structured, we performed a Cluster and Outlier analysis. The analysis uses the Anselin Local Moran's I statistic to identify upgrading tracts that are located amidst other upgrading tracts (high-high) and downgrading tracts that are surrounded by other downgrading tracts (low-low). It also identifies spatial outliers: upgrading tracts amidst downgrading clusters (high-low) and vice versa (low-high). The analysis reveals how upward and downward changes due to both factors were prominently clustered in the north and south respectively (Fig. 4), with very few exceptions to this pattern. But it also reveals spatial nuances of these effects. Among them, is the containment of the inequality effect in areas closer to the core, which reproduces the prevailing divisions as of 1995. In contrast, there is the spreading outwards of upward positional change in the north. Such outward spread of upgrading, however, has not occurred in the south. Another insight that can be gained from mapping clusters and outliers is the way whole cities are affected quite homogeneously by either factors of change. This ascertains that municipal affiliation is extremely important in the process of neighbourhood change and mostly all neighbourhoods of a municipality upgrade or downgrade in sync. Outliers are predominantly located at the outskirts of cities, implying that spatial contingency might play an important role in these synchronized ups and downs, and not only the affiliation of neighbourhoods with municipalities.

## 6. Discussion

This paper examines how the evolution of the socio-spatial structure in the context of an existent historical divide is influenced by two different factors: increasing inequality and urban-development processes. By empirically distinguishing between these two different factors, this paper provides an additional step forward in understanding the complexity in intensifying socio-spatial divisions. The paper focuses on the metropolitan area of Tel-Aviv, Israel, which is characterized by a historical north-south socioeconomic divide. The existent divide stemmed from the ethno-national conflict and materialized over the decades due to persistent inequalities among ethnic groups. On top of these deeply-rooted mechanisms, following Israel's integration in the global economy there was a substantial increase in national inequality. At the same time, Tel-Aviv metropolitan area went through a period of extensive development. This paper focuses on explaining how these developments aggravated the existent divide during the period 1995–2008. The analysis is based on a recent methodological application in the context of neighbourhood change which can offer insight into the two different factors that generate changes among neighbourhoods and the socio-spatial structure. This method was introduced by Van Kerm (Van Kerm, 2004) in the context of income mobility, and applied to neighbourhood change by Modai-Snir and van Ham (Modai-Snir & van Ham, 2018).

Initially, findings describe the changes in the socio-spatial structure that have occurred during the research period with specific relation to the north-south divide. The much greater average increase in incomes among northern neighbourhoods (34.9% compared to 19.2% in southern neighbourhoods) intensified the disparities between the north and south. While at the outset disparities between north and south were largest in the core and diminished outwards, the disparities in income increases were negligent in the core and increased outwards. This pattern indicates the spreading out of the intense disparities existent in the core. The analysis further points to a spatial polarization process through which the north section absorbed the increase in high-income neighbourhoods and the south - the increase in low-income neighbourhoods.

Overall, the effect of positional exchanges (related to urban-level processes) is larger than that of increasing inequality, but in specific places they can be comparable in size. The two processes have distinct spatial patterns: The average effect of increasing inequalities on intensifying north-south disparities was largest in the core and diminished outwards. This pattern stems from the fact that increasing inequality affects neighbourhoods based on their starting positions. So, the effect of increasing inequality simply replicates the spatial pattern of disparities at the starting point. This exemplifies how historical circumstances serve as a springboard for contemporary inequality-related
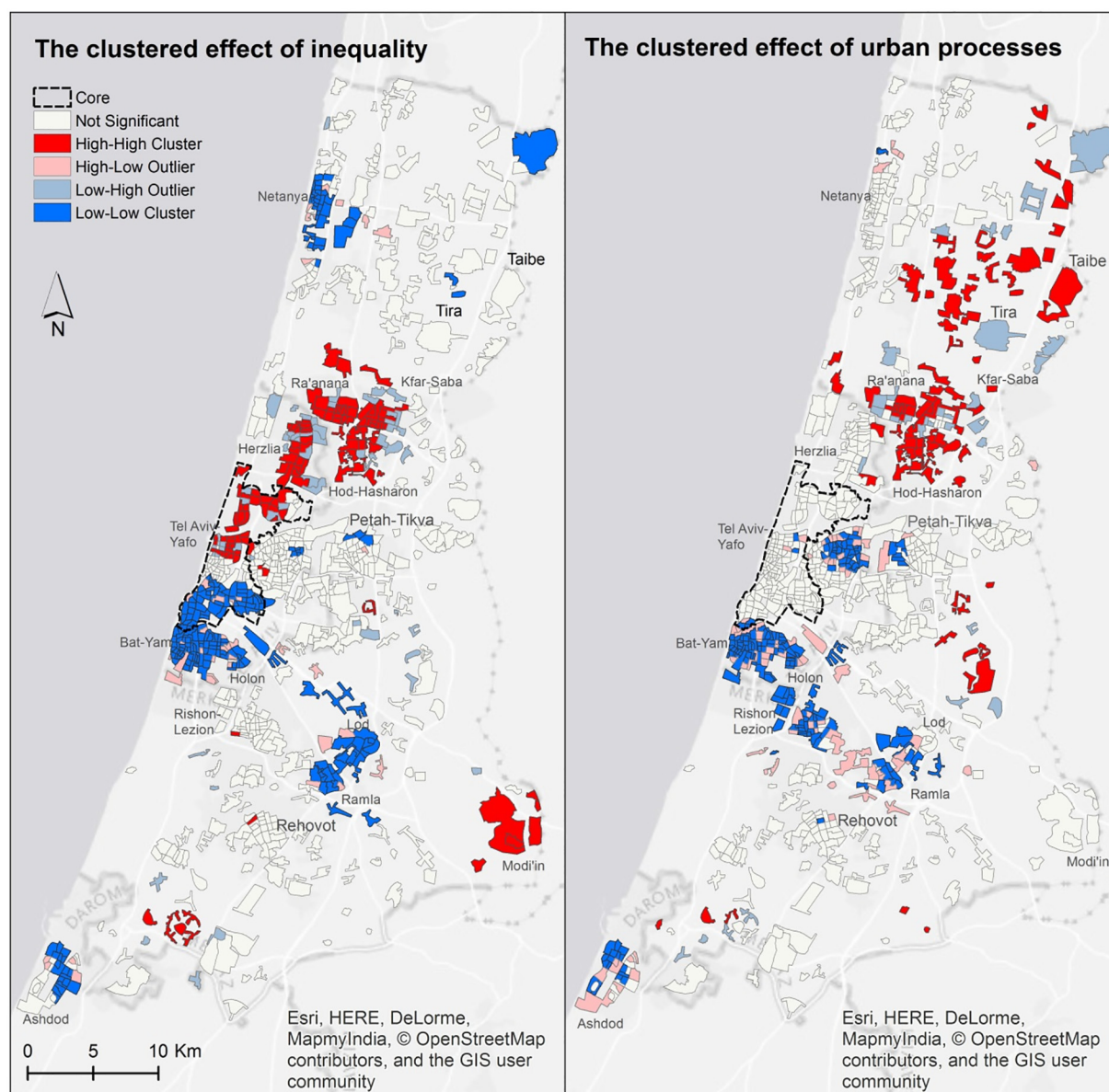
**Fig. 4.** Cluster and Outlier Analysis of neighbourhood socioeconomic upgrades and downgrades due to two different factors.

disparities. Urban-level processes (which drive positional exchanges) affected the north-south divide differently; In the core they seemed to decrease disparities among northern and southern neighbourhoods, and moving outward from the core they increasingly intensified disparities.

The pattern of positional exchanges points to a "rural renaissance"; neighbourhoods in the outer belt have gained, on average, the largest increases in socioeconomic positions. The second winner is the core, whose neighbourhoods also gained positional increases, indicating a process of gentrification, in correspondence with theory and empirical evidence (e.g. Brueckner & Rosenthal, 2009; Zukin, 1987)). Neighbourhoods in the inner belt were doing the worst, signifying that they suffered the largest losses of attractiveness, and hence they grew to cater for lower income groups than before. This replicates findings from studies in different metropolitan areas, that emphasized the recent decline of inner suburbs (e.g. Lee & Leigh, 2007). Overall, the concentric pattern of increases and decreases corresponds to the literature, but in the context of the prominent divide in the Tel-Aviv metropolitan area this pattern is distorted. In the north section, the inferiority of the inner belt is expressed as an average stagnation in positions, whereas in the south it is marked by the largest decreases in positions. The primacy

of the outer belt is marked by the largest average increases of neighbourhoods in the north, and stagnation in the south. In the core, gentrification seems to be more important in the south, which can be explained by the attractiveness of the most depreciated places for investment. To summarize, the process of urban expansion is concentric but asymmetric because the attractiveness of the northern part is extremely persistent. It causes the reproduction of historical patterns outwards, in the course of urban development and expansion.

As noted, the effects of urban processes and increasing inequality differ by their spatial distributions. This points to the complex interactions between them in producing a joint effect. If we focus on the core, for example, the figures imply that the north-south convergence that was driven by urban level processes was, on average, offset by the divergent effect of increasing inequality. Therefore, the apparent stability in disparities between northern and southern core neighbourhoods covers two active opposing forces that eliminated each other. Without increasing inequality, the southern core could have decreased the gap from the northern core. In the inner and middle belts, both processes had a divergent effect. In these belts, the effect of increasing inequality was smaller in size but not negligent. So, with regard to these

belts it can be concluded that increasing inequality exacerbated the decline they experienced as part of the urban-development phase. Overall this study indicates that both urban processes and increasing inequality have had an important effect in intensifying the socio-spatial divide, but they operated in different ways. Their interaction with the historical socio-spatial context had a critical role in transforming the urban social landscape. The distinction between the effects of the two socio-spatial change factors points to the potential effectiveness of different policies in tackling urban inequalities and polarization. Specifically, the significance of the "inequality" factor highlights the relevance of people-based policies (as opposed to place-based policies) that aim at tackling individual-level inequalities, even in dealing with spatial disparities.

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