Deconcentration versus spatial clustering: changing population distribution in the Turku urban region, 1980–2005

ANTTI VASANEN

Vasanen, Antti (2009). Deconcentration versus spatial clustering: changing population distribution in the Turku urban region, 1980–2005. *Fennia* 187: 2, pp. 115–127. Helsinki. ISSN 0015-0010.

Many urban regions in developed countries have experienced major changes during the past few decades. The deconcentration trend of urban regions has been accompanied with new processes where traditional monocentric cities have been replaced by increasingly polycentric urban constellations. This study seeks to present evidence on how Finnish urban regions have developed in recent decades using the Turku urban region as an example. The results show that the Turku urban region has indeed become more polycentric when population distribution is considered. Global socio-demographic trends, the housing careers of young families and municipal planning policies were found to affect the changing population distribution. The paper is concluded by highlighting the importance of scale in the development of Finnish urban regions. The fundamental factor in urban regional dynamics seems to be a conflict in scale, in which demographic processes influence the urban spatial structure on the regional scale whereas planning practices have predominantly effects on the municipal scale.

Antti Vasanen, Department of Geography, FI-20014 University of Turku, Finland. E-mail: antti.vasanen@utu.fi.
MS received 24.02.2009.

Introduction

During recent decades, urban regions across developed countries have experienced considerable changes. The outward shift of population and overall deconcentration of urban regions have characterised most cities; a trend initiated by the development of public transportation systems and accelerated by private car ownership (Millward & Bunting 2008). More recently, globalisation, expanding knowledge and information based economy and changing demographic composition have dramatically changed the structure of urban regions as traditional monocentric cities have given way to more polycentric urban constellations (Hall 1993; Musterd et al. 2006).

The trend towards increasing polycentricity was first discovered in the United States, where new economic nodes, or edge cities as they were named by Garreau (1991), were observed in the peripheral outskirts of metropolitan regions. In Europe, the dense settlement system and high population density created distinct polycentric urban development, which became visible through the transition from traditional hierarchical relations between urban subcentres to polycentric urban constellations where also complementary relations between the nodes existed (Dieleman & Faludi 1998; Kloosterman & Musterd 2001; Parr 2004; Hall & Pain 2006). However, as Beauregard and Haila (1997: 328) emphasise, despite the emergence of subcentres, central cities in Europe still function as dominant cores for their regions and American cities continue to have downtowns. The new processes shaping urban areas have never replaced the old ones completely, which has lead to a complex pattern of old and new urban structures.

Urban regions in Finland have also gone through considerable changes. The urbanisation in Finland took place fairly recently, with the most rapid urban population growth occurring in the 1960s and

1970s. This resulted in rather peculiar urban development, where the process of urbanisation mostly took place in the form of suburbanisation. In Finland, the major trends in urban development since the end of the Second World War have been the continuous concentration of population to urban regions with simultaneous suburbanisation. Vartiainen (1991) has described this process with the term regionalisation, which is typified by both nationwide population concentration and the regional dispersion of population. The regional aspect has grown increasingly important in the Finnish context during the past decade as urban population growth has increasingly taken place in the remoter parts of urban areas. Although a lot of research has been conducted on urban issues in Finland, the regional aspect of urban development has recently been a rather scarcely researched subject.

This paper aims at providing understanding on the complex dynamics behind changing urban structure during the period of 1980–2005 using the Turku urban region as a case study. The purpose of this paper is not simply to make deterministic generalisations of the dynamics of the urban structure in Turku but to provide a broader view on the changes visible in Finnish urban regions. The paper begins by discussing recent theoretical and empirical research regarding changes in urban population distribution and urban dynamics in general. The theoretical section is followed by a description of the research data and used methods as well as a brief introduction to the study area. In the succeeding section, the empirical results of the paper are presented followed then by discussion and conclusions where the results are reflected against the wider societal and theoretical context.

Recent trends in urban population distribution

Two major trends have become evident when considering recent changes in urban spatial structure. First, a large number of studies have examined different forms of decentralisation or deconcentration processes all around the developed world. The terminology linked to the deconcentration of human activities within urban regions has ranged from counterurbanisation to urban sprawl (Berry 1976a; Fielding 1982; van den Berg et al. 1982; Champion 1989; Geyer & Kontuly 1993; Bruegmann 2005; EEA 2006). Secondly, the emergence of new urban centres within urban regions has been noted by many scholars particularly in Northern America and in Western Europe (Garreau 1991; Anas et al. 1998; Dieleman & Faludi 1998; Kloosterman & Musterd 2001; Parr 2004; Hall & Pain 2006). This trend of evolving multinodality in urban regions was largely recognised in the early 1990s and it has since been an inseparable part of the way urban regions are understood.

Although the processes leading to the decentralisation of urban population have been well recognised in several cities in Europe and North America, the predominant trend in population change has been growing metropolitan areas and declining peripheries. The turnaround in this trend was first documented in the United States where the population shift from metropolitan to non-metropolitan regions was documented in the 1970s (Beale 1975; Berry 1976a; Beale 1977). This turnaround, or counterurbanisation as it was named by Berry (1976a), is an ambiguous concept. In his seminal article, Berry (1976b: 17) defines counterurbanisation simply as "a process of population deconcentration". The imprecision of the concept's definition led, according to Mitchell (2004: 27), to a myriad of different interpretations of the deconcentration process. Mitchell (2004) categorises different viewpoints on counterurbanisation according to whether counterurban population growth occurs in adjacent areas to metropolitan regions, in peripheral locations, or down the settlement hierarchy. Common to these definitions, however, is that in every category population growth takes place in areas beyond the suburban or metropolitan region.

As a theoretical concept counterurbanisation was questioned relatively soon after its emergence. In Britain, Champion (1987) demonstrated that rural population growth and metropolitan decline peaked in the early 1970s only to stabilise again in the following decade into much smaller population growth differences between rural and urban regions. Similar results were reported by Richter (1985) and Long and DeAre (1988) concerning the population trends in the United States. Furthermore, Long and Nucci (1997) demonstrated that although metropolitan population growth in the US surpassed non-metropolitan growth in the 1980s, features of population deconcentration were again visible in the 1990s. Vartiainen (1989: 223) stated that the conceptual framework of counterurbanisation together with such concepts as reurbanisation and gentrification are "losing sight of a more flexible socio-spatial organisation, where deconcentration may evolve together with concentration". Vartiainen (1989) calls this process regionalisation after the Swedish scholars Ventura and Wärneryd (1983). Based on an empirical example from Finland, Antikainen and Vartiainen (2002) define regionalisation as the growth of large urban regions where population growth branches out to surrounding rural areas whereas the growth of economic activities are increasingly concentrated in the urban centre.

Geyer and Kontuly (1993) expanded the discussion on counterurbanisation to also include developing countries by introducing the concept of differential urbanisation. The theoretical model of differential urbanisation principally outlines the development of national urban systems, but also addresses urban development on a metropolitan scale. In the model, counterurbanisation is seen as an advanced stage of urban system, in which population shifts take place from the large cities towards small urban centres. This phase of urban development is preceded by the stages of rapid urbanisation of primate cities and their gradual maturing characterised by the shift of population growth from the central areas to suburban locations (Geyer & Kontuly 1993; Geyer 1996). On the subnational scale, the model of differential urbanisation closely resembles the model of urban development introduced first by Dutch scholars in the early 1980s (Klaassen & Scimemi 1981; van den Berg et al. 1982). The first stage of the model is urbanisation characterised by the fast growth of cities at the cost of their surrounding countryside. Urbanisation is followed by suburbanisation as cities grow and sprawl into their surrounding area. The third stage of the model is counterurbanisation succeeded finally by the fourth stage, reurbanisation, which refers to the revival of old urban centres.

Extensive empirical illustrations testing the theory of differential urbanisation were published in the special issue of *Tijdscrift voor Economische en Sociale Geografie* in the early 2000s (Kontuly & Geyer 2003a). Using evidence based on cases from nine different countries, Kontuly and Geyer (2003b) concluded that the differential urbanisation model is consistent with reality. In more than half of the studied countries, urban development followed the sequence of stages proposed by the model and in the rest of the cases the anomalies could have be explained through policy interventions. According to Kontuly and Geyer (2003b), Finland went through all the stages of differential urbanisation and was the only country to progress thorough the whole cycle and then moving again into the phase of urbanisation. In Finland, the first urbanisation stage took place in the 1940s when the population of Helsinki grew rapidly (Heikkilä 2003). During the 1960s, the population of the largest cities began to deconcentrate leading the country to enter into the counterurbanisation phase. According to Heikkilä (2003), the second cycle of differential urbanisation started in the 1990s when population in the largest cities of Finland again started to grow.

From the 1990s onwards, the identification of new patterns of urban structure has proceeded rapidly (Champion & Hugo 2004). According to Anas et al. (1998: 1426) urban regions have been spreading out for a long time but only recently has the "process of decentralization taken a more polycentric form", which has been characterised by the fragmentation of urban spatial structure and the emergence of new business districts in the urban periphery. Perhaps the most renowned concept describing the new urban form is Joel Garreau's (1991) edge city, which refers to a large concentration of office and retail space that was "nothing like city just a few decades ago" (Garreau 1991: 6–7). Although edge cities are mainly associated with the urban form of, for example, Los Angeles, similar, but not identical, patterns of urban development have also been observed in Europe (e.g. Hitz et al. 1994; Phelps & Parson 2003; Bontje & Burdack 2005).

In European research literature, polycentric urban development refers rather to a multinodal settlement structure than to a rise of economic subcentres. The term polycentric urban region has emerged in various contexts describing mainly urban development in north-western Europe (e.g. Dieleman & Faludi 1998; Kloosterman & Musterd 2001). According to Dieleman and Faludi (1998: 366), a polycentric urban region is a large urban region that does not contain a single primary city. The term, therefore, refers rather to inter-metropolitan than intra-metropolitan polycentric patterns, of which the most often used examples include the Dutch Randstad, the Belgian Flemish Diamond and the German Rhine-Ruhr area. The term polycentricity has occasionally been used more broadly to describe national urban networks (e.g. Antikainen & Vartiainen 2005; Meijers et al. 2005) instead of functional cohesive entities. This broad definition, however, differs largely from the characteristics of polycentric urban regions, which according to Kloosterman and Musterd (2001) require sufficient proximity to enable commuting between the urban nuclei.

The concept of polycentric urban region has gained largely purpose-oriented connotations as it has been adopted by planners and politicians. Furthermore, many scholars have questioned the actual existence of polycentricity within urban regions in practice. Musterd and van Zelm (2001: 694) argue that in functional terms, such as cross commuting, the Randstad polycentric urban region does not exist. Instead they recognise several smaller functional entities within the region. Parr (2004: 239) questions the validity of the concept of polycentric urban regions and argues that it should not be treated as an established theoretical concept "but rather as a hypothesis in need of testing". Furthermore, Hall et al. (2006: 87) reason that "some of Europe's major metropolitan areas are intrinsically more polycentric than others." As Musterd and van Zelm (2001) demonstrate in the Dutch context, relatively small daily urban systems can be regarded as polycentric functional units. They argue that polycentrism is reality at the intra-metropolitan rather than the inter-metropolitan level, which is undoubtedly true in the wider European context as well (Musterd & van Zelm 2001; cf. Kloosterman & Musterd 2001). In their further analysis of the Amsterdam metropolitan region, Musterd et al. (2006) underline that although the historic city centre has not lost its position in the urban system, Amsterdam is clearly a polycentric urban region and both population and economic tendencies point towards increasing intra-metropolitan polycentricity (Musterd et al. 2006).

Research setting

Study area

The urban region as a study area is not a straightforward concept at least in the Finnish context. Recent research addressing urban regions has been policy-driven and the basis for determining the urban region has formed twofold. At first, the need for describing the nationwide urban network in Finland led to a series of studies on urban regions carried out mainly by the Ministry of the Interior (Antikainen 2001; Antikainen & Vartiainen 2005). In these studies, urban regions were defined merely as NUTS-4 regions, which are mainly used as units of statistical classification and have very few administrative functions. Although these regions coincide with functional urban regions in most cases somewhat adequately, they are mainly usable in large scale regional comparisons. A second approach to urban regions has addressed the rapidly changing internal structure of urban regions and has been initiated by the Ministry of the Environment (e.g. Ristimäki et al. 2003; Helminen & Ristimäki 2007). This approach has been more analytical defining the extent of the urban region according to the spatial distribution of population and workplaces. However, the definitions of region have emphasised more physical than functional features of urban regions.

In this study, urban region is defined by adopting John Parr's (2007) four different spatial definitions of the city. First, Parr describes the built city (BC), which is composed of the continuous built-up area of housing, manufacturing, transport etc. and of which population exceeds a certain level. The second approach to defining the urban region is the consumption city, which involves the BC and all the localities dependent of the goods and services offered by the BC. Parr's third definition of the city, the employment city, includes the BC as well as the localities where at least every other employee commutes to the BC. As commuters also support employment opportunities in their resident localities, and thus increase the dependence of the given locality on the BC, the actual share of the commuters of the localities included in the employment city is notably smaller than 50 per cent. The fourth definition of the city, the workforce city, represents the area from which a certain number of the workforce of the BC is drawn. The workforce city is based on a series of isolines starting from the boundary of the BC and continuing until the given majority of the BC's workforce is reached. The challenge with this approach is to define the particular given percentage of the outer extent of the workforce city. Since a small number of the BC's workforce resides very far from the city, the hundred per cent isoline would not define the city appropriately and some other, rather arbitrary percentage needs to be chosen.

In this study, the employment city incorporating the densely built up area with its commuting region forms the most usable approach to the study area. The outer extent of the workforce city is difficult to define and reliable data for defining the consumption city are unavailable at least on the required scale. The built city in the Turku urban

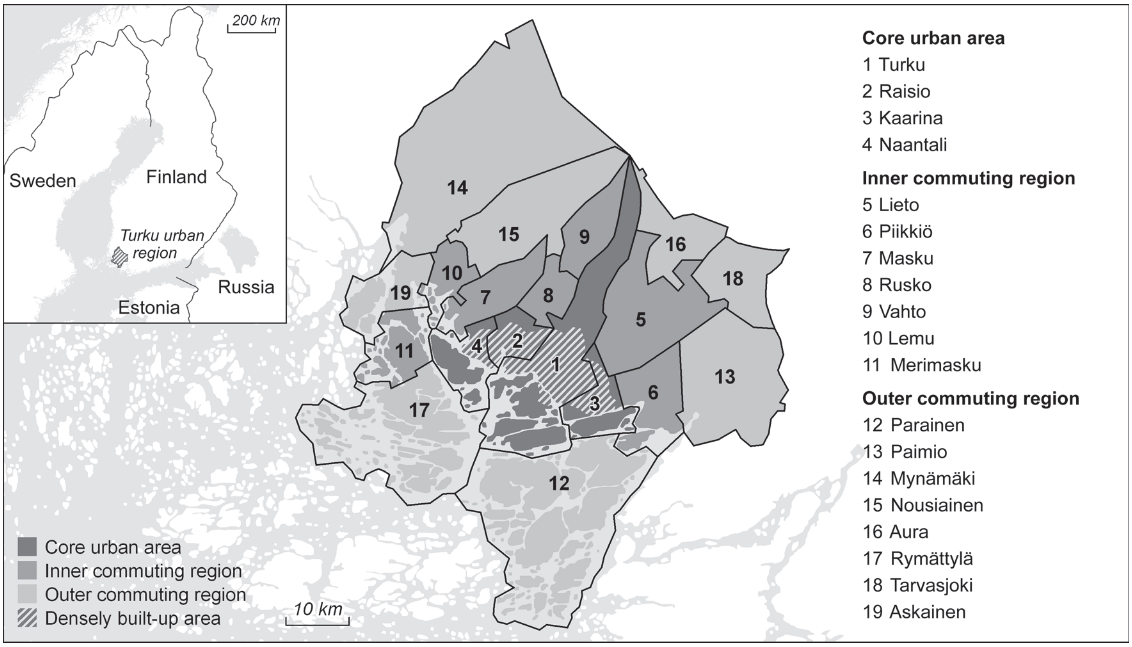

Fig. 1. Turku urban region. The municipal borders are defined in line with the situation in 2008. Source of the base map: National Land Survey of Finland.

region includes the central areas of Turku and three of its neighbouring municipalities: Raisio, Kaarina and Naantali (Fig. 1). Since municipalities are used as spatial units defining the extent of the study area, these four cities together form a core urban area. However, because of its elongated shape, Turku includes also some predominately rural areas in the northern parts of the city. Thus, the commuting centre is defined as the densely built-up area of the core urban area (BC) and not as the outer extent of four municipalities. Furthermore, the municipal borders are defined in this study as they were in 2008 and the numerous municipal mergers that took place in Finland in 2009 are ignored.

The commuting region is divided into two categories. The inner commuting region includes the municipalities, where at least half of the employed workforce commutes to the core area. As Parr (2007) points out, the dependence of the commuting locality on the central city emerges at commuting levels of less than 50 per cent and thus, the outer commuting region was included in the study area, from which at least a quarter of the workforce commutes to the central area of the Turku urban region. Although the division between the inner and outer commuting region seems random and purely statistical, the municipalities belonging to these two categories represent some significant differences. The municipalities in the inner commuting region are mainly small formerly rural communities, which nowadays are increasingly dependent on the jobs and services of the core city, whereas the outer commuting region includes mainly larger towns with better service infrastructure and job self-sufficiency.

Data

The empirical data used in this study are obtained from the urban structure monitoring system maintained by the Finnish Environment Institute. The monitoring system consists of a large amount of longitudinal data aggregated from different registers of Statistics Finland and the Finnish Population Register Centre. The basic spatial unit of the data is a 250–250 metre grid cell and the data are available in five-year intervals between 1980 and 2005. Only the cells that were inhabited at least in one year of six different time periods were included in the study, amounting to a the total of 12,924 grid cells for the analysis.

In order to examine the dynamics of population distribution in the Turku urban region, altogether seven variables were included in the study on the grounds of pre-existing studies (Table 1). Champion (2001) links changes in urban population with recent demographic trends. These trends, which Van de Kaa (1987) named the second demographic transition, are characterised by decreasing household sizes, the increasing number of the elderly and the increasing number of small childless households (Van de Kaa 1987; Champion 1992). Five variables describing socio-demographic changes were included in the study. Another, and in Finnish context a very important approach to intra-metropolitan population change, is urban planning. Although several actors have an impact on land use planning, the influence of land use planning on urban structure is inevitable as all major housing construction in Finland require a thorough planning procedure (Jauhiainen & Niemenmaa 2006). As longitudinal data describing planning activities are not available, the impact of land use planning is quantified indirectly using data on residential buildings. The increasing number of a certain type of residential building indicates in the urban context more or less inevitably that such dwellings have been planned in the given area.

The spatial and temporal resolution set limitations to the data available for the purposes of this study. According to Kim et al. (2005), intra-metropolitan population change is largely the outcome of residential mobility and residential location choice. However, since variables related to residential location choice or preferences are highly subjective in nature, it is rather impossible to obtain such data alongside with other longitudinal grid data. Also several other potentially interesting variables were impossible to quantify as grid data. As a result, issues addressing, for example, the increasing number of immigrants residing in urban regions and spatial variation in housing prices remain subjects for further research.

Table 1. Variables used in the study and related descriptive statistics on the study area.

	1980	2005
Proportion of people aged over 65	18.5 %	18.6 %
Floorspace (m²) per person ratio	40.8	64.2
Mean household size (persons)	2.82	2.51
Proportion of families with children	37.7 %	32.3 %
Proportion of 1 person households	18.6 %	24.0 %
Number of residential buildings		
block of flats	2 906	3 267
detached or terraced houses	32 397	50 536

The problem that derives from using the grid data is the amount of data missing coordinate reference. Within the study area, the proportion of unlocated data is in most cases less than 2 per cent and often close to zero. As a basic rule, data from 1980 and 1985 are the most biased, although these records have been revised by the Environmental Institute using secondary data (Ristimäki 1999). In some cases the proportion of uncoordinated data is high enough to cause potential problems in the interpretation of the results. The most obvious case is the variable of over 75 year old population, which is influenced by relatively large numbers of institutionalised people. In order to diminish the possibility of misinterpretations, this variable is aggregated with the age group of 65–74. Another problem that might arise when using high resolution datasets is the need for privacy protection in cases of personal information such as income or education level. In this study, however, the need for such protection is not relevant as highly personal data are not illustrated on the map in a way that an individual person might be recognised.

Methods

In order to analyse the changes in urban structure, two indices were calculated. The first index is a modification of Duncan and Duncan's (1955) dissimilarity index *D*, which is used to measure the rate of spatial segregation between two population subgroups and is defined as:

$$D = \frac{1}{2}\sum_{i=1}^{n}\left|x_i - y_i\right|$$

where x_i and y_i are the population counts of two subgroups in the given areal unit *i* in proportion to the total population count in the whole study area. The index ranges from 0 to 1, the larger index value suggesting a greater level of spatial segregation (O'Sullivan & Wong 2007: 149). The modified concentration index, also called the Hoover index, measures the concentration of single phenomenon, such as population, in the study area. The formulation of the concentration index follows the formula 1, where x_i is the population count and y_i is the area of the given areal unit *i* in proportion to the total values of the study area (Duncan et al. 1961: 82–83; for a more recent approach, see Tsai 2005: 146 and Horner & Marion 2009). Likewise to the dissimilarity index, the concentration index ranges from 0 to 1, where the value 0 suggests equal concentration of population in the whole study area, whereas the value 1 suggests complete concentration into a single areal unit. In order to visualise the concentration index on the map, the local concentration index was developed. The local version of the index follows the formula 1 closely where the $|x_i - y_i|$ value is calculated for each inhabited grid cell.

Whereas the concentration index measures the distribution of a phenomenon in the whole area, the second index used in the study, the Moran's *I* statistic of spatial autocorrelation, detects the non-randomness of events in the studied area (Wang 2006: 167). The *I* statistic by Moran (1950) is one of the oldest measures of spatial autocorrelation (or spatial clustering) and its methodological foundation is presented elsewhere (e.g. Cliff & Ord 1973). The Moran's *I* statistic ranges from –1 to 1, where negative values indicate that dissimilar and positive values that similar values are clustered while values near zero indicate a random pattern of observations (Wang 2006: 173). Moran's *I* is a global statistic giving a single value of spatial association for the whole study area. In order to interpret the patterns of spatial clusters within the study area, a class of local indicators of spatial association was used, which allowed the decomposition of global Moran's *I* into the contribution of each individual observation (Anselin 1995: 94). Several different local indicators for local clustering exist, of which a local version of Moran's *I* described by Anselin (1996) is used here. The strength of the local Moran's *I* lies in its ability to classify spatial clusters into four distinctive categories, of which the category implying positive spatial autocorrelation of high values is particularly useful in the analysis of the spatial dynamics of population distribution (Messner & Anselin 2004).

The calculation of the local Moran's *I* requires information of the neighbouring values of a given grid cell. This neighbourhood relation or spatial weight can be calculated in several ways. In this study, all cells within 500 metre radius are regarded as the neighbours of the given grid cell. This radius can be seen as justified, since the typical diameter of a single neighbourhood in the study area is roughly about one kilometre. In order to make the interpretation of the local concentration index compatible with the local Moran's *I*, the concentration index is generalised by calculating the average values of the index to the grid cell and its neighbouring cells within a 500 metre radius. The analyses were performed using ArcGIS, SPSS and GeoDa software.

Changing population distribution in the Turku urban region

The total population of the Turku urban region has increased notably in the studied period of 1980–2005. The population was 265,000 in 1980 and it increased by fifty thousand inhabitants to 315,000 in 2005. The internal composition of the population growth, however, has varied significantly. In absolute terms, the population grew in all three sub-regions during the 1980s more or less at the same rate (Fig. 2). In the early 1990s, the growth rate of the core area increased rapidly while the rate of inner commuting region remained constant and the population growth of the outer commuting region stagnated. Altogether, more than half of the total population growth occurred in the core area. The picture is very different when the population change is considered in relative terms. The relative population growth of the inner commuting region has been very intense as the population has increased with more than 50 per cent, while the population in the core area and in the outer commuting region has grown only about 15 per cent. The overall picture of the population change in the urban region is therefore twofold. The fastest population increase has occurred in the inner ring of municipalities around the core urban area but the best part of the population growth in absolute terms has still taken place in the densely built urban core.

To get a better view of the changes in the spatial pattern of population distribution, two indexes describing the level of population concentration were constructed. The first one, the concentration index, measures the overall level of population concentration in the whole study area and shows that the population pattern has become more dispersed as the index decreased by 5.2 per cent between 1980 and 2005 (Table 2). The second index, Moran's *I* statistics, which measures the level of

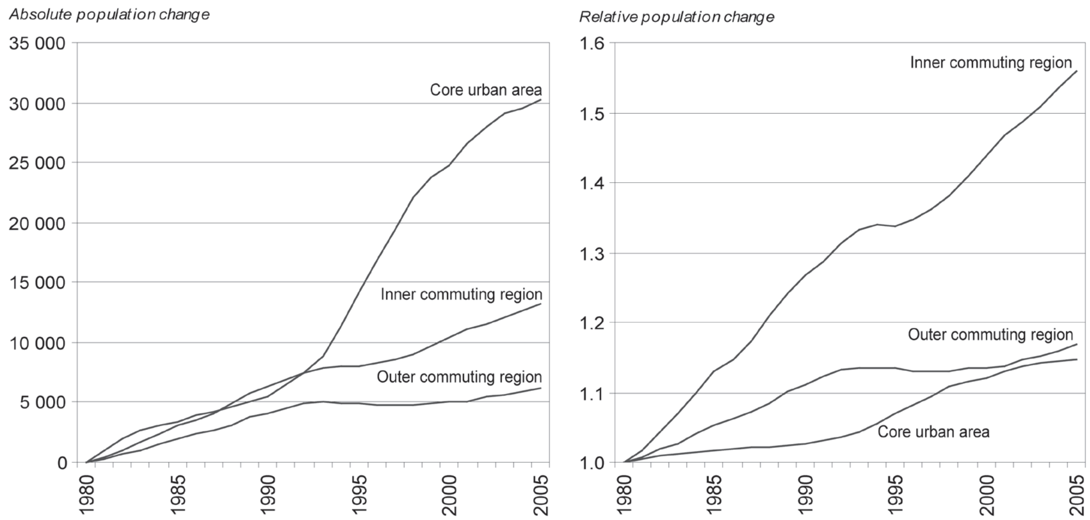

Fig. 2. Cumulative population change in absolute and relative terms in the Turku urban region. Data source: Statistics Finland.

spatial autocorrelation and thereby the level of spatial population clustering displays an opposite trend. The *I* statistic shows notable non-randomness in the population pattern and the value of the statistic rose over 10 per cent during the study period suggesting increasing population clustering. The high level of spatial autocorrelation, however, indicates a population pattern where both high and low population densities are clustered implying that also the areas with low population density have expanded. The interpretation of these basically opposing findings is that the population is getting increasingly clustered in certain areas whereas the population of the formerly most densely inhabited areas has decreased.

In Fig. 3, the changes in the population pattern between 1980 and 2005 are visualised on the map using the local versions of the concentration index and Moran's *I* statistic. The reason for the decreasing concentration index is clearly visible in Fig. 3A. The population distribution has become less concentrated in the central areas of the urban region whereas at the edges of the central area the population distribution has become more concentrated. In the more peripheral areas, the pattern of concentration dynamics is somewhat fragmented suggesting that the main factor in decreasing concentration overall has been the diminishing importance of the central city as a concentration point of population.

The local clustering pattern emphasises the same kind of population trend as the concentration index (Fig. 3B). In the spatial cluster approach, the core city was the main population cluster in the region both in 1980 and 2005 complimented by few smaller clusters, consisting of the centres of the small towns of Lieto, Paimio and Parainen, which are mainly located in the outer commuting region. In 2005, however, new population clusters have formed both at the edges of the core area and

Table 2. Changes in population concentration.

	1980	1985	1990	1995	2000	2005	Change 1980–2005
Concentration index	0.721	0.714	0.705	0.698	0.692	0.683	-5.2 %
Moran's *I* statistic[a]	0.500	0.510	0.518	0.532	0.550	0.556	11.2 %

[a] All values are significant at 0.001 level.

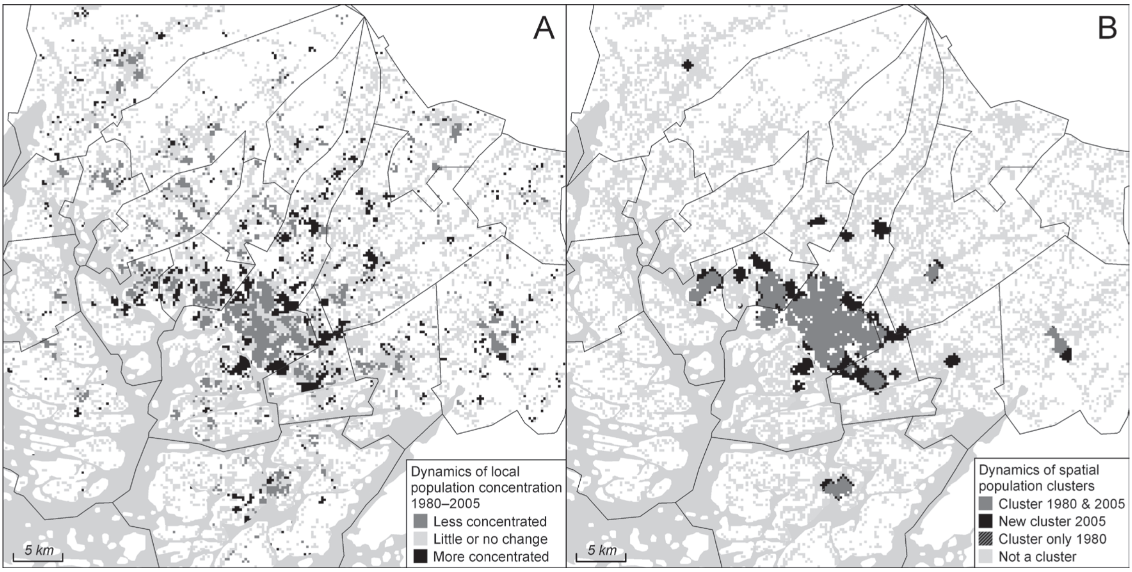

Fig. 3. Changes in population distribution from 1980 to 2005. Base map source: National Land Survey of Finland. Data source: SYKE, Urban structure monitoring system.

more notably in the inner commuting region[1]. A few areas classified as a cluster in 1980 but not in 2005 are mainly located at the edges of older residential areas where population decline has occurred. Altogether, the spatial pattern of population concentration demonstrates a trend where spatial clusters of high population density are spreading more evenly around the urban region, thus forming a more polycentric intra-metropolitan population pattern.

Both, changes in population concentration and the emergence of new spatial population clusters have a strong effect on the intra-metropolitan population distribution. In order to understand the processes behind these changes, the socio-demographic characteristics and the changes in the built environment are examined. The overall socio-demographic trend in the whole study area during the period of 1980–2005 has been decreasing household size and the proportion of families with children together with the increasing proportions of small households and per capita housing space (Table 3). This result is expectable and congruent with numerous other studies (e.g. Van de Kaa 1987; Champion 1992; Musterd & van Zelm 2001).

The interpretation changes completely when areas of population growth and loss are examined separately. In the areas where the population grew during the 25-year period, the number of people per household was increasing as well as proportion of families with children. Conversely, the share of one person households and aged people decreased notably. The only socio-demographic variable that shows similar trends in the population growth areas and in the whole study area is floorspace per person ration. However, the growth of housing space was rather modest in comparison with the overall development in the whole study area. In the population loss areas, the socio-demographic trends are parallel with the overall development but the changes were much more extreme. The socio-demographic trends in the areas of increased population are rather clearly in line with housing career type explanations (e.g. Feijten 2005) as population growth seems to be linked to parents seeking housing for their growing families. Population decline, on the other hand, seems to be an outcome of the current socio-demographic trends of people getting wealthier at the same time as the proportion small households is growing, both increasing the per capita housing space (cf. Champion 1992: 467).

Whereas the socio-demographic variables revealed a housing career aspect in the changes of

Table 3. Characteristics of areas where population increased or decreased during the period of 1980–2005.

	All areas			Population growth			Population loss		
	1980	2005	Change	1980	2005	Change	1980	2005	Change
Mean household size	2.8	2.5	-11 %	2.5	3.0	17 %	3.3	1.9	-41 %
Floorspace per person ratio	40.8	64.2	57 %	47.7	56.4	18 %	35.2	77.1	119 %
Proportion of families with children	37.7	32.3	-14 %	33.8	43.7	29 %	41.8	16.8	-60 %
Proportion of 1 person households	18.6	24.0	30 %	22.6	17.9	-21 %	15.5	33.9	118 %
Proportion of people aged 65+	18.5	18.6	1 %	19.9	12.2	-39 %	17.1	27.7	62 %
Number of residential buildings									
block of flats	2 906	3 267	12 %	547	1 240	127 %	2 333	2 018	-14 %
detached or terraced houses	32 397	50 536	56 %	13 535	30 520	125 %	17 188	17 155	0 %
Number of cases		11 612			6 460			5 152	

intra-metropolitan population distribution, the changes in the number of the residential buildings show an obvious relation between population growth and housing construction. In the 25-year study period, the number of residential buildings more than doubled in the areas where population growth occurred whereas, in the population decline areas, the number of residential buildings remained the same or their use was changed into non-residential, which explains the decreasing number of the block of flats. These interpretations are highly intelligible since new houses rarely remain uninhabited thus creating population growth in the given locality. The interesting result is, however, that population growth is furthered by both the construction of blocks of flats and detached houses, which shows that population growth is not only supported by the sprawl of low density housing but also by intensification of central areas by the construction of residential blocks of flats.

Discussion and conclusions

The population structure in the Turku urban region has evolved in two ways. On the one hand, the population seems to be more and more evenly distributed in the urban region. On the other hand, the spatial form of the region appears to be increasingly spatially clustered. Fig. 3 showed that these simultaneous and basically opposing phenomena can be explained by the diminishing importance of the old urban centre as a single monocentric population concentration point in the region and by the emergence of new spatial population clusters in the outer parts of the urban region. Thereby the trend in population distribution in the Turku urban region appears to be the decentralisation of population clusters, which has lead to an increasingly polycentric urban form in intra-metropolitan terms.

The population deconcentration process in Finnish urban regions has been explained through the concept of regionalisation, which according to Antikainen and Vartiainen (2002) is characterised by the population growth in large areas with simultaneous intra-regional population deconcentration. Although these processes are clearly visible in the empirical results of this study, the concept of regionalisation needs fine-tuning. The widely recognised tendencies of the increasing multinodality of urban systems (e.g. Anas et al. 1998; Kloosterman & Musterd 2001; Musterd et al. 2006) appears to be reality also in Finnish urban regions. Thereby, the ongoing trend of urban population deconcentration needs to be understood above all as increasing metropolitan polycentricity rather than as the sprawl of residential areas from the central city to the surrounding areas.

In order to shed light on the societal changes behind polycentric urban development, the population growth and loss areas were examined respectively. In the areas where population loss took place during the period of 1980–2005, a clear increase in the proportion of small households and per capita housing space was observed. These changes are linked to a broader societal trend known as the second demographic transition, which is characterised by decreasing household sizes and the increasing number of small childless households (cf. Van de Kaa 1987; Champion 1992). The second demographic transition has evidently influenced the process of population deconcentration since declining household size will inevitably lead to population decrease in a given locality if new housing is not constructed. Thereby, the population decrease in the older and more central parts of the built-up area can be seen as a natural outcome of the trend where smaller families tend to live more spaciously.

The areas where population grew from the 1980s onwards displayed an opposite socio-demographic trend to the areas of population decline. In these areas, mean household size grew together with the proportion of families with children, which is a trend closely related to housing careers. With the general trend being the increasing number of small households, the opposite trend evidently points towards young parents seeking homes for their growing families. The factors behind population growth caused by families, however, are twofold. Natural population growth is an obvious factor resulting in population growth, but the migration of families to new locations is likely to cause population growth in the area as well. Although there were no data available to distinguish these two factors, it is obvious that population increase in the given area is not simply an outcome of natural population growth; particularly since the essential role of migration in intra-metropolitan population changes has been underpinned in several studies (e.g. Heikkilä 2003; Bontje & Latten 2005; Broberg 2008). Furthermore, migration is inevitably involved with subjective and economic factors, such as residential preferences and housing markets. Low density housing, which is often preferred by families with children, is much more affordable in the commuting region than in the central city, and therefore many young families seeking for new dwelling choose to move to the newly built residential areas in the municipalities surrounding the core urban area. However, since there are no data available on these processes for the purposes of this study, the influence of residential preferences and housing markets remains a subject for further research.

The descriptive analysis also revealed a strong impact of housing construction on population growth. Although this result is rather trivial as such, it highlights the importance of urban planning on the changes in population distribution within the urban region. Since the overall demographic trend is decreasing household sizes, population growth on the metropolitan scale, evident from the Fig. 2, is impossible without new housing made available. The eventual outcome of the interaction between demographic trends and housing construction is a more evenly distributed population structure in the region, since the pressure for population decline is the greatest in the most densely built central areas and housing construction is more likely to take place in the outskirts of the region as undeveloped sites are scarcer and more expensive in the inner city.

A notable aspect of the above processes is the scale on which they affect urban spatial structure respectively. Demographic trends, as Champion (1992) points out, have changed markedly throughout the developed world, which makes the second demographic transition a significant process, if not truly global, at least well beyond the national scale. The consequences of demographic trends, on the other hand, are mainly visible on the regional scale by evening out population distribution within urban regions. The consequences of planning and housing construction on urban spatial structure, however, take shape to a great extent on the sub-regional scale. In Finland, municipalities have strong self-governance, which actualises in municipal taxing power and planning monopoly but also in obligations to provide a wide range of welfare services, which has lead the municipalities to compete for good tax payers. The recently reformed Finnish land use legislation underpinned the role of regional planning but at the same time strengthened the municipal planning monopoly. The reinforcement of the municipalities' potential to influence their land use has resulted in a situation where planning has become one of the key instruments for inter-municipal competition within urban regions. As a consequence, a large number of single family housing has been made available, supported especially by the planning policy of the municipalities around the core urban region. Following this line of reasoning, the increasingly polycentric urban pattern is by large an outcome of the fragmented municipal structure in the urban region together with the competitive municipal planning practices. The conflict between these scalar components, socio-demographic processes on the regional scale and planning on the municipal scale, can thereby be seen as one of the corner stones influencing recent population dynamics in Finnish urban regions.

ACKNOWLEDGEMENTS

The author would like to thank two anonymous referees for their valuable comments on the earlier version of this paper. The author wishes also to acknowledge the Regional Council of Southwest Finland for making the datasets of the urban structure monitoring system available for the purposes of this study.

NOTES

[1] Although some of the new population clusters have formed within the municipal borders of Turku, they are functionally more similar to the clusters of the inner commuting region than to the core urban area.

REFERENCES

Anas A, R Arnott & KA Small (1998). Urban spatial structure. *Journal of Economic Literature* 36, 1426–1464.
Anselin L (1995). Local indicators of spatial analysis – LISA. *Geographical Analysis* 27: 2, 93–115.
Anselin L (1996). The Moran scatterplot as an ESDA tool to assess local instability in spatial association. In Masser I & F Salgé (eds). *Spatial analytical perspectives on GIS*, 111–125. Taylor & Francis, London.
Antikainen J (2001). Functional regions of the future – The Finnish urban network study. *Journal of Nordregio* 3/2001, 20–23.
Antikainen J & P Vartiainen (2002). Finnish districts and regional differentiation. *Fennia* 180: 1–2, 183–190.
Antikainen J & P Vartiainen (2005). Polycentricity in Finland: from structure to strategy. *Built Environment* 31: 2, 143–152.
Beale CL (1975). *The revival of population growth in nonmetropolitan America*. 16 p. Economic Research Service, United States Department of Agriculture, Washington D.C.
Beale CL (1977). The recent shift of United States population to nonmetropolitan areas, 1970–75. *International Regional Science Review* 2: 2, 113–122.
Beauregard RA & A Haila (1997). The unavoidable incompleteness of the city. *American Behavioural Scientist* 43: 3, 327–341.
van den Berg L, R Drewett, LH Klaassen, A Rossi & CHT Vijverberg (1982). *Urban Europe: a study of growth and decline*. 162 p. Pergamon Press, Oxford.
Berry BJL (ed) (1976a). Urbanization and counterurbanization. *Urban Affairs Annual Reviews* 11. 334 p.
Berry BJL (1976b). The counterurbanization process: urban America since 1970. In Berry BJL (ed). Urbanization and counterurbanization. *Urban Affairs Annual Reviews* 11, 17–30.
Bontje M & J Burdack (2005). Edge cities, European-style: examples from Paris and Randstad. *Cities* 22: 4, 317–330.
Bontje M & J Latten (2005). Stable size, changing composition: recent migration dynamics of the Dutch large cities. *Tijdscrift voor Economische en Sociale Geografie* 96: 4, 444–451.
Broberg A (2008). Valikoiva muuttoliike Uudellamaalla (Abstract: Selective migration in Helsinki region). *Uudenmaan liiton julkaisuja E* 97. 104 p.
Bruegmann R (2005). *Sprawl: a compact history*. 301 p. The University of Chicago Press, Chicago.
Champion AG (1987). Recent changes in the pace of population deconcentration in Britain. *Geoforum* 18: 4, 379–401.
Champion AG (ed) (1989). *Counterurbanization: the changing pace and nature of population deconcentration*. 266 p. Edward Arnold, London.
Champion AG (1992). Urban and regional demographic trends in the developed world. *Urban Studies* 29: 3/4, 461–482.
Champion AG (2001). A changing demographic regime and evolving polycentric urban regions: consequences for the size, composition and distribution of city populations. *Urban Studies* 38: 4, 657–677.
Champion T & G Hugo (2004). Moving beyond the urban-rural dichotomy. In Champion T & G Hugo (eds). *New forms of urbanization: beyond the urban-rural dichotomy*, 3–24. Ashgate, Aldershot.
Cliff AD & JK Ord (1973). *Spatial autocorrelation*. 178 p. Pion, London.
Dieleman FM & A Faludi (1998). Polynucleated metropolitan regions in Northwest Europe: theme of the special issue. *European Planning Studies* 6: 4, 365–377.
Duncan OD & B Duncan (1955). A methodological analysis of segregation indexes. *American Sociological Review* 20, 210–217.
Duncan OD, RP Cuzzort & B Duncan (1961). *Statistical geography: problems in analyzing areal data*. 191 p. The Free Press, Glencoe, IL.
EEA (2006). *Urban sprawl in Europe: the ignored challenge*. 56 p. European Environment Agency, Copenhagen.
Feijten P (2005). *Life events and the housing career: a retrospective analysis of timed effects*. 152 p. Eburon Publishers, Delft.
Fielding AJ (1982). Counterurbanisation in Western Europe. *Progress in Planning* 17, 1–52.
Garreau J (1991). *Edge city: life on the new frontier*. 548 p. Doubleday, New York.
Geyer HS (1996). Expanding the theoretical foundation of differential urbanization. *Tijdscrift voor Economische en Sociale Geografie* 87: 1, 44–59.
Geyer HS & T Kontuly (1993). A theoretical foundation for the concept of differential urbanization. *International Regional Science Review* 15: 2, 157–177.

Hall P (1993). Forces shaping urban Europe. *Urban Studies* 30: 6, 883–898.

Hall P & K Pain (eds) (2006). *The polycentric metropolis: learning from mega-city regions in Europe*. 256 p. Earthscan, London.

Hall P, K Pain & N Green (2006). The informational geography of europolis: mapping the flow of information. In Hall P & K Pain (eds). *The polycentric metropolis: learning from mega-city regions in Europe*, 70–87. Earthscan, London.

Heikkilä E (2003). Differential urbanisation in Finland. *Tijdscrift voor Economische en Sociale Geografie* 94: 1, 49–63.

Helminen V & M Ristimäki (2007). Kaupunkiseutujen haja-asutusalueen väestömuutokset 1980–2005 (Abstract: Population changes in sparsely populated areas surrounding urban regions in Finland 1980–2005). *Suomen ympäristö* 9/2007. 72 p.

Hitz H, C Schmid & R Wolff (1994). Urbanization in Zurich: headquarter economy and city-belt. *Environment and Planning D* 12: 2, 167–185.

Horner MW & BM Marion (2009). A spatial dissimilarity-based index of the jobs–housing balance: conceptual framework and empirical tests. *Urban Studies* 46: 3, 499–517.

Jauhiainen JS & V Niemenmaa (2006). *Alueellinen suunnittelu*. 292 p. Vastapaino, Tampere.

Kim JH, F Pagliara & J Preston (2005). The intention to move and residential location choice behaviour. *Urban Studies* 42: 9, 1621–1636.

Klaassen LH & G Scimemi (1981). Theoretical issues in urban dynamics. In Klaassen LH, WTM Molle & JHP Paelinck (eds). *The dynamics of urban development*, 8–28. St. Martin's Press, New York.

Kloosterman RC & S Musterd (2001). The polycentric urban region: towards a research agenda. *Urban Studies* 38: 4, 623–633.

Kontuly T & HS Geyer (2003a). Introduction to special issue: testing the differential urbanisation model in developed and less developed countries. *Tijdscrift voor Economische en Sociale Geografie* 94: 1, 3–10.

Kontuly T & HS Geyer (2003b). Lessons learned from testing the differential urbanisation model. *Tijdscrift voor Economische en Sociale Geografie* 94: 1, 124–128.

Long L & D DeAre (1988). US population redistribution: a perspective on the nonmetropolitan turnaround. *Population and Development Review* 14: 3, 432–450.

Long L & A Nucci (1997). The 'clean break' revisited: is US population again deconcentrating? *Environment and Planning A* 29, 1355–1366.

Meijers E, B Waterhout & W Zonneweld (2005). Polycentric development policies in European countries: an introduction. *Built Environment* 31: 2, 97–102.

Messner SF & L Anselin (2004). Spatial analyses of homicide with areal data. In Goodchild MF & DG Janelle (eds). *Spatially integrated social science*, 127–144. Oxford University Press, Oxford.

Millward H & T Bunting (2008). Patterning population densities: a spatiotemporal model compared with Toronto 1971–2001. *Environment and Planning A* 40, 283–302.

Mitchell CJA (2004). Making sense of counterurbanization. *Journal of Rural Studies* 20, 15–34.

Moran PAP (1950). Notes on continuous stochastic phenomena. *Biometrica* 37, 17–23.

Musterd S & I van Zelm (2001). Polycentricity, households and the identity of places. *Urban Studies* 38: 4, 679–696.

Musterd S, M Bontje & W Ostendorf (2006). The changing role of old and new urban centres: the case of the Amsterdam region. *Urban Geography* 27: 4, 360–387.

O'Sullivan D & DWS Wong (2007). A surface-based approach to measuring spatial segregation. *Geographical Analysis* 39, 147–168.

Parr JB (2004). The polycentric urban region: a closer inspection. *Regional Studies* 38: 3, 231–240.

Parr JB (2007). Spatial definitions of the city: four perspectives. *Urban Studies* 44: 2, 381–392.

Phelps NA & N Parsons (2003). Edge urban geographies: notes from the margins of Europe's capital cities. *Urban Studies* 40: 9, 1725–1749.

Richter K (1985). Nonmetropolitan growth in the late 1970s: the end of the turnaround. *Demography* 22: 2, 245–263.

Ristimäki M (1999). Yhdyskuntarakenteen seurantajärjestelmä – ehdotus yhdyskuntarakenteen seurannan järjestämiseksi ja kehittämiseksi (Abstract: Urban structure monitoring system – a proposal for organization and development of urban structure monitoring). *Suomen ympäristö* 344. 74 p.

Ristimäki M, K Oinonen, H Pitkäranta & K Harju (2003). Kaupunkiseutujen väestömuutos ja alueellinen kasvu (Abstract: Population changes in urban regions and urban growth). *Suomen ympäristö* 657. 196 p.

Tsai Y (2005). Quantifying urban form: compactness versus 'sprawl'. *Urban Studies* 42: 1, 141–161.

Van de Kaa DJ (1987). Europe's second demographic transition. *Population Bulletin* 42: 1, 1–57.

Vartiainen P (1989). Counterurbanisation: a challenge for socio-theoretical geography. *Journal of Rural Studies* 5: 3, 217–225.

Vartiainen P (1991). Seutuistuminen yhdyskuntasuunnittelun haasteena (Abstract: The city-region-based development of the settlement system: a challenge to local planning). *Terra* 103: 2, 75–86.

Ventura F & O Wärneryd (1983). Differentiation of settlement systems on the basis of population densities and level of development. 'Regionalization' now and in the future. *Geographia Polonica* 47, 29–37.

Wang F (2006). *Quantitative methods and applications in GIS*. 265 p. Taylor & Francis, Boca Raton.