

**“Localising extensive urbanisation: comparing the emergence
of second-tier urban regions in Europe”**

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Abstract

The end of cities as bounded entities and the generalisation of undirected, fragmented and dispersed urbanisation processes are often interpreted as pertaining mostly to the second half of the 20th century, leading to the assumption that earlier stages of urbanisation were dominated by centrifugal core city expansion. This may be due to a relative neglect by urban studies of the role of urban fragments outside core cities as early producers of multiple and simultaneous processes of expansion, densification and dispersion. Nevertheless these processes of extensive urbanisation left behind forms and networks that coexist with contemporary urbanisation, despite the tendency of massive core city expansion to override them. Acknowledging this tension adds local specificity to the generic and travelling models that often underpin research on extensive urbanisation. Moreover, urban regions where this process has been more visible may have developed different morphological, functional, cultural and political features than those broadly following a linear timeline of core city decentralisation over an assumed urban void. Exploring these differences helps to understand the different functional, spatial and institutional configurations of urban regions.

Second-tier cities produce and are embedded in extensive urban regions but their history of lesser impact over surrounding centres and weaker core-periphery functional hierarchies, when compared with dominant primate cities, may have preserved more traces of these early forms of extensive urbanisation. Their particular case is explored through a long-term analysis of how their urban regions emerged based on detailed population data between 1890 and 2011 in three European second-tier cities: Porto, Bristol and Antwerp. The indicators illustrate the progression of the urban-rural divide, population growth rates in different locations and relations between distance to core city and growth. The results reveal a trajectory of erratic metropolitan growth mixed with densification of loose urban fragments spread across the territory, following simultaneous and contradictory trends of expansion, dispersion and densification in different locations. The assumption of a linear timeline of centripetal and centrifugal forces emanating from the core city may not tell the whole story of the early emergence of urban regions and this may particularly clear in second-tier cities. This suggests a different interpretation of what is indeed 'new' about extensive urbanisation processes and argues the need for precision and historical specificity in the application of general frameworks of analysis. Finally, a discussion is proposed about how the implications of such a trajectory to current functional and institutional arrangements in second-tier urban regions.

1. Introduction: a long-term view of extensive urbanisation

"[The South West region] is full of rivers and towns and infinitely populous [...] interspersed with a great number of villages, I had almost said innumerable villages, hamlets and scattered houses [...]" Daniel Defoe, cited in Barry, 2000: 81

"The province [northwest Portugal] is the smallest in the land but has been growing the most in terms of population: [...]. It has no more than three cities and twenty-five towns; however, the villages and hamlets are so numerous, that it looks like a continuous city [...]" Silveira, 1789

The last few decades saw the emergence of a growing set of literature describing the end of cities as bounded and discernible entities and the generalisation of undirected, fragmented and dispersed urbanisation processes of territorial scale, shifting the matter of concern of urban studies from the 'city' to the city-region, city-territory, urban region, urban landscape, and a plethora of neologisms trying to define the new entities taking shape (Gottmann, 1961; Friedmann, 1978; Sudjic, 1992; Ascher, 1995; Sieverts, 1997; Soja, 2000; Nello, 2001; Hall and Pain, 2006; Schmid, 2006; Katz and Bradley, 2013; Brenner, 2014). In Europe, particularly in southern countries, the term 'extensive urbanisation' has been used (Portas et al., 2007; Font, 2004; Grosjean, 2010), as an umbrella term for the large-scale processes of territorial reconfiguration, in which new land uses, functions, people and activities penetrate urban and rural areas alike, beyond centre-periphery hierarchies and predefined urban centres.

'Extensive' is suggested in opposition to 'intensive' urbanisation processes, characterised by physical expansion of central cities into dense built-up agglomerations over a relatively non-problematised void (the 'empty' countryside), driven by heavy infrastructure and large-scale planning, and following a linear and socially differentiated chronology of urbanisation, suburbanisation and disurbanisation (Berg et al. 1982). By contrast, the 'extensive' is mostly polycentric, undirected and fragmented (Schmid, 2006), allows simultaneous contrary trends rather than a life-cycle of successive stages (Soja, 2000; 2011), grows by colonising existing infrastructure like a 'fluid percolating through a sponge' (Secchi, 1989), and is often erratically induced by the attractive force of large functional concentrations rather than any plan-based expansion (Sudjic, 1992). Spatial patterns become blurred and changeable, and planning tools try to keep up rather than prepare the ground for urban development (Sieverts, 1997).

This stage of urbanisation, replacing the urban-rural divide by an ubiquitous 'urban field' (Friedmann, 1978) and giving rise to a coalescence of the meanings of 'city' and 'region', is broadly considered as pertaining to the second half of the 20th century. However, much earlier than that, descriptions by travellers and attentive observers of populous 'continuous cities' made of 'innumerable villages and hamlets' highlighted that the presence of urban patterns and ways of life on the territory was becoming more and more dominant. Admittedly, the scale of urbanisation has changed in the last 50 years, from a 'pointillist' and dispersed fabric of buildings and localised connections to a much heavier system based on large infrastructural axes and functional concentrations. But in many cases, like the ones illustrated by the 18th-century quotes above, the seeds of erratic and fragmented urbanisation processes gradually humanising places, creating landmarks and overriding clear urban-rural divisions were in place, both in 'cities' and 'non-cities', at an earlier stage than much urban literature, with its embedded "*methodological cityism*" (Brenner, 2014: 15), is ready to acknowledge.

Indeed, the further we go back in time, the more difficult it becomes to tell the story of territories outside core cities. Data is scarce, mapping and imagery is not accurate, and the history of their *urbanisation* falls outside the proper history of *urbanism* (Grosjean, 2010). In fact, such territories were not, until recently, sufficiently problematised by the discipline of urban studies. To start, urbanisation outside core cities lacked proper planning and consequently an interpretative framework as a (proto-)urban setting. Mapping such places was more the concern of military authorities than urban scholars. Only in the twentieth century has the problem of urbanisation been applied the territory as a whole, which led to assumptions, still present today, that places outside core cities are a 'recent' urban problem only because they appeared recently in the field of urban studies (Grosjean, op.cit.).

This led to a notion of urban growth as a city expanding over an assumed and unproblematic spatial-historical void – and that void was gradually occupied by 'suburbs', equally perpetuated as theoretically generic, a-historical and generally unproblematic (Vaughan et al., 2009). This devaluation of the role of places outside core cities in the historical process of urbanisation found its correlate in the way many authors have equally devalued these urban spaces as something lesser than 'the city'. Phelps notes how "*post-suburban development has been defined in relation to something considered the city proper – whether broadly 'good' or 'bad' – since at least medieval times*" (Phelps et al., 2006: 9). As the distinction between city and periphery dissolves into a single entity, we have "*urbanisation but not city*" (Nello, 2001: 13).

The different routes towards the urban region

Largely ignoring the role of places outside the largest core cities as early sources of undirected and polycentric urbanisation processes, rather than empty spaces awaiting urban expansion, 'methodological cityism' has great difficulty in departing from the core-periphery centrifugal models assumed as the default trajectory of urban growth. In fact, the 'city region' is often defined as the outcome of the diffusion and relocation of core city activity, "*a long process of very extended decentralisation from big central cities to adjacent smaller ones, old and new*" (Hall and Pain, 2006: 3). But such a centrifugal expansion process from a monocentric city into a polycentric configuration is by no means the only possible route to an urban region; if the specificity and variability of individual cases is taken into account, beyond generic and universal models, we are necessarily confronted with the notion that, in terms of historical trajectory and contemporary configurations of urbanisation, one size does not fit all.

In an effort to provide a more nuanced model, A. G. Champion (2001) proposes a three-tier typology of *centrifugal*, *incorporation* and *fusion* modes for the emergence of polycentric urban regions. The centrifugal and fusion modes roughly express the accepted distinction between the progressive outward expansion of large primate cities over their comparatively 'empty' hinterland, arguably the case of Greater London, Paris or Madrid (Lambregts, 2006), and the convergence of separate centres of similar size into a single urban system, typically illustrated by the Randstad or RhineRuhr (ibid.). The incorporation mode, on the other hand, corresponds to a mixed trajectory of core city expansion blending with the densification and merger of pre-existing smaller urban centres and fragments spread across the region.

Whatever route an urban region has followed, and disregarding the problems of this simplified model (urban regions will exhibit different tendencies across their history) this framework of differentiation reminds us that "*pre-existing forms of settlement can influence subsequent patterns of development.*" (Champion, 2001: 665). Pre-existing differences have an influence on the cultural and political identity of a region and on the consolidation of contemporary patterns of infrastructure, urban functions and urban forms, as they are "*superimposed on inherited physical structures, property rights and network linkages.*" (ibid.). Knowing whether urban regions emerged as the result of a broadly centrifugal, fusion or incorporation process helps us make sense of the visible differences between them (Lambregts, 2006), and uncover the strengths and weaknesses of the territory: the identification of its features will allow a "*good use of the opportunities presented by the spatial structure itself*" (Font, 2004: 331).

Looking for traces of early urbanisation: a research hypothesis

Despite the traces and superimpositions they have left behind, such loose and localised processes of *in situ* urbanisation were often countered, and sometimes totally obliterated, by the large-scale expansion of dominant core cities and contemporary urbanisation modes. However, the extent to which they could be overridden, and how much their traces have disappeared, is related to the scale and speed of expansion of core cities and their influence on the development of the surrounding urban region. In other words, it is likely that the different routes towards the urban region theorised by Champion had different impacts on these fragile and place-specific processes, and on the role they play in contemporary configurations. In this respect, earlier literature hints at particularly relevant differences between large primate cities and smaller second-tier cities, such as Hohenberg's view of capitals growing in a 'central place' framework and smaller cities developing in a network model (2004), or the distinction between hierarchic 'spiderweb metropolises' around 'first order' dominant cities and 'network metropolises' elsewhere, proposed by Heynen, Loecks and Smets (1991).

The common feature of these descriptions is that 'first order' cities tend to play a historically dominant role in their urban regions, which are assumed to evolve from a monocentric to a polycentric condition based on relocation of activity as core cities project their large-scale political and economic expansion agenda over a relatively 'passive' hinterland (Barry, 2000). This is a fundamentally core-dependent, hierarchic and progressive process, but one that only cities large enough to first attract or aggregate a large amount of functions, people and activities were then able to trigger. As a result, such cities will be able to influence accordingly the socio-economic, functional and spatial configurations at the urban region scale, and form hierarchic relations with the secondary centres in their hinterland (Phelps et al., 2006). Such a process, closer to Champion's centrifugal mode, is likely to have erased more autonomous and smaller-scale forms of urbanisation elsewhere in the urban region.

Conversely, in other cities lacking both the attractive pull to gather and redistribute functions and activities, as well as the ability to override divergent local configurations and define a functional and spatial hierarchy for the larger region, centrifugal processes played a lesser role in constraining the trajectory towards the urban region. Places less subject to core-periphery hierarchies may therefore have built a functionally and spatially more fragmented urban system, with important urban functions emerging at different points of the territory not necessarily through decentralisation, making the city vs. hinterland contrast less visible than in

the case above. Note that this does not describe 'polycentric urban regions' based on separate centres of equivalent size (Klosterman and Musterd, 2001; Parr, 2004): between them and the hegemonic primate cities described above, there is a world of medium-sized, second-tier cities, which do not play dominant roles in the functional, demographic or socio-economic structure of the wider hinterland, but are nevertheless the main cities of the urban region.

This development mode is arguably closer to Champion's incorporation mode, in which smaller centres have hosted and retained their own set of jobs and services regardless of core city expansion, and form "*a more powerful catalyst for attracting extra non-residential activities than the centres emerging through the centrifugal mode*" (Champion, 2001: 664). The emerging hypothesis is that, whatever the early forms of urbanisation in place, this route of urban region formation has done less to erase their place-specific traces than the development of primate cities, as the intensive and large-scale centrifugal forms of expansion did not have the reach and strength to fully override historical peculiarities and local configurations.

In summary, this paper tries to address several questions:

- Can the analysis of the emergence of urban regions in second-tier cities reveal a trajectory somewhere between the centrifugal expansion mode of dominant core cities and the fusion mode in polycentric urban regions, broadly consistent with the incorporation mode?
- Can such a non-centrifugal and less intensive expansion mode be less destructive of local configurations and historical peculiarities and actually preserve the traces of this trajectory?
- And finally, can an interpretative lens which abandons the constraints of 'methodological cityism' and core-periphery assumptions help illuminate the role of *all* places within the urban as sources of early urbanisation processes?

The analysis aims to add nuance and specificity to existing models describing the historical processes of extensive urbanisation; to discuss the compartmentalised timeline of the different stages of urbanisation, highlighting simultaneity and mixed trends; and to confront dominant core-periphery views of urbanisation as initially related to the outward expansion of a core city gradually decentralising into an urban region, producing other important cores in the process. The next section describes the methodology used, followed by the results obtained for three case studies, a discussion of their implications both for research methodologies and the theoretical framework, and finally some conclusions about second-tier city development modes and the possible directions of future research.

2. Methodology

To achieve the purposes above, a diachronic analysis of long-term urbanisation patterns based on population change (1890-2011) in three European second-tier urban regions will be used. A view covering such a long period is important for two reasons:

- In theoretical terms, it directly confronts the notion that dispersed urbanisation and undirected, fragmented urban expansion are 'recent' processes or 'final' stages of urban growth (Keil, 1994; Schmid, 2006). Several related questions emerge here: did the 20th century always correspond to the emptying out of rural territories and exodus towards core cities followed by a centrifugal process of suburbanisation? Are processes of dispersion recent because they correspond to the generalisation of the private car? And do different modes of urban expansion necessarily correspond to different and sequential time periods?
- Methodologically, it highlights place-specific processes that were in place long before the discipline of urban studies started to look at places outside core cities. Place-specific differences have arguably a greater influence on modes of urbanisation than general similarities (Salvati and De Rosa, 2014). In fact, research has produced many different descriptions of extensive urbanisation, which are, with some exceptions, local syntheses (hence keeping the terms in their original language) rather than grand theories: *Zwischenstadt*, *Cittá Diffusa*, *Randstad*, *Hyperville*, *100-mile City*, or *Postmetropolis* are all describing different places. Urban theory is recent but urbanised territories are ancient and a long-term view helps to avoid 'travelling theory' (McNeill, 1999).

Case studies

The three second-tier cities – Porto (Portugal), Antwerp (Belgium) and Bristol (United Kingdom) were chosen according to two criteria:

- They should be second-tier cities, i.e. not political capitals or the largest national cities, preferably in countries where the contrast with a dominant capital is visible from important political, economic or functional imbalances. The recent ESPON report on second tier cities (2012) clearly situates these three cities in such a context.
- They should be embedded in a dense urban region with a polycentric and dispersed structure, being its institutional or cultural core but not functionally and demographically

hegemonic – i.e. neither primate cities nor part of a ‘classic’ polycentric urban region. Porto and Antwerp have been described as part of an extensive and fragmented ‘diffuse city’ (Meulder et al., 1999, 2008; Grosjean, 2010; Portas et al., 2007; Domingues, 2008). Development in Bristol has been more contained historically, but it is the UK region where the shift to polycentricity has been stronger in recent years (Burger et al., 2011).

The study area is broadly defined as the ‘urban region’, following the ESPON 1.4.3 report (2007) that determines criteria to compose Functional and Morphological Urban Regions (FUA and MUA). The Porto urban region includes five MUAs within a polycentric FUA. It covers a surface area of 2,524 km² and a population of 2,018,402 (2011). Administratively, it includes 238 LAU2 units (*freguesias*, the lowest sub-municipal division) in the Porto Metropolitan Area and surrounding areas. The Bristol region has four MUAs in one FUA, with 1,579 km² and 1,094,957 inhabitants (2011). The study area is composed by 153 LAU2 units (wards), in the City of Bristol, Bath and North East Somerset, North Somerset and South Gloucestershire. The Antwerp urban region includes two MUAs and covers 1,831 km², with a population of 1,451,802 (2011). It includes 50 LAU2 units mainly in the Antwerp province.

Data and Indicators

Due to the methodological cityism discussed above, largely neglecting the role of places outside core cities in early urbanisation, the study of the urban region scale has embedded difficulties of precision and data availability. The problem is how to look at long-term processes in large urban regions with the same level of precision as in core cities. Additionally, we need data that is available and can be compared for the three case studies. Indicators normally used in comparisons of urban development, like land use, extension of built up fabric, etc., only exist with sufficient accuracy since the 1950s (EEA, 2002; Kasanko et al., 2006). However, population data goes much farther back, to the times when national authorities started systematically gathering census data.

Using population data to understand urban change has advantages and limitations. The important point is that, while absolute population numbers say little about the problem, population *change* is seen as both an influence in and consequence of urban conditions: “Migration is a response to differences in employment or the quality of life between places, even if the process of adjustment is inefficient.” (Turok and Mikhnenko, 2007: 167). Population

data also allows direct and accessible comparisons between different contexts. The main problem of such analyses, namely the arbitrary definition of spatial units (administrative areas) is partially averted by focusing on the smallest possible unit (LAU2): extreme variability of unit size and inaccuracies brought by density and settlement pattern variations inside larger units are thus kept under control. Naturally, more precise units used in contemporary measurements, such as 1km² grids, are also not available for a long term analysis.

While in Porto and Antwerp LAU2 units have remained rather stable throughout the years (an exception is the annexation of several districts by the City of Antwerp in 1983, leading to a great increase of population), the successive administrative definitions and boundary changes in the UK make the Bristol case less reliable. Nevertheless, a great effort was made to access historical data for each parish/ward/local government district and to attribute the most extreme population changes to boundary changes rather than explosive urban growth. Despite that, a few values for Bristol are estimates: when the LAU2-equivalent data was truly inaccessible for a given area, the averages of the higher boundary were used.

Five census years with approximately 30-year intervals are used from 1890 to 2011. Data was gathered from a variety of sources: for Porto, all census documents are available online from the National Statistics Institute. For Bristol, data for 2011 is also available online at the Office for National Statistics; older data was mainly gathered from the 'A Vision of Britain' database, run by the University of Portsmouth. For Antwerp, data was gathered from the Belgian Statistics Institute, as published by other online sources. The indicators and maps used for the long-term analysis are the following:

1. Map of areas over the 300 inh./km² threshold defined by Eurostat as the urban/rural divide (for current conditions): this will assess the areas undergoing early urbanisation, their change over time and relation to the expansion process of the main urban cores.
2. Graph of population growth 1890-2011 by geographical area (core city, MUA, FUA): this will check the long-term dynamics, trends for simultaneity and mutual relations between core city expansion, urban fringe growth, and peri-urban discontinuous urbanisation processes.
3. Map of population growth ratio by LAU2 unit: related to the former two indicators, this allows the visualisation of population growth 'hotspots' according to their location in the urban region and relates the findings of 1) and 2) above.

4. Graph of population growth ratio as a function of distance to core city (polynomial regression), according to geographical area, and comparing the 1890-1950 and 1950-2011 periods for the whole urban region: this will assess how the distance to the core city influenced the pace of urbanisation elsewhere, whether specific areas followed independent agendas, and how this changed over time.

3. Results and findings

In this section long-term population change and the spatial organisation of urban regions are analysed based on the indicators above. The results for each are discussed separately.

3.1 Urban vs. rural areas: the early seeds of the urban region

Eurostat uses the 300 inh./km² threshold to separate urban and rural areas for statistical purposes. It applies that value to a grid of 1km² cells and then groups them into continuous units with more than 5,000 people to define morphological urban areas. Here, the same density threshold is used to classify LAU2 units as far back as 1890 to verify what areas in the region could already be considered 'urban' by today's standards. The purpose is to locate the origins of urban expansion in each urban region and their change over time, confronting the notion of a dominant city expanding onto a void.

In Porto, the seeds of the present MUAs were already present in 1890. The 'urban' covered 16% of the region in four main high-density cores, including the central agglomeration where the limits of the core city had already been dissolved as far as the urban-rural divide is concerned. By 1920 the main evolution had taken place in this agglomeration, gradually consolidating and eventually integrating with the MUAs to the South and East by 1950. In 1981, 56% of the urban region was over the 300 inh./km² limit, growing smoothly to 60% in 2011 – note that this is a very large region including remote rural areas. Rather than the expansion of a dominant core, the urban-rural divide was surpassed by the growth and coalescence of several sub-centres.

The case of Antwerp reveals a similar evolution until 1950, followed by quicker growth in the later period. There were also four density cores in 1890, but more closely knitted than in Porto (which is a larger region). The density threshold was first surpassed along relatively linear

connections between Antwerp and its sub-centres. Unlike Porto, where each core seems to have densified in a relatively autonomous fashion, the development here seems to privilege interconnected areas. The period between 1947 and 1980 shows a very strong increase of higher density areas, a trend that remains strong until the present. Today, 81% of the Antwerp urban region has a population density over 300 inh./km².

Bristol is rather different. Here the progression was slower and while 16% of the region was deemed 'urban' in 1890, the individual centres did not suffer the same sprawling process as in Porto, or the linear densification along connective areas as in Antwerp. There were originally more separate centres over the density threshold – the territory was punctuated by small settlements - but they remained largely self-contained until the post-war period, when the northern fringe of Bristol began to grow significantly. While this can be partially attributed to the different sizes of LAU2 units inside and outside core cities (thereby missing some internal variations in the larger units) it is also explained by the stronger role of planning regulations regarding urban containment that were not in place in Belgium and Portugal until much later.

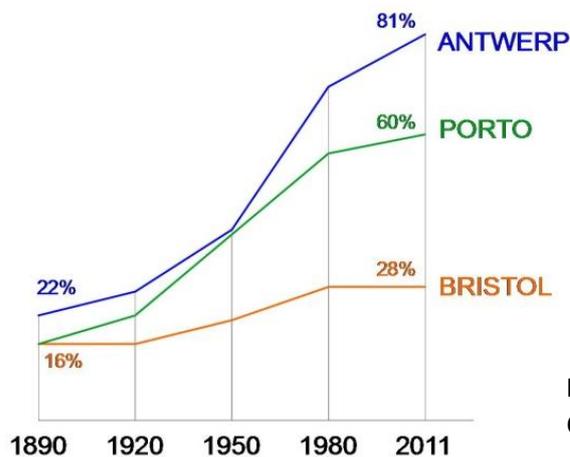


Figure 1:
Coverage of 'urban' areas (>300 inh./km²)

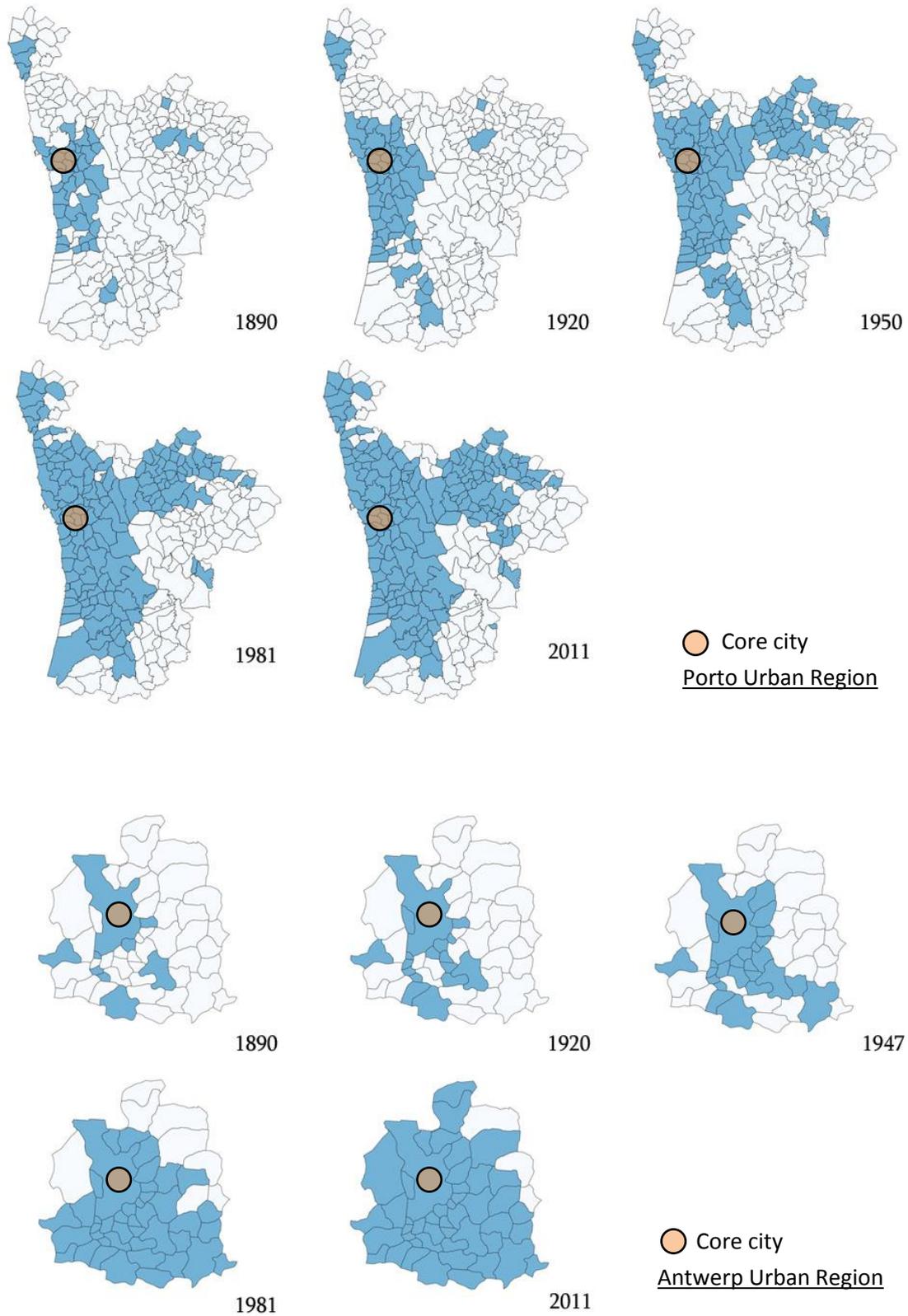


Figure 2a/b: Urban-rural division in Porto and Antwerp 1890-2011. Dark colour, 'urban' areas (> 300 inh./km²); light colour, 'rural' areas (< 300 inh./km²).

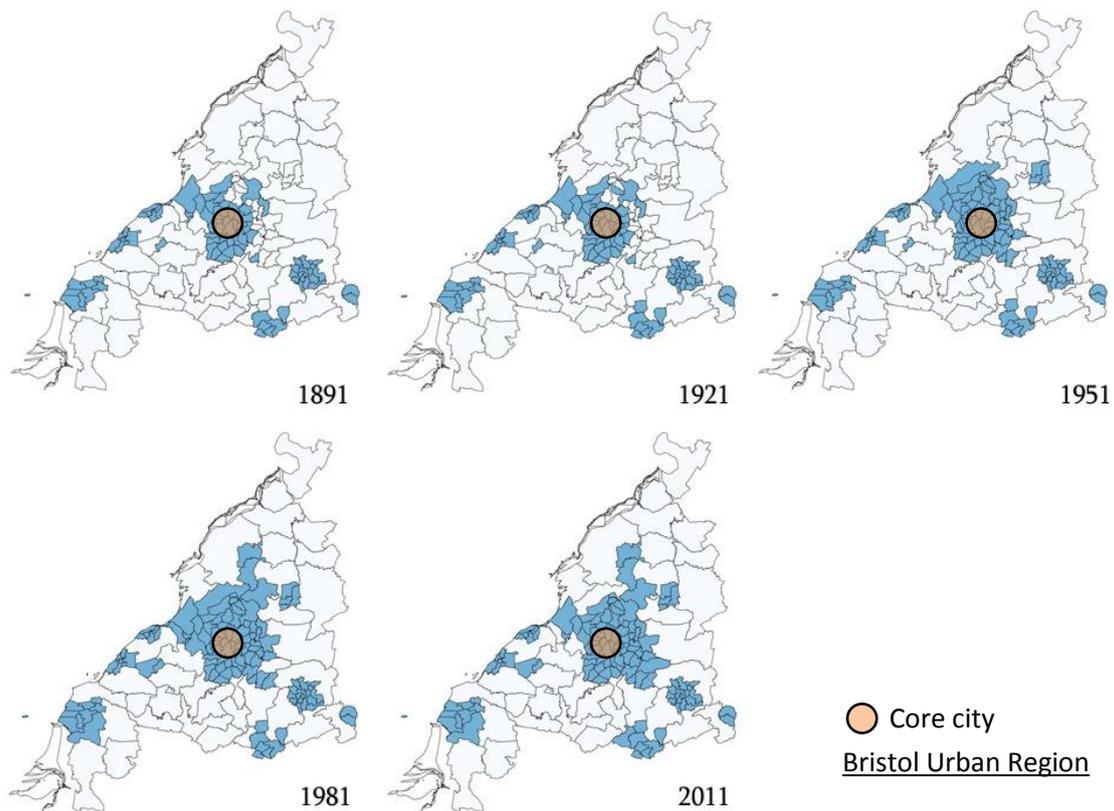


Figure 2c: Urban-rural division in Bristol 1890-2011. Dark colour, 'urban' areas (> 300 inh./km²); light colour, 'rural' areas (< 300 inh./km²).

3.2 Population growth by geographical area

The centrifugal model of growth, based on successive stages of core city growth, sub-, de- and reurbanisation (Berg et al., 1982; Kipnis, 2010), assumes that different modes of growth dominate in different time periods and suggests that they are sequential and interdependent, in the sense that a metropolitan area will achieve a certain status – e.g. dispersion - by having experienced all prior phenomena – e.g. suburbanisation. This neglects notions of simultaneity, non-hierarchy and autonomy that are also part of growth in urban regions – and have been so for a long time, despite the models focusing explicitly on the more massive shifts of the last 30-40 years. Locating the older, place-specific manifestations of such notions and their outcomes today is the purpose of this section. This will be done by comparing long-term population change in the three urban regions according to their geographical location.

Metropolitan growth in Porto is characterised by an early balanced distribution between core city, agglomeration and FUA (which was basically a densely occupied 'rural' typology). The core city was not very significant, mainly because it was, and still is, administratively bounded; but even the considering the surrounding agglomeration (Porto MUA) there was not a clear demographic dominance and there were still many people living in the remaining FUA. From 1920, the core MUA started to grow fast, but that did not correspond to the emptying out of other MUAs or the FUA whose population kept increasing. The population loss in the core city in the last 30 years is not enough to justify the growth of the core MUA. This simultaneity of different urbanisation modes was already visible in the progression of 'urban' coverage above.

The core city of Antwerp was the main demographic nucleus until 1950 but a tendency for population decrease started from 1920. Note that the great increase in the core city between 1950 and 1980 is due to the annexation of several municipalities with around 300,000 people. The dashed line shows the estimated trend if the same geographical boundaries had been kept. While all other areas experienced some growth, the strongest trend has been the great population increase in the less dense FUA, now concentrating one third of the total population. Considering the early distribution of 'urban' settlements visible above, this suggests a strong trend of densification of a pre-existing dispersed pattern.

In Bristol, core city dominance remained unchanged throughout the whole study period. The population of the city of Bristol increased strongly until 1951, then suffered a gradual loss and has been growing again recently. The remaining core MUA was comparatively unimportant until 1951 but then experienced strong growth at the same time that the core city was losing population. Unlike the more mixed processes of simultaneous growth in Porto and Antwerp, this period may be considered closer to a classic suburbanisation process. Other MUAs and the remaining FUA also increased their pace in the post-1950 period, but not at the rates of the other two case studies. The core-periphery hierarchy has been less affected.

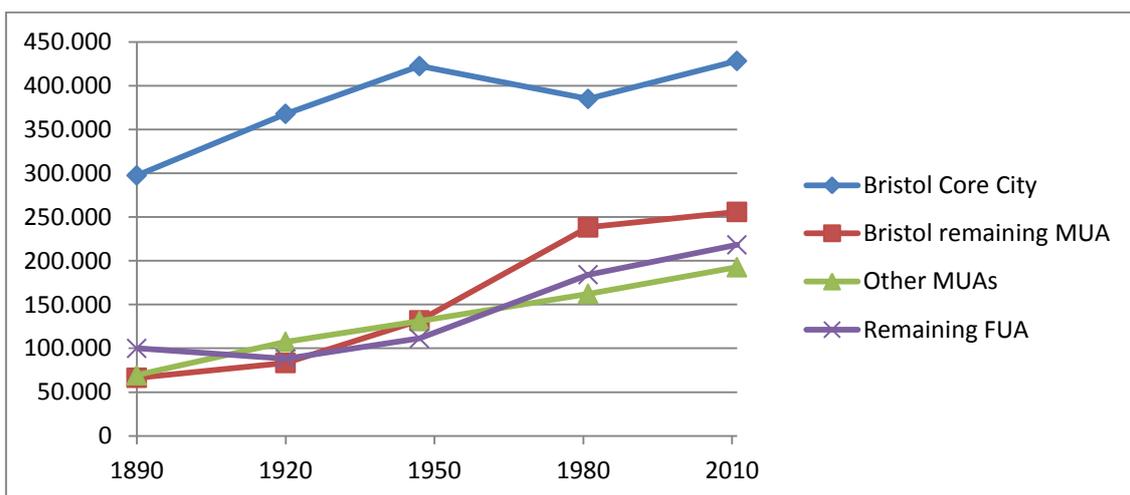
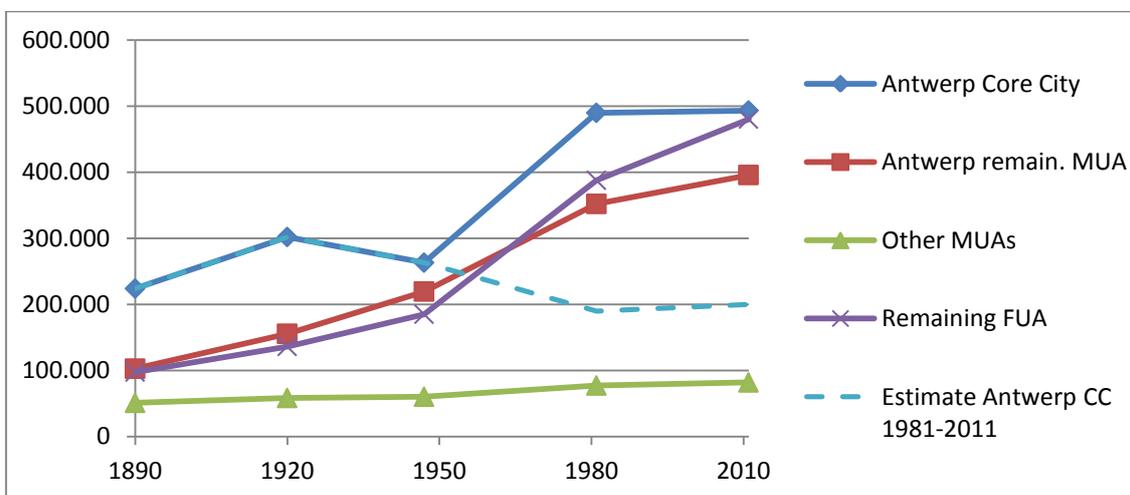
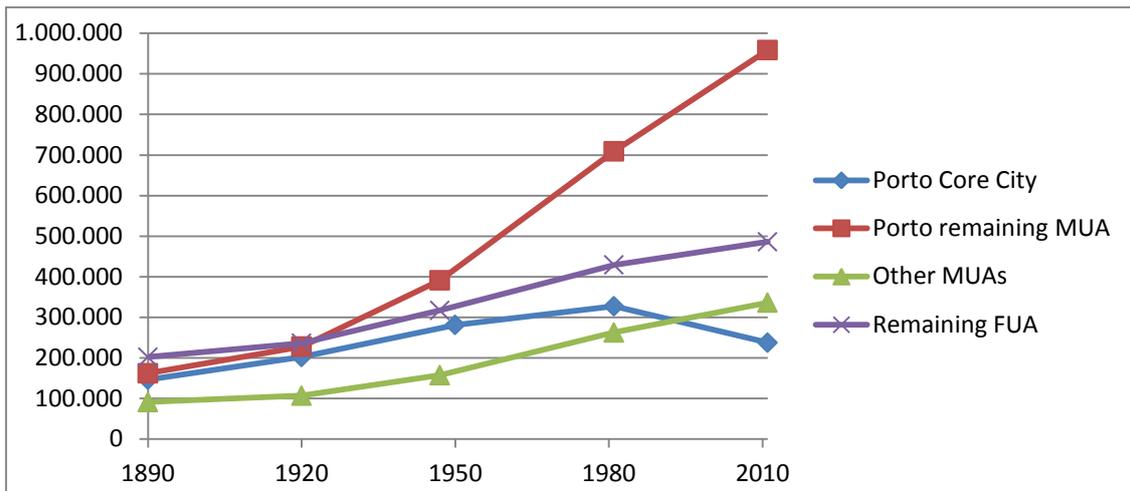


Figure 3: Population change in Porto, Antwerp and Bristol 1890-2011 according to geographical areas (core city, remaining core MUA, other MUAs, remaining FUA)

3.3 Mapping population change

The next series of maps tries to visualise and relate the trends detected in the two sections above. The findings suggest that if both core cities and 'hinterland' are treated with similar accuracy in terms of analysis, the usual models and timings of metropolitan growth are replaced by a more nuanced and complex process of urbanisation, which is often multi-centred, fragmented and non-hierarchical and does not comply with a laboratorial view of progressive spatial 'expansion' along a relatively linear timeline. The elasticity and blurredness of the borders between urban and rural space are stronger than much urban analysis assumes and have been so for a very long time. The following maps will depict this multi-centricity and fragmentation, by showing, as far as population change is a reliable indicator, where and when urban growth occurred in the region.

In Porto, like Portugal in general, growth has always been stronger near the coast. The first cores of population increase were coastal areas north and south of the core city, followed by a generalised growth in the northern fringe of Porto between 1920 and 1951. Small growth nodes had begun to appear in more remote regions, mainly due to the development of local industrial areas. 1951-1981 marked the strongest population increase virtually everywhere in the region (except for the core city), especially in the Porto MUA, stressing the emergence of other important sub-centres that build the core agglomeration as well as the densification of the FUA population outside predefined centres. The core MUA gradually integrated with other MUAs and a continuous pattern of similarly high growth rates can be read across a wide area. The 1981-2011 period resumed the earlier pattern of smaller and isolated growth patches in particular centres, surrounded by areas of little increase or even population loss.

In Antwerp, high densification of isolated patches is an even stronger trend, mostly visible before 1947 in the east of the urban region, where several areas both in the Antwerp MUA and the FUA were experiencing growth. The prevalence of linkages between centres visible above is no longer apparent here and relative population change follows a more fragmented pattern than in the transition of the urban-rural threshold. 1947-1981 corresponds to a very strong population increase everywhere in the region, with some municipalities closer to Antwerp more than doubling their population. Interestingly, no special growth was detected in the south of the region, closer to Brussels; the greater change tends to be nearer to the core city. As in the pre-1947 period, the eastern fringe of the urban region has grown the most in recent times, with comparatively little population increase elsewhere.

Bristol lacks the isolated cores of strong population change of Porto and Antwerp partly due to the difficulty to obtain early data for individual LAU2 units. The continuous colour patches indicating similar growth in large parts of the urban region can therefore be deceiving. Between 1891 and 1921, growth occurred mainly in South Gloucestershire, with more dormant areas south and west of Bath. 1921-1951 marked a tendency for higher growth throughout the region, still stronger in the immediate surroundings of the core city. This trend continued in the next period, even greater in the northern fringe of the City of Bristol, but with a more fragmented pattern of strong densification further south, in the area between the sub-centres of Weston-super-Mare and Clevedon. This area also experienced higher population growth in recent times, even if the general pace has decreased across the whole urban region.

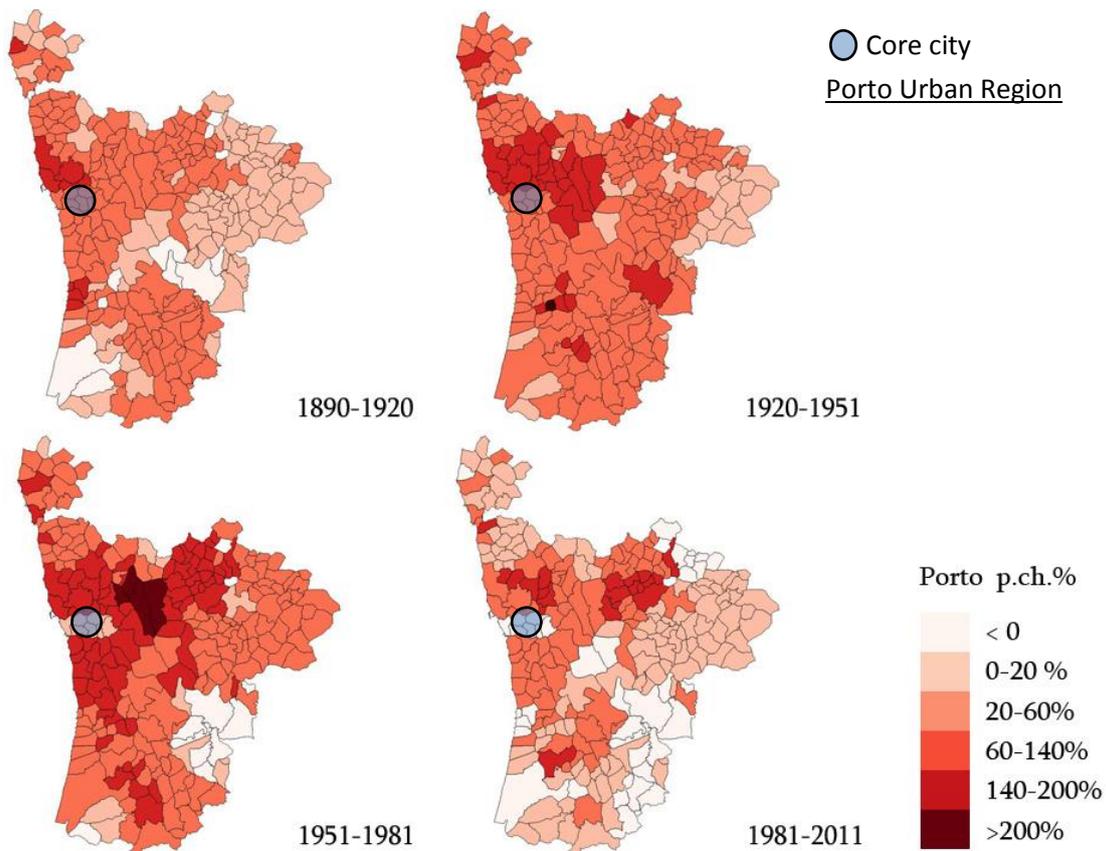


Figure 4a: Population change rates in Porto 1890-2011

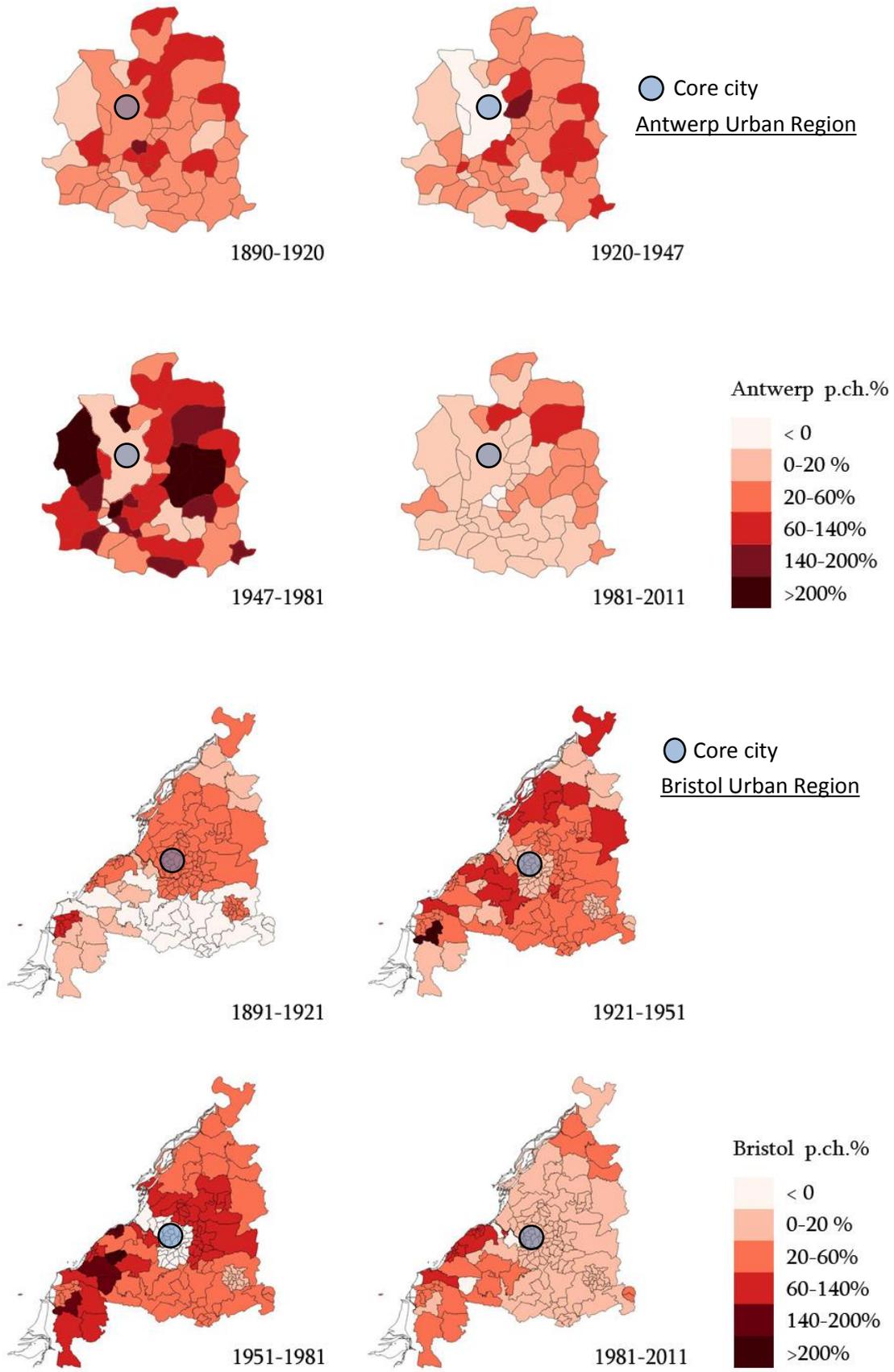


Figure 4b/c: Population change rates in Antwerp and Bristol 1890-2011

3.4 Proximity to core city and population change

The last indicator analyses whether being geographically close to the core city has an impact on the population growth rate of individual LAU2 areas, by depicting the growth rate as a function of distance to the core city. The graphs below evaluate this for Porto, Antwerp and Bristol from two perspectives: the general trend of the urban region for 1890-1950 and 1950-2011, and the trends of individual geographical areas within the urban region (FUA and MUAs) for the same two periods. The observations are shown with their respective regression lines (4th degree polynomial). For a close connection to real-life conditions, the distance to the core city was defined by actual road distances as measured by Google Maps.

The first observation for Porto is that the influence of core city proximity remained virtually unchanged between 1890-1951 and 1951-2011. Both regression lines fall smoothly as distance increases, reflecting the continuous role of the central MUA in concentrating population growth detected above, as well as the lack of growth peaks in the more distant areas of such a large urban region. From the analysis of the prior indicators, we can suggest that the apparent influence of the core city is actually the impact of the strong growth the central MUA as a whole. This is visible in the next two graphs, illustrating the trends in individual geographical areas. Here we can see how the Porto MUA curve changed over time, peaking in 1951-2011 exactly where it lowered in 1890-1951 (around the 15 km threshold). The areas in the FUA follow a smooth decreasing path very similar to the general urban region trend (despite a rise in the more remote areas in 1951-2011). However, the other two MUAs considered in the analysis – both highly industrialised – very clearly followed an independent agenda throughout the whole study period, and their regression lines cannot be linked to the dominant influence of Porto in any way. They were constrained by their own sub-centres, suggesting a greater and less interdependent form of polycentricity in the urban region.

The influence of proximity to Antwerp in the population growth of the urban region changed significantly from 1890-1947 and 1947-2011. The first period shows a strong impact of the core city, possibly due to the great development of the Port of Antwerp and related activities. The second period indicates that economic diversification and relocation throughout the region played a role, and the proximity to the core city does not correspond to a stronger rate of population growth. The same pattern is visible if we distinguish the Antwerp MUA and the surrounding FUA – the MUA is strongly influenced by core city proximity in 1890-1947 and not particularly in 1947-2011, while the FUA timidly follows a similar pattern in the former period

but mostly detaches from it in the latter, peaking at around 18km distance and growing again in the most distant areas, probably influenced by the juxtaposition of relations with Brussels (south), Ghent (west) and the Netherlands (north-east).

Bristol is a less reliable case, as seen by the lower R^2 values, with many equally distant LAU2 units showing disparate values. This is in part due to the continuous administrative boundary changes in the UK affecting the stability of LAU2 units, but also because of the relatively compact growth experienced by the individual urban centres (see above) – unlike Porto and Antwerp, it is possible for a specific LAU2 unit to increase over 500% while the next unit shows very little growth. In any case, the general trends of Bristol show that between 1891 and 1951 the rate of population change was similar in the whole urban region, with no visible peaks near the core city. This changed in the 1951-2011 period, with a decrease of growth in the areas closer to Bristol and an increase around the 15 km distance. The pattern is clearer in the division by geographical areas, showing how the trend in 1951-2011 in the Bristol MUA reveals an increase in the rate of population change as the distance to the core city grows, suggesting a possible ‘leapfrogging’ of development over the Green Belt introduced in the late 1950s. The FUA regression line peaks around the 15km and rises again in more distant areas, stressing the importance of alternative sub-centres outside the Bristol core MUA.

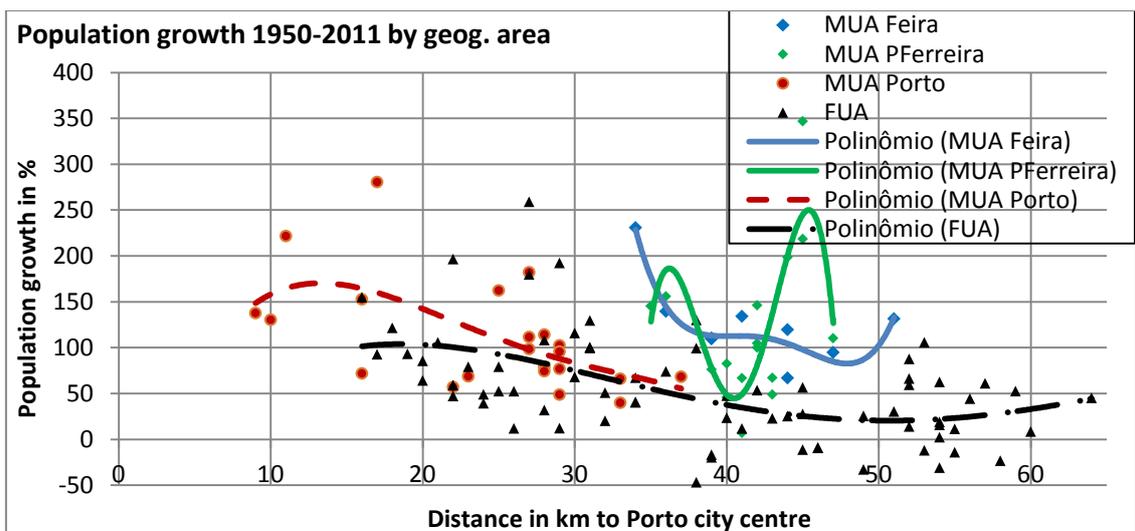
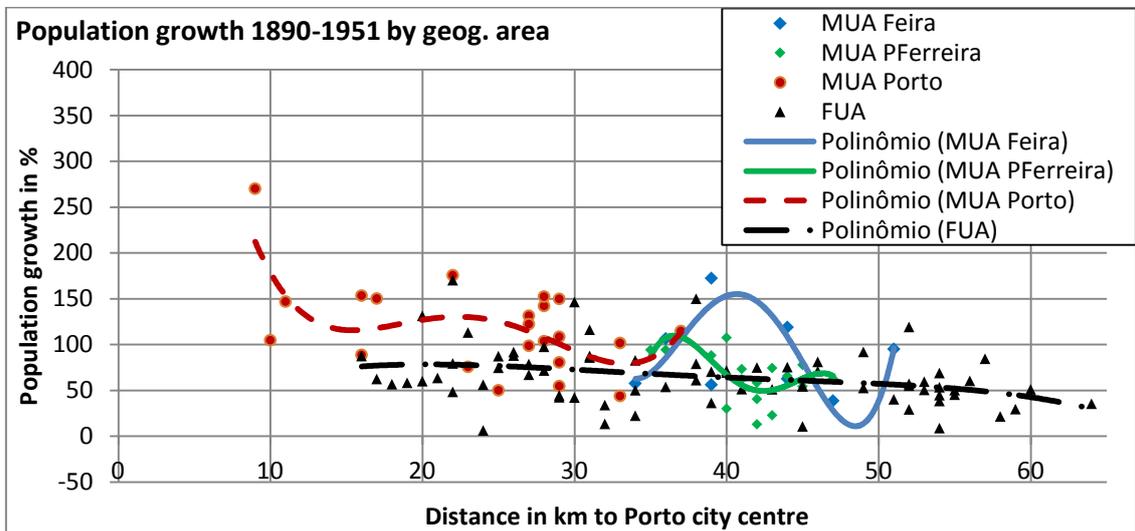
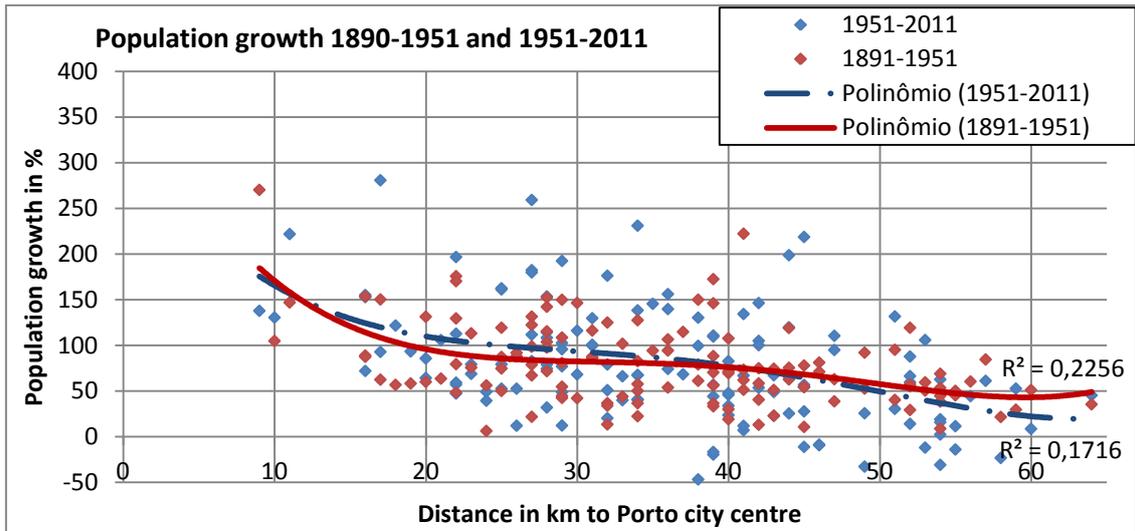


Figure 5a: Population change as a function of distance to the core city in Porto: (1) for the whole urban region, 1890-1951 / 1951-2011; (2) by geographical area (FUA/MUAs)

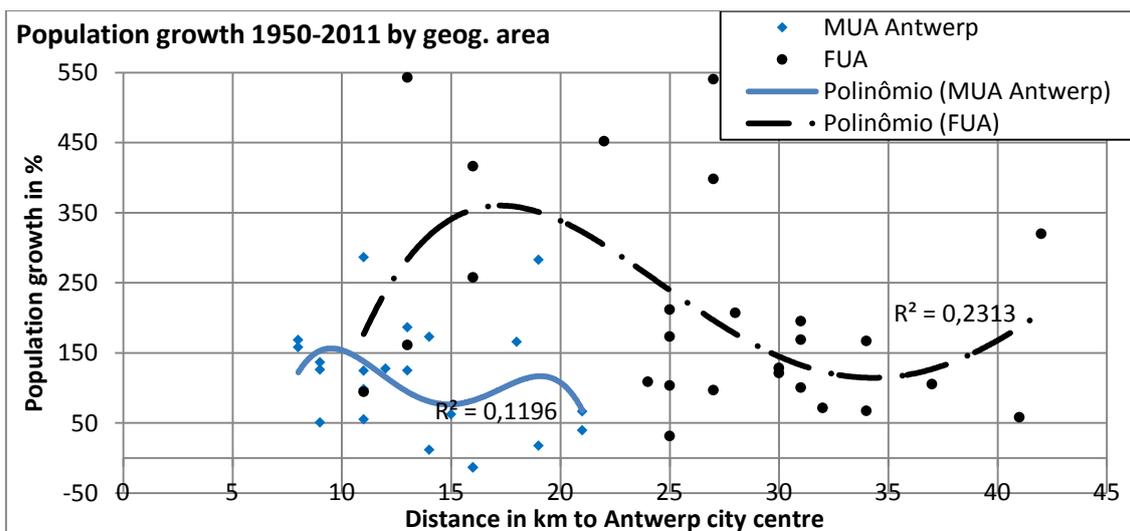
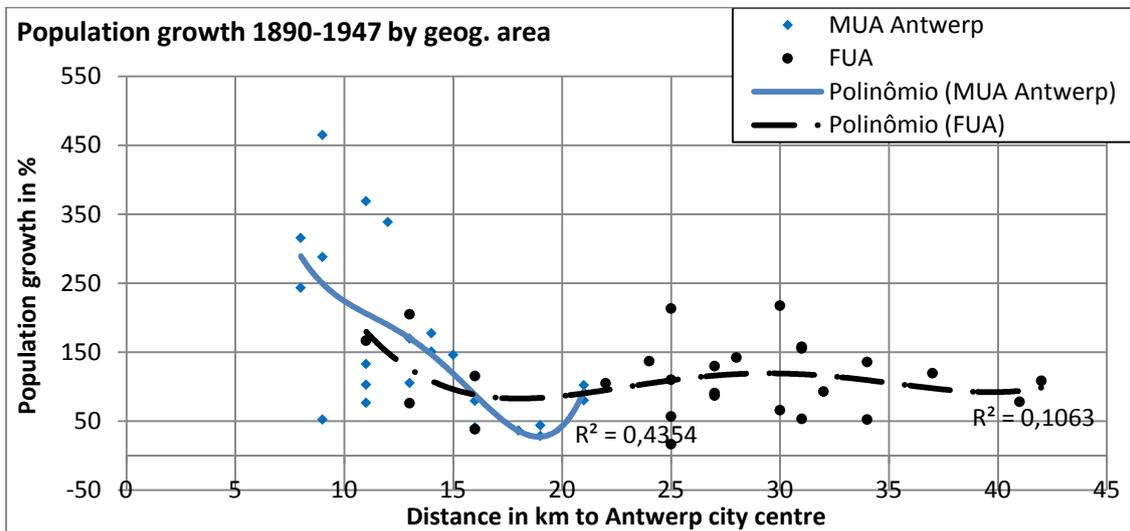
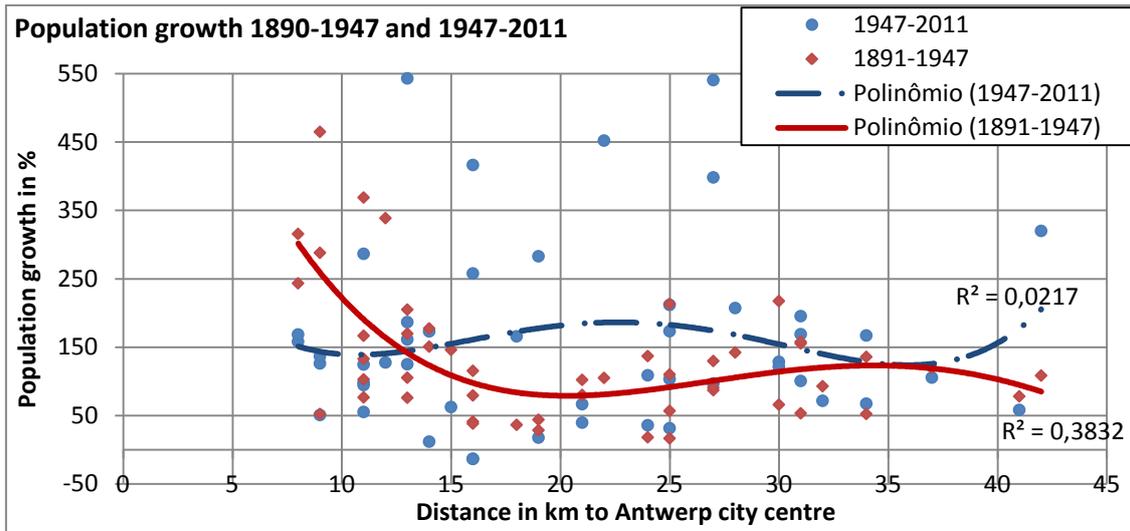


Figure 5b: Population change as a function of distance to the core city in Antwerp: (1) for the whole urban region, 1890-1951 / 1951-2011; (2) by geographical area (FUA/MUAs)

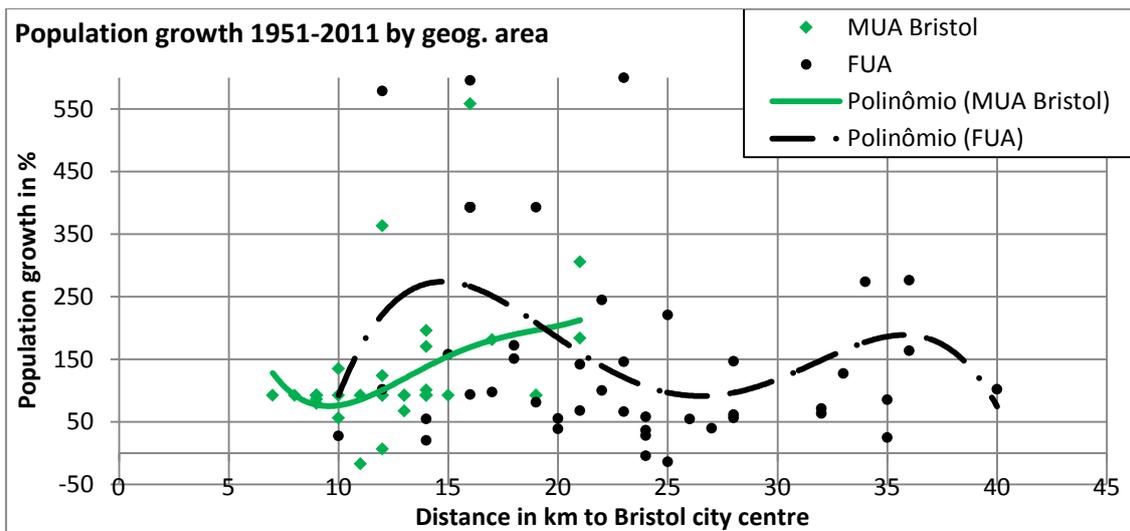
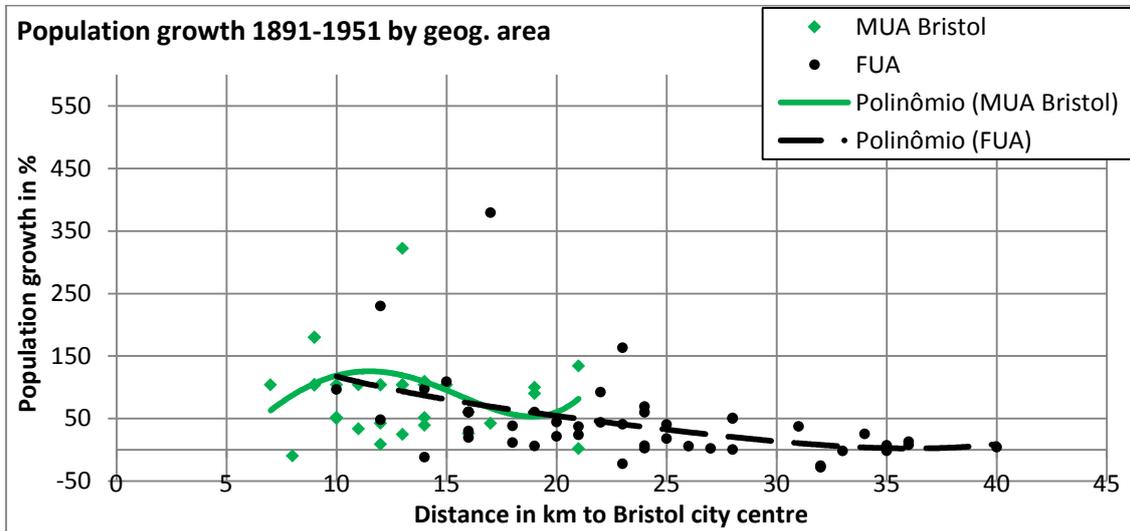
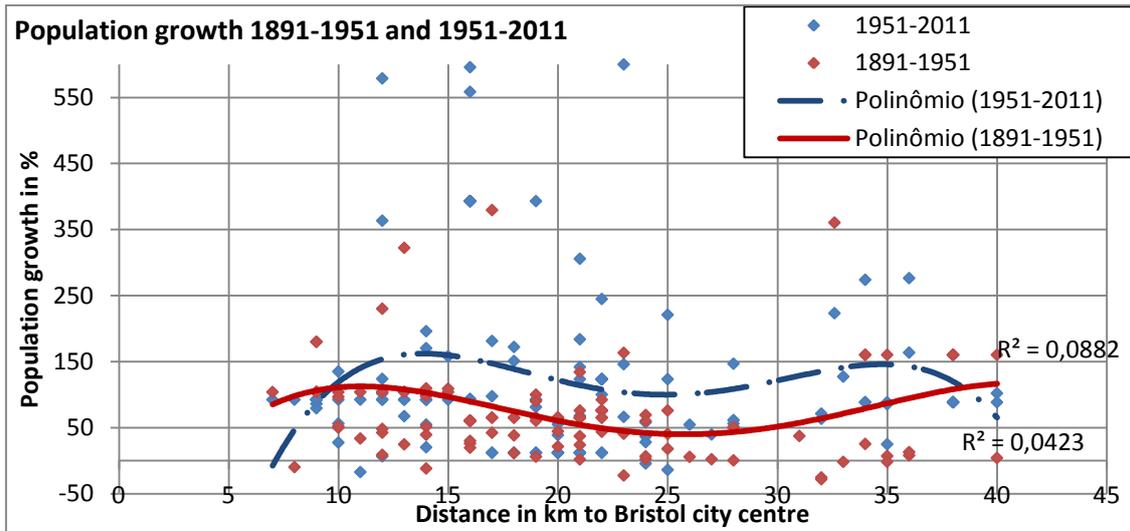


Figure 5c: Population change as a function of distance to the core city in Bristol, (1) for the whole urban region, 1890-1951 / 1951-2011; (2) by geographical area (FUA/MUAs)

4. Discussion and interpretation

Summarising the case studies

This analysis above tried to address questions related to the historical trajectory of urbanisation in three case studies of European second-tier urban regions. Namely, the analysis looked for insights about the actual timing, sequence and coexistence of different modes of urban expansion; and evaluated the role of core cities and other centres to situate the development mode of these second-tier cities in a 'region of variability' somewhere between the centrifugal expansion mode of dominant primate cities and the fusion mode of equivalent centres, close to the incorporation mode theorised by Champion (2001).

The strongest feature of the Porto region is the largely autonomous development processes of its different sub-regions, more erratic and fragmented than Antwerp, where there seemed to be greater urgency to connect and coalesce into a networked unit. Porto as a core city never had a strong influence on the region, which suffered forms of dispersion and peri-urbanisation without having experienced earlier periods of centrifugal expansion and suburbanisation. The findings above illustrate this: early patterns of polycentric and generalised urbanisation of territories; simultaneous and continuous population growth in MUAs and FUA regardless of the dynamics in the core city; strong densification of isolated patches across the region, with no visible timeline or hierarchy indicating a centrifugal process (even the huge core MUA growth emerges from the multi-centred dynamics of nine municipalities); and little influence of core city proximity (and even core MUA) in the general dynamics, with strongly independent trends going on in individual sub-regions around alternative morphological cores.

This trajectory can be related to two parallel phenomena: first, unlike Lisbon, that tended to hyper-concentrate economic power and tertiary high-end functions in the core while decentring housing and lower-order activities to the periphery (Domingues, 2009), Porto lacked the role of the central state and economic headquarters as producers of centrality, attractiveness and selective urban functions in the centre. Second, early settlement patterns in the region were based on very small cadastral divisions, a 'rhizomatic' collection of roads and paths connecting dispersed housing and activities (Portas et al., 2007), and a network of small urban cores embedded in largely rural lifestyles mixed with small-scale industrialisation. This generated a progressive densification of the territory with no critical mass or functional clustering, therefore little demand for new urban functions and little need for long-distance commuting, as well a weaker perception of a core-periphery contrast.

In Antwerp, the population loss of the core city came with a strong densification of the core MUA but even more of the FUA. While this could be expected for the dense MUA, as a consequence of core city centrifugal expansion and relocation of population, the FUA is more remote and lacks important morphological cores. This suggests that the case of Antwerp has been more about gradual and dispersed urbanisation brought by the densification of an existing settlement structure than actual development of a polycentric entity spreading from established urban cores: like Porto, *“the general urbanisation of the territory is to a large extent a parasite of the pre-existing network of rural roads which undergoes no restructuring during urbanisation.”* (Meulder, 2008: 28). An early and dense coverage of public transport, small cadastral divisions and a multitude of equally powerful municipalities¹ – the latter two aspects similar to Porto – also played an important role (ibid.). This claim stands even if a macro view of population change maps shows a more closely knitted urban region than the Porto case. In Antwerp, the attraction of the core city was indeed greater, but the ‘hotspots’ indicating autonomous and simultaneous growth in several places stress the existence of alternative, if incipient, urban territories in the region. Their role has gradually gained importance, as suggested by the different impacts of core city proximity in population change rates between 1890-1947 and 1947-2011. The gradual flattening of the regression line suggests less core city dominance over the urban region in recent times.

Porto and Antwerp are clearly the main cores of their region but they have been embedded very early in an extensive process of dispersed growth that led to a dense and ubiquitous urban landscape, rather than a truly polycentric region of discrete urban cores. The case of Bristol is different; the findings suggest that the region was from the beginning the most polycentric, in the sense that there were several discernible urban cores, but their individual growth patterns have been more compact than the two other cases. Bristol started from a similar percentage of ‘urban’ coverage as Porto and Antwerp but the rise of that curve was much gentler and urbanisation remained relatively self-contained until recently. The result is an important core city surrounded by smaller urban centres, all with comparatively compact

¹ See Harrison and Heley (2015) about how the ‘non-city’ spaces in an urban region actually gather not only population but also an important part of the region’s decision-making powers and therefore need to be considered at the same level as established cities when envisioning a governance framework for the urban region. In Belgium and Portugal, all municipalities have in theory the same powers over their territory, regardless of their size or urban-rural typology. The British system of single- and double-tier authorities is more complex, especially since the first wave of City Deals gave additional powers to the largest urban local authorities.

development patterns. This is consistent with Barry's (2000) description of the region since the seventeenth century as having a strong urban infrastructure in place consisting of numerous small and medium towns rather than concentration in a single central city. Nevertheless, Bristol did stand out of the other cities and was dominant in terms of population throughout the whole study period, even if losing people in certain periods. In fact, that loss² is the only of the three cases that has been relatively consistent in time and scale with the growth of the immediate MUA – thus closer to a classic 'edge-of-city' expansion model - mainly due to the economic success of the north fringe from the 1970s (Boddy et al., 2004). In contrast to the apparent 'naturalness' of the dispersion and densification processes in the other two cases, based on ancient factors intrinsic to the territory, urban growth in Bristol was more planned, directed and supported by investment and infrastructure.

Methods and history

An important insight of this analysis responds to the last question raised in the introduction: despite the traditional neglect of the role of places outside core cities in the processes of urbanisation, there is more to say about their history than merely seeing them as empty space awaiting urban expansion. This analysis suggests that 'non-urban' territories played indeed an early role in phenomena of dispersal, polycentricity and extensive urbanisation, often following a relatively autonomous agenda invisible to urban studies concentrated on core cities and neglected by models assuming centrifugal urban expansion: in the case of Belgium, *"late nineteenth-century urban dispersal was indeed much more about autonomous urbanisation within the countryside than about the suburban expansion of established cities."* (Fisher, 2013: 334). Urbanisation was spread out as much as territories were humanised and given identity through place names, local networks of activity and people finding their way through 'urban' references, in the sense proposed by Kevin Lynch (1960): rural parish churches and their bell towers immediately come to mind. In fact, even before the census years considered here, this was already clear to some observers, as noted by the description of Northwest Portugal as a 'continuous city' of dispersed settlements or Daniel Defoe's reference to the Bristol region punctuated by 'innumerable villages', both quoted above. Actually, Barry

² 1951-1981 according to the intervals used here, but in fact occurring more strongly between 1971 and 2001, consistent with the suburbanization process in the northern fringe (Boddy et al., 2004) followed by a great increase (380,615 to 432,500) between 2001 and 2011, denoting a return to the centre common to many of the largest English cities.

writes that the South West of England is not usually associated with sudden urban growth in the main centres in the 19th century (like the Midlands, for example) “*in part because of the strong urban infrastructure already in place, with over a quarter of the region’s people living in towns by 1660*” (2000: 67).

Besides adding local specificity to the generic and travelling models that often underpin research on extensive urbanisation, these insights speak directly to the recent concerns of Brenner (2014) or Harrison and Heley (2015) about the city-centric bias of both urban research and city-regional policy-making: as the role of places outside core cities in the development of current configurations of urban region is gradually recognised, and all places in the urban region become more integrated and less differentiated, core-periphery and spatially selective perspectives must be replaced by the consideration of the full organism of the urban, in which the ‘city’ is just a rather successful and generalised form. In this sense, an interpretative lens that recognises this scale as an ‘extensive city’ with urban qualities and problems, supports integration strategies and sees urban planning as a tool to ensure liveability at any point of the territory, seems particularly appropriate to deal with this type of urban entity.

The explanation of proto-industrialisation

Interestingly, and regardless of the second-tier city framework underpinning this paper, such descriptions of fragmented and dispersed urbanisation have been particularly associated to regions experiencing early (proto-)industrialisation. These regions were supported by a dispersed network of small industry units inserted into rural typologies that did not tend to cluster into large complexes or promote the emergence of important functional and demographic cores. Rather, proto-industrialisation would adapt to and colonise the previous cadastral and topographic constraints, and, as long as there was sufficient population density, it was able to recruit the needed workforce from people living nearby who would literally walk to work³, with no need for major infrastructural, cadastral or functional changes in existing settlements. As argued by Mendels for eighteenth-century Flanders, “*industrial growth was*

³ This also relates to the fact that population dispersal throughout the 19th century is only partially explained by the effects of the extension of railway. Although a correlation between increasing population densities and the extension of rail (more based on number and proximity of stations than length of lines) has been detected, for example for England and Wales (Felis-Rota et al., 2011), in some cases, like Northwest Portugal, the railway would often follow previous demographic dispersal rather than the other way round.

induced and promoted by population growth. [...] The highest levels of rural industrialization [...] were found in areas with the highest population density and land fragmentation." (1971: 269). Proto-industrialisation also developed early in South West England, mainly in the form of heterogeneous and deconcentrated units of cloth industry, "*each with specific urban networks*" (Barry, 2000: 81), and Northern Portugal, where the phenomenon of 'diffuse industrialisation' was shown to be characteristic of regions with considerably high population densities but low rates of urbanisation (Santos, 1992).

This insight – population without proper urbanisation - suggests a hypothetical relation between the type of core city and the structure of industrialisation in its hinterland. This study does not go as far back as the emergence of proto-industrialisation, nor does it cover its multiple explanations or the challenges to the conceptual appropriateness of the notion. However, Barry (2000) argues that one of the reasons why Bristol, as a city, did not grow as much as its Northern rivals is that it did not forge hierarchic ties with its industrial hinterland, consolidating fragmented nodes and promoting (through political power or economic policy) the emergence of denser and larger complexes in the region. Instead, the city left the development of the emerging textile industry to its own devices, and concentrated on its main economic priority, namely being a colonial port city. There was a functional differentiation and little contact between the workforce in Bristol and the workforce spread across the region.

In this sense, it is interesting to note that Porto and Antwerp were also port cities, largely relying on related mercantile activities, and have equally failed to consolidate dense industrial nodes in their surroundings. Arguably, this can also be a case of *need* and *ability* to do so. Cities less concerned with an outward-looking economy and more dedicated to exploit the emergent economies of its own hinterland would forge stronger ties with this region, promote its agglomeration economies by upscaling industrial concentration, gradually need to insert greater infrastructural and functional changes in the pre-existing settlements, attempt to control decision-making, and ultimately build a more hierarchic political, functional and socio-economic structure at the urban region scale; this ability probably needs a core city which is, from the outset, quite large and which gathers an important part of the region's population and economic activity. Naturally, this was not the case of our three case studies. Hence the view by Barry, following his argument about the detachment between Bristol and its industrial hinterland, that, despite population growth, there was little sign of "*a growing Bristol [demographic] domination of the region.*" (Barry, 2000: 79).

This is strikingly similar to the description of ‘dominant’ primate cities, as opposed to ‘weaker’ second-tier cities, as discussed above, namely concerning their need and ability to constrain the economic, spatial and functional development of the urban region. The question whether second-tier cities (or perhaps ‘non-primate’ cities), less concerned with and less able to urbanise and control its surroundings, also tend to be those where the traces of proto-industrialisation are more visible and those less affected by large-scale consolidation of industrial nodes provides another path for further research on comparative urban history.

‘The land is a palimpsest’

So what is new? Mainly the scale of the phenomena. Dispersed and fragmented urbanisation has become less based on small buildings and cadastral divisions and a tight mesh of local connections to rely more on large infrastructural axes and functional concentrations. While an increasingly complex functional mix is visible at the urban region scale, specific areas tend to be more monofunctional at smaller scales (logistics parks, shopping centres, etc.), unlike the former ‘filigree’ of different activities and land uses in close vicinity. Inevitably, hierarchies emerge and despite the blurred urban forms, imprecise boundaries and dispersed growth processes remain, the territory is less isotropic and the fine grain of the ‘urban’ has now turned coarse and patchy. Additionally, spatially contained lifestyles based on localised relations and needs now exist alongside greater interdependence at territorial scales.

The relevance of a long-term analysis of the urban region hinges on the fact that these new and old forms and scales of urbanisation coexist. The ancient, dispersed and loose occupation of the territory was consolidated, rather than erased, throughout the years and left behind a porous mesh of urban fragments and mobility networks providing “*sufficient infrastructural support for the post-1960 construction boom.*” (Portas et al., 2007: 4). And the less intensive urbanisation processes detected here, in which the expansive and centrifugal force of core cities did not play such a dominant role, may have helped to preserve these traces of the past. There is a contrast between an intensive expansion process, emanating from a strong core and advancing through large areas of suburban growth, huge functional nodes and massive infrastructure, with the associated economic and political power providing this ability, and a trajectory in which the core has less attractive power and critical mass and by consequence less impact on the development of the urban region. This contrast arguably has an influence on how much pre-existing configurations were obliterated by metropolitan expansion.

The land is a palimpsest (Corboz, 1983) and the problems emerging from contemporary forms relate to where they come from and what was there before. How do planning strategies address the dissociation between large-scale networks (hierarchical and focused on discrete centres) and existing forms of urbanisation (isotropic and extensive, a continuous fabric rather than a sequence of nodes)? How do dense functional concentrations 'land' onto a sponge-like territory filled with a capillary fabric? Addressing such questions, informed by the long-term nature of each urban region, can create the basis for a 'territorial project' (Vigano, 2012) embedded in the concept of the urban region. In Antwerp, the lack of such knowledge was criticised by Meulder et al. (1999), seeing the 1997 Regional Master Plan for Flanders as an unfit model borrowed from Dutch experiences, trying to impose a 'compact city' policy onto a "totally contrary" (1999: 80) spatial structure. In Porto, Domingues (2008) has been corrosive in his critique of the dead ends encountered by generic policy aims, such as urban containment and polycentricity, when applied to the extensive and non-hierarchic urbanisation patterns of the urban region. An exercise in specificity and precision can respond to the calls by Sieverts (1997) and Harrison and Heley (2015) for greater attention of policy and planning to the spaces in-between 'proper' cities where much population actually lives and works.

5. Conclusions

The results help to sustain the claim that there are no 'pure' and laboratorial forms of urbanisation and the route to an urban region shows simultaneous and contradictory features of expansion, dispersion, consolidation and densification. Bristol evolved from a progressive expansion of multiple urban nodes, large and small, while Porto and Antwerp followed a more encompassing and isotropic process of dispersion and densification largely detached from existing cores. This was more interrelated and directed to integration in Antwerp and more erratic and autonomous in Porto. In all cases, place-specific factors influenced development and the modes of urbanisation did not follow a clear sequence or defined chronology. Dispersed, fragmented and undirected urban processes started early and are in many ways intrinsic to ancient territorial conditions, rather than based on recent changes such as suburban lifestyles or the advent of the private car. Coexistence of contradictory trends and 'leapfrogging' of stages predicted in generic models are common in all cases. Strong and continuous core city dominance, either by exerting centripetal and centrifugal forces or influencing the pace of growth elsewhere through proximity, could not be detected.

Overall, and despite the variability of the trajectories, this situates the three cases within Champion's incorporation mode. Porto, Bristol and Antwerp were neither monocentric cities expanding over a previously unoccupied territory nor part of a set of equivalent centres gradually fusing as a result of individual expansion and infrastructural linkages. They were the leading cores of a complex and fragmented region of generalised urbanisation, generating both alternative centres and scattered urbanised areas lacking a morphological core, which were relatively self-sufficient and free from core city influence before being incorporated in the integrated urban region. Future research can explore the veracity of Champion's corollary that this allows smaller centres to present a stronger challenge to the main core, in terms of attracting functions, services and jobs, than the 'satellites' emerging from a centrifugal mode.

The last set of observations relates to the specific ability of second-tier cities to generate this kind of urban region. While the findings here do not claim generalisability of any kind, we have seen that the common (while nuanced) features of Porto, Antwerp and Bristol stand in direct opposition to the clear core-periphery contrasts assumed as the 'original state' of many hegemonic, primate cities. Such cities tend to exert a strong influence on their hinterland and constrain their urbanisation process through centripetal and centrifugal forces; they tend to evolve from a strong monocentric condition into some form of 'hierarchical' polycentricity, with new centres emerging from the expansion or relocation of core city activity.

The present findings suggest that second-tier cities lacking this 'big central' condition (i.e. lacking a 'capital effect', the historical role of the state and the economy as producers of centrality and attractiveness) have not been able to counteract the tendency for dispersion, fragmentation and autonomy of urbanisation throughout their hinterland. Population and activities have not so much 'decentralised' but directly emerged *in situ* and clustered across the urban region with little respect for boundaries or hierarchies. An immediate consequence is that the whole territory tends to be filled with infrastructure and thereby receptive to be repeatedly occupied and consolidated (Meulder, 2008). Despite the costs of such infrastructural redundancy, if it comes with enhanced accessibility, decentralised urban functions and a history of cultural identification with local settlements, this may create greater ability to stay and work in a particular place, thus reducing core-periphery commuting and generating greater diversity at local scales. Commuting towards the core city is indeed stronger in Lisbon, London and Brussels than in Porto, Bristol and Antwerp, whose sub-centres tend to be more self-contained, as recent statistics by the three national offices can show.

A further consequence of such a configuration is that important urban functions tend to be more distributed throughout the territory, so that the urban region becomes more interdependent as a whole (Cardoso and Meijers, 2013). Finally, there is a political argument: a history of horizontal relations, little perception of core city dominance, a sense of widespread interdependence and weak hierarchies may create a political landscape opposed to the descriptions of core-periphery assumptions and asymmetric relations around large capitals (Phelps et al, 2006; Nelles, 2013), as well as mitigating the difficulties to anchor a regional governance project in polycentric urban regions lacking a leading city (Dieleman and Faludi, 1998; Lambregts, 2006). Future research may be interested in evaluating whether second-tier cities are indeed cases of such an arrangement somewhere between primate cities and polycentric urban regions, or rather non-cases failing to recognise this position.

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