Shifting fortunes of neighbouring cities

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Abstract

Polycentricity is often conceived to be the product of "a long process of very extended decentralization from big central cities to adjacent smaller ones, old and new" (Hall and Pain, 2006: 3). Accordingly, polycentric spatial development (as a process) is usually identified with a development towards a more balanced distribution of functions and activities across regional space, and with the moderation of intra-regional urban hierarchies. However, the term polycentricity is also linked to the idea that formerly independent, but close-by and well–linked cities start to 'fuse' into larger metropolitan areas as their spheres of influence start to interfere. Classic products of this kind of polycentric spatial development can be found in Europe (e.g. the Randstad), but also in the U.S. such areas have been identified (e.g. SF bay Area, Dallas-Fort Worth, Baltimore-Washington, Raleigh-Durham etc). While 'fusion-mode' and 'decentralization-mode' metropolitan areas are subject to grossly similar overarching trends such as globalization and the post-industrialization and informationalization of the economy, these trends seem to produce contrasting patterns of spatial organization. The dominant trend in 'fusion-mode' polycentric metropolitan areas appears to be towards the creation of new leading cities and a strengthening rather than a moderation of intra-regional hierarchies. In this paper, we explore this trend for 'fusion-mode' polycentric metropolitan areas in the U.S., thereby employing occupational data, and seek to explain the emerging new intra-regional hierarchies found.

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1. Introduction

TIME Magazine's recent cover story about the woes of Detroit makes the case pointblank: fortunes of cities may shift – at times even dramatically (TIME Magazine, 2009). Through time, the occasional spectacular rise and/or the tragic fall of cities has given occasion to some of the most fascinating and eloquent literature produced by our discipline (e.g. Hall, 1998). However, while such typical cases as Detroit, Rome, Shanghai, Vienna, Baghdad, Manchester and Berlin deservedly receive a lot of attention, there are many other, admittedly less dramatic, but nonetheless intriguing stories to tell.

One such a story is that of changing urban hierarchies in metropolitan areas displaying *polycentric* characteristics. Polycentricity, which basically refers to the co-location of multiple urban centers or cities within a particular area (Parr, 2004; Meijers, 2007a; Lambregts, 2009) has become a key element of many recent concepts that try to capture the idea that what is urban these days is no longer the quality of cities alone, but spreads out over much larger territories encompassing multiple urban and suburban communities. Examples of such concepts include the polycentric urban region (Kloosterman and Musterd, 2001), the polycentric metropolitan region (e.g. Schwanen et al., 2004) and the polycentric mega-city region (Hall and Pain, 2006). Hall and Pain (2006: 3), for example, describe the latter as a "new urban form", consisting of "a series of anything between 10 and 50 cities and towns, physically separate but functionally networked, clustered around one or more larger central cities, and drawing enormous economic strength from a new functional division of labour." Such polycentric metropolitan entities are often hypothesized to derive competitive advantages from offering both a wider variety of agglomeration economies (Sassen, 2007) and a better balance between economies and diseconomies of agglomeration than their monocentric counterparts (Meijers and Burger, 2009). Apparently, by 'borrowing size' from each other and by enjoying 'network' or 'regional' externalities (Parr, 2002) the various cities in polycentric metropolitan areas are able to achieve sufficient scale to sustain advanced and competitive economic activities (Phelps and Ozawa, 2003; Meijers, 2007a; Hoyler et al., 2008), while keeping diseconomies caused by hyper-concentration and congestion at bay.

Metropolitan areas displaying polycentric characteristics are also often conceived to be the product of "a long process of very extended decentralization from big central cities to adjacent smaller ones, old and new" (Hall and Pain, 2006: 3). Accordingly, polycentric spatial development (as a process) is usually identified with a development towards a more balanced distribution of functions and activities across regional space, and with the moderation of intra-regional urban hierarchies. A recent study into spatial dynamics in eight North-west European 'polycentric mega-city regions' found indeed that smaller functional urban regions over the past 20 years had generally gained relative to the larger, central functional urban regions in these areas (Hall and Pain; 2006: 42). Notably in Europe, the promising perspective of being able to achieve a more balanced distribution of functions and activities across space has now become a reason for actually *pursuing* – by ways of policy – polycentric development, not only at the regional scale but also at other, higher spatial levels (European Commission, 1999; Waterhout, et al., 2005).

However, not all polycentric metropolitan areas result from said process of 'extended decentralization from big central cities to adjacent smaller ones, old and new'. There is another type of polycentric area: one that arises from what Champion (2001) has labelled the 'fusion-mode' of polycentric development. Fusion mode polycentric development concerns the situation where several, previously independent centres of more or less similar size *fuse* as a result of their own separate growth, both in overall size and lateral extent and particularly because of the improvement of transport links between them (ibid). When the

spheres of influence of such nearby located cities start to interfere, their functions and inhabitants commence to benefit from having access to, for instance, greater numbers of potential suppliers and larger pools of customers, potential employers or, the other way round, employees. These cities as such mutually start to 'borrow size' from each other (Alonso, 1973; Phelps and Ozawa, 2003; Meijers and Burger, 2009). It is this type of polycentrism Kloosterman and Musterd (2001) had in mind when they committed their definition of a 'polycentric urban region' to paper, circumscribing it as a collection of historically and administratively distinct smaller and larger cities located in more or less close proximity (roughly within commuting distance), the larger of which do not differ significantly in terms of size or overall economic and political importance. Fine examples of such fusion-type polycentric metropolitan areas include the Randstad Holland in the Netherlands and the RhineRuhr region in Germany. The apparent lack of hierarchy between the cities in these regions has been adduced as a major distinguishing feature on many occasions (Batten, 1995; Parr, 2004; Hall and Pain, 2006; Meijers, 2007b).

Interestingly, recent research (Meijers, 2007b; Ruimtelijk Planbureau, 2007; Lambregts, 2009) has found that in contrast to what appears to be happening in polycentric metropolitan areas resulting from decentralization tendencies, intra-regional urban hierarchies in fusion-type polycentric areas are not really diminishing. Rather, the opposite seems true, especially in the Randstad Holland. In contrast to the long-prevailing Randstad planning doctrine, which aims, amongst other things, at maintaining balance between the region's major urban centres (Lambregts and Zonneveld, 2004), empirical evidence suggests that Amsterdam – vis-à-vis the other three key cities of Rotterdam, The Hague and Utrecht – is gaining ground and strengthening its position as the region's international gateway city and economic command centre (OECD, 2007; Lambregts, 2009). In the Randstad Holland the trend of the past 10-15 years seems to be *not* in the direction of a more equal and balanced distribution of key economic functions across space, but towards concentration in one particular centre, and hence towards the strengthening of intra-regional urban hierarchies instead (VROM, 2008).

This is a conspicuous, at first sight contrary finding that begs to be explored in more detail. Fusion-mode polycentric metropolitan areas and their non-fusion or 'decentralization-mode' counterparts are subject to grossly similar overarching trends such as globalization, the post-industrialization and informationalization of the economy, the rise of a network economy and society and the coming about of a new international division of labour in services production. Yet, the same overarching trends seem to produce different results on the ground. Whereas in 'decentralization-mode' polycentric areas they seem to incite a fairly straightforward tendency towards spatial decentralization (and reconcentration in smaller centres), in fusion-mode areas they foster a more complex spatial redistribution of functions at the regional scale in a process that might even be subject to increasing returns to scale. The fusion-mode of polycentric development – i.e. the process that makes the spheres of influence of nearby located, roughly similar-sized cities to interfere and that enables cities to borrow size from each other and enjoy the concomitant economies – not only creates new, functionally integrated metropolitan regions, but also seems to be inductive to the shifting of fortunes of neighbouring cities, or the creation of new leading cities and intra-regional urban hierarchies. Could it be that behind the balanced, polycentric images such metropolitan areas produce on the map, lie hidden strong functional hierarchies between the cities?

This paper sets out to further explore this intriguing issue and strip it of its hypothetical character. Two questions will be addressed. The first concerns the commonness of the observed phenomenon. The research into fusion-mode polycentric metropolitan areas referred to above (Meijers, 2007a; Ruimtelijk Planbureau, 2007; Lambregts, 2009) notably focussed on the Randstad Holland and to a lesser extent on the RheinRuhr region and the Flemish Diamond in Belgium. These are all located in the larger Rhine-Meuse delta, where polycentrism has been a key characteristic of the landscape for centuries (certainly in morphological terms). In order to establish if the observed developments are unique to these areas or if they can be more generally observed, it is necessary to look into the spatial dynamics of preferably a substantial number of other fusion-mode polycentric

metropolitan areas, and establish whether or not they are subject to similar trends (i.e. the emergence and/or strengthening of new urban hierarchies). In this paper, we therefore take a closer look at a substantial number of 'fresh' fusion-mode polycentric metropolitan areas, that is: areas that have so far largely escaped the attention of the – also so far – very much Eurocentric debate on polycentricity. The polycentric metropolitan areas studied here are ten continental U.S. metropolitan areas, which all display evidence of fusion-mode polycentric development and which provide a welcome alternative to their much more frequently analysed European counterparts. In exploring their internal dynamics, or, to be more precise, in establishing to what extent the regions are displaying evidence of new hierarchy formation, the paper examines in which cities in these regions, over the past three decades 'top-level' economic functions have tended to concentrate. The paper takes an innovative approach in defining top-level functions: these will not be defined on the basis of a sectoral classification of firms (e.g. advanced producer services), but on a functional classification based on occupations and occupational standing of the work force employed in these cities instead (see section 2 for more details).

If there appears to be a broader trend towards strengthening intra-regional urban hierarchies in fusion-mode polycentric metropolitan areas, the obvious next question is of course: how come? This is the second main question addressed in the paper. It will be answered more tentatively than the first question, simply because of the fact that actual research into the possible explanations for the observed pattern has yet to take place. We therefore limit ourselves to a first, tentative interpretation of the results, bearing in mind the fact that a sound understanding of regional development and change requires one to take into account regional assets and intra-regional dynamics on the one hand and the impact of global circulations and extra-local dynamics, on the other.

The paper breaks down into 6 sections. The next section (Section 2) explains the methodology used to select fusion-mode polycentric metropolitan areas in the U.S.A. It also discusses the data on occupations and occupational standing, and the analytical methods applied. Next, section 3 presents the first of two major analyses in this paper. It concerns an analysis of the jobs in terms of their prestige, associated income and required educational level in each major city of the ten metropolitan areas identified. The aim of this analysis is to see whether there are divergent trends in mean and median occupational standing of jobs within the different cities making up the metropolitan area, which would unveil the development of a new urban hierarchy. The second mayor analyses in section 4 concentrates on the spread of top-level jobs, defined by the highest occupational standing, over the cities of a polycentric metropolitan area, in order to explore which city is leading in the region. In section 5, the findings are discussed, and tentatively explained with help of the latest insights developed in the literature dealing with regional (economic) dynamics. Conclusion and some suggestions for further research are presented in section 6.

2. Data and methodology

In order to see if more fusion-mode polycentric metropolitan areas show evidence of strengthening intra-regional urban hierarchies, this paper presents two analyses. The first analysis looks at average and median levels of occupational standing in the cities making up the polycentric metropolitan areas, and explores whether these differ and how these differences evolve. Its outcomes provide a rough, but robust picture of shifting hierarchies between the cities. The second analysis provides a more detailed insight by examining the evolution of urban hierarchies in the selected polycentric metropolitan areas by tracking how the top 20% jobs in a region – measured by prestige, earnings or education – are distributed between their main cities or constituent Metropolitan Statistical Areas (MSAs).

This section presents the groundwork for these analyses. It explains the selection of the polycentric metropolitan areas and discusses the occupational data sources and the occupational standing variables employed.

Selection of polycentric metropolitan areas

Attempts to delimit non-administrative regional constructs – be they global-city regions, mega-city regions or network cities – normally soon run into difficulties because of their inherent reliance on normative and subjective choices. This also applies to efforts aimed at demarcating polycentric metropolitan regions (or areas). A recurrent subject of discussion in the debate on such regions is how polycentrism should be measured and how it should be established if a city still belongs to 'the region' or not. Morphological, functional/relational and socio-cultural indicators have been employed, but unity of thought and harmony in research approach has not been reached yet (e.g. Davoudi, 2003; Hall and Pain, 2006; Hoyler et al., 2008; Meijers, 2008; Lambregts, 2009). In this paper, we adopt a two-step approach to the selection of U.S. polycentric metropolitan areas for study: we first determine 'the metropolitan areas' and then establish whether they show evidence of polycentrism or not.

The thorny issue of how to determine what belongs to 'the metropolitan area' or not, in this paper is dealt with quite simply by relying on the widest possible official delimitation of metropolitan areas in the continental United States: the so-called Combined Statistical Areas (CSAs). CSAs, of which there are 124, are aggregates of adjacent metropolitan or micropolitan statistical areas (MSAs)[i] that are linked by commuting ties. However, not all Metropolitan Statistical Areas are part of a CSA: there are 'stand-alone' Metropolitan Statistical Areas as well. Next to CSAs, these were also included, meaning we started our selection with 175 metro areas in the continental U.S.

For each CSA and stand-alone MSA[ii] we then determined whether they display evidence of polycentrism or not. As stated before, polycentricity can be measured with help of various indicators. Since an important functional/relational factor (i.e. commuting ties) already lied at the basis of the delimitation of the basic spatial units (i.e. the CSAs and MSAs), we used a morphological indicator to establish the extent of polycentrism. We considered a CSA or MSA to show evidence of polycentrism if it included at least two more or less equally-sized *and* historically distinct cities (as we are interested in fusion-mode polycentric metropolitan areas only). The selection process itself consisted of three steps. First, CSAs or stand-alone MSAs that did not have at least two cities (incorporated places) with 50,000 inhabitants or more, were omitted. Next, we also excluded cities that cannot be considered 'distinct' places historically, but that represent sizable suburban places in the vicinity of 'true' distinct places instead. Therefore, places that counted less than 5,000 inhabitants in 1950 were not taken into account.[iii] Thirdly, we looked for evidence of polycentrism in the remaining metropolitan areas, by analyzing the rank-size distribution (based on 2000 Census population data) of the cities making up these areas (see also Nordregio et al., 2004; Parr, 2004; Meijers and Burger, 2009). Three types of polycentric areas were distinguished, based on the number of dominant or principal cities they contained:

- **multipolar metropolitan areas**: the size of the fourth largest place is at least one-third of the population size of the largest place in the region;
- **tri-polar metropolitan areas**: the size of the third-largest place is at least half of the population size of the largest place in the region, and the region does not qualify as multipolar;
- **bi-polar metropolitan areas**: the size of the second largest place is at least two-third of the population size of the most populous place in the region, and the region does not qualify as multipolar or tri-polar.

The three steps produced a yield of 22 metropolitan area displaying evidence of polycentrism: 15 bipolar metropolitan areas, three tri-city metropolitan areas and four multipolar metropolitan areas[iv]. However, data limitations forced us to part with 12 of them. The occupational data used in our analyses is only available for geographical areas with more than 100,000 inhabitants. This means that we could not include in our analyses those areas where one of the principal cities has less than 100,000 inhabitants.

The resulting ten case-study areas are presented in Table 1, where they are named after their major cities (the cities focused on in the analyses), as well as by their unofficial 'nickname'. The fact that all these regions have nicknames indicates that they are more

widely (i.e. not only by us) seen as showing some degree of coherence, or that some degree of coherence is aspired to. It means that the regions are to certain, though probably varying degrees institutionalized, and that our selection process has not been without sense.

Table 1. U.S. Polycentric Metropolitan Areas analysed.

Polycentric Metropolitan Area	(nick)name	Polarity	Spatial scale of analyses
Baltimore - Washington, DC-MD-VA-WV	"Baltimore Washington Metroplex"	Bi	City and MSA
Dallas - Fort Worth, TX	"Metroplex"	Bi	City and MSA
Greensboro – Winston-Salem, NC	"Piedmont Triad"	Bi	City
Miami-Fort Lauderdale, FL	"South Florida"/"Gold coast"	Bi	City and MSA
Midland – Odessa, TX	"Petroplex"	Bi	City and MSA*
Minneapolis – St. Paul, MN-WI	"Twin Cities"	Bi	City
Raleigh - Durham, NC	"(Research) Triangle Region"	Bi	City and MSA
San Jose - San Francisco, CA	"SF Bay Area"	Bi	City and MSA
Tampa – St. Petersburg, FL	"Tampa Bay Area"	Bi	City
Virginia Beach – Norfolk – Chesapeake – Newport News, VA-NC	"Hampton Roads"	Multi	City

* City boundaries and MSA boundaries are congruent.

Data on occupational standing and top-level jobs were collected at the city-level (that is, the level of incorporated places) and at the MSA-level where appropriate. As we are interested in differences between the MSAs making up a CSA, we could not do the analysis at the MSA-level for all polycentric metropolitan areas since some are made up of just one MSA. Even when CSAs were made-up of multiple MSAs, sometimes we found that the major cities were located in the same MSA (e.g. Dallas-Fort Worth, Minneapolis-St. Paul), making a comparison between the MSAs not useful. However, data at the place or city-level was available for all areas in Table 1 and it is therefore that our analyses will primarily focus on the place or city-level. The analyses at the MSA-level yields, however, quite similar results, making the results of our analyses more robust. The main findings of the analyses at the MSA level are presented in Appendix A.

Occupational data and the study of urban hierarchies

Analyses of specializations of cities are often based on sectoral data (see e.g. Kloosterman and Lambregts, 2001; Hall and Pain, 2006; Meijers, 2007c), but as Duranton and Puga (2005) have convincingly shown, cities nowadays specialize by function rather than by sector. For practical reasons (i.e. easy availability of data) functions of cities most of the time are still proxied with sectoral employment data. However, for several reasons occupational data is to be preferred over sectoral data when analyzing functions of cities. The main reason is that since the late 1970s and 1980s, many firms have switched to different organizational models in which different functions, such as physical production, administration, marketing and sales, research and development (R&D), and strategic management and control, were separated and to various degrees relocated in space. Functions, or different parts of the value chain, were located in places where returns on investments were expected to be largest (Kim, 1999). Manufacturing firms entered this road first, but from the 1980s and early 1990s, producer services firms followed suit. A new economic geography emerged, with some places specializing in manufacturing, others in R&D functions, again others in back-office functions and again others in global or regional command and control functions (e.g. Garreau, 1992; Storper, 1997; Sassen, 2001). Sectoral employment data is not the most suited to reveal these specializations, but occupational data is. Another advantage of occupational data over sectoral employment data is that it is easier from the former to derive a sense of hierarchy between places. Deriving a sense of hierarchy on the basis of sectoral data is a rather arbitrary affair (on

which reasonable grounds could one put one sector on top of another?), but jobs can be more easily associated with rankable attributes, such as the prestige associated with a particular type of job, the educational level required for performing that job and the wages paid for it. These can be used to rank jobs and hence, since we know where the jobs are located, to infer urban hierarchies from.

A major source of occupational data in the U.S. is the decennial Census, and from 2000 on, the yearly American Community Survey (ACS). For this paper, we used Census and ACS occupational data made available through the IPUMS-project (Integrated Public Use Microdata Series) (Ruggles et al., 2008). This project is to be credited not only for making micro-data conveniently available but also for harmonizing data across time and across samples, thus enabling excellent comparisons over time. In this paper, we use the 5% State samples for the 1980, 1990 and 2000 Censuses (a 1-in-20 national sample of the population) and the 1-in-100 ACS samples of 2005, 2006 and 2007. The latter were aggregated to create a reasonable match with the 1-in-20 census samples in terms of the number of respondents. Older Census data were not used because these do not record place-of-work. The 1980-2007 period covered by our data, largely coincides with the already mentioned transition from an industrial to a post-industrial economy and with the emergence of functional rather than sectoral specializations of cities. Our database contains just over 1,7 million individual respondents for all four reporting years together. All of them are employed in the selected cities and MSAs and between 16 and 65 years of age.[v]

Occupational standing variables

Occupational codes can be scaled according to external criterions so as to turn occupation into a measure of prestige or socioeconomic standing. If, at the same time, the jobs are tied to geographical locations, it is possible to determine where top-level jobs are located. The IPUMS samples include various harmonized occupational standing variables. These are based on consistent occupational coding schemes and are therefore comparable across the four years studied. In this paper we employ five such variables.[vi] Three of these - prestige, education and earnings - present a single dimension. The other two are composite measures, which combine either prestige, education and earnings (Hauser and Warren) or just earnings and education (Nam Powers Boyd). The variables involving prestige all build on the 1989 General Social Survey in which prestige was related to occupations. In result, these variables have similar scores for occupations across all censuses. The other three variables are recalculated for each census/ACS year. Each type has its advantages. Those that build on the 1989 scores describe very well the shifts in occupational structure, whereas the others offer a refined indicator for the shifts in skills and financial rewards associated with each occupation category.

- Nakao-Treas Prestige Score: The Nakao-Treas Prestige Score is based on prestige assessments assigned by Nakao and Treas, using data from the 1989 General Social Survey (Nakao and Treas, 1994). Respondents were asked to evaluate "social standing" of occupations in this survey. The prestige score is a weighted average of ratings received by each occupation. Prestige scores can range from 0 (lowest prestige) to 100 (highest prestige). The score is the same for occupations across the years analyzed.
- Occupational Education Score: The Occupational Education Score indicates the percentage of persons in each occupation with one or more years of college education. Values obviously can range from 0% to 100%. The scores can vary across census years reflecting changes in the skills needed to perform a certain occupation.
- Occupational Earnings Score: The Occupational Earnings Score represents the median earned income of persons in each occupation. The scores can vary across census years for a given occupation. In order to maximize comparability over time, the median earned income was standardized as a "z-score" and then converted to a percentile rank. The Occupational Earnings Score reports the percentage of persons in occupations having lower standardized median earnings than the respondent's occupation. Thus values range from 0 to 100%.
- Hauser-Warren Socioeconomic index: The Hauser and Warren (1997) Socioeconomic index is a composite measure of occupational standing based upon the earnings and

education attainment associated with each occupation. The index is a weighted sum of the occupational income/earnings and education, in which the weight is determined by regressing prestige ratings on occupational income/earnings and education. Education and earnings data from the 1990 census and the occupational prestige ratings of the 1989 General Social Survey were used. The scores are the same for a given occupation across all census years and vary in our sample from 7 to 80.

- Nam-Powers-Boyd occupational status score: Also the Nam-Powers-Boyd occupational status score is a composite measure of occupational status based upon the median earnings and median educational attainment associated with each category in the occupational scheme (Nam and Boyd, 2004). Contrary to the Hauser and Warren index, earnings and education are given an equal weight and prestige is not included. The score can be interpreted as the percentage of persons in the civilian labor force who are in occupations having combined levels of education and earnings below that occupation. The scores therefore vary from 0 to 100.

3. Evolution of occupational standing of jobs

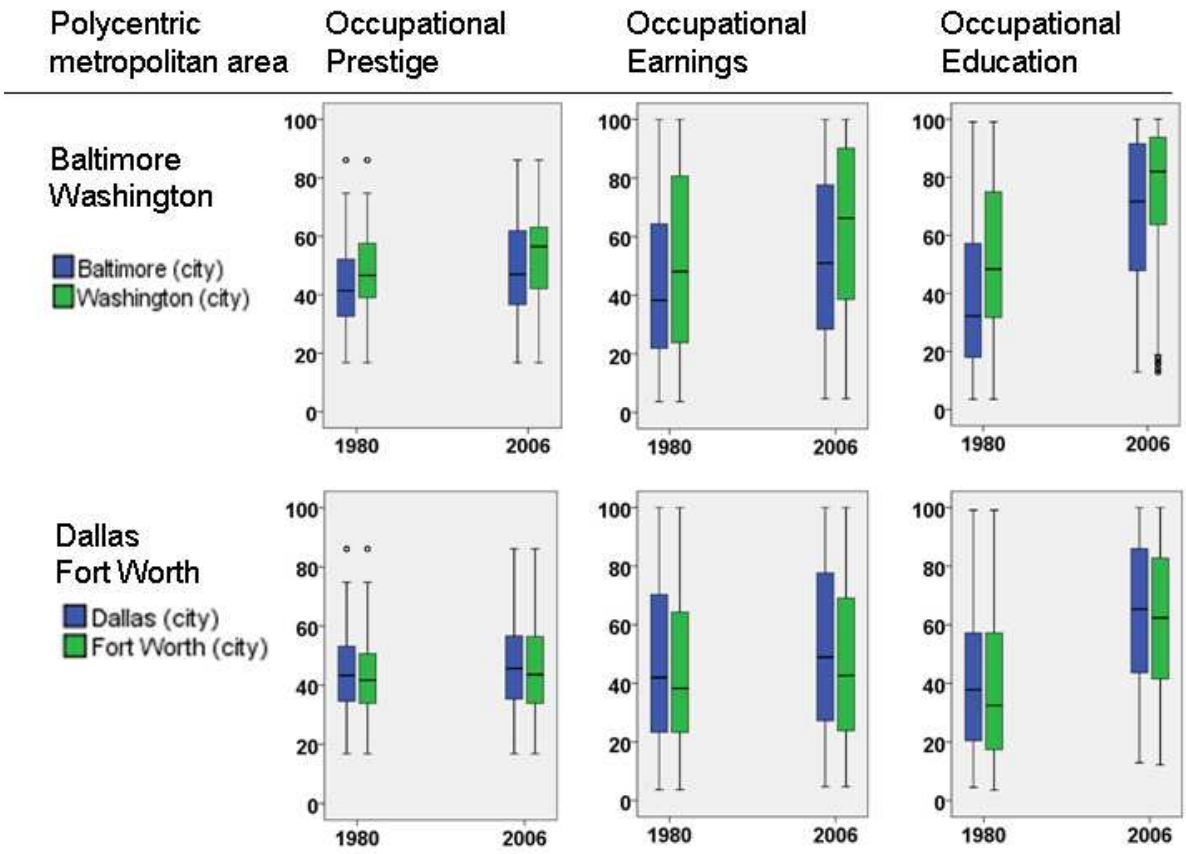
In this section we explore shifts in hierarchies between cities in the ten polycentric metropolitan areas selected. We use the occupational standing of the jobs in these cities as an indicator. Obviously, if a city accommodates jobs of considerably higher standing than its more or less equally-sized neighbour, this city apparently provides higher-order functions than its neighbour and hence can be seen as the leading city in the area. Below in Figure 1, we first look at boxplots[vii] presenting median values and the dispersion of the data around these median values, and examine how these have evolved between 1980 and 2006. In addition, Table 2 presents the mean occupational standing of jobs in cities and their development over time, and it is indicated whether or not these means differ significantly. These data describe the evolution of occupational standing in great detail. Figure 1 displays the evolution between 1980 and 2006 of occupational standing based on the three main variables: occupational prestige, occupational earnings and occupational education. In addition, Table 2 presents the two composite measures of occupational standing. Moreover, it does so for all four years analyzed (1980, 1990, 2000, 2006) and hence provides more detail on the trends.

The information in Figure 1 is grouped on the basis of the type of development that has taken place in each of the ten polycentric metropolitan areas studied. On the basis of the evolution of occupational standing, we can discern polycentric metropolitan areas with:

1. Stable hierarchies (Figure 1a)
2. Shifting hierarchies (Figure 1b)
3. Absent hierarchies (Figure 1c)
4. Emerging hierarchies (Figure 1d)

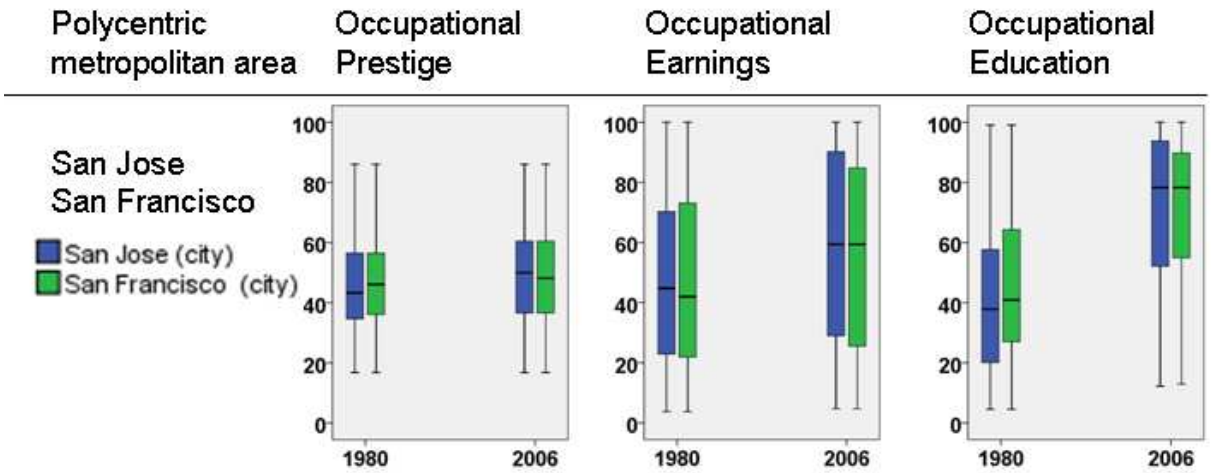
Of the ten polycentric metropolitan areas analyzed, Baltimore-Washington and Dallas-Fort Worth are, with one exception, the only ones that already saw a clear hierarchy between their cities in 1980. Figure 1a shows that this hierarchy has remained in place. Jobs in Washington in 2006 still have a much higher occupational standing than those in Baltimore. This also holds for Dallas when compared to Fort Worth, although here the differences are more modest and the hierarchy therefore less outstanding.

Figure 1a. Stable hierarchies.



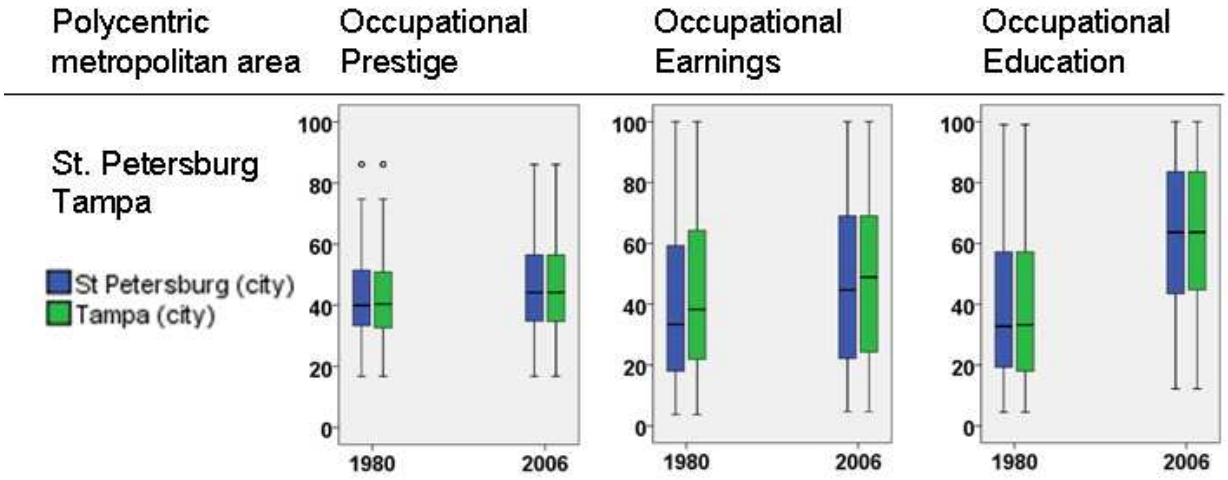
The San Francisco Bay Area is the only other region characterised by a clear hierarchy already in 1980. However, in contrast to what happened in Baltimore-Washington and Dallas-Fort Worth, here the city that led in 1980 - San Francisco – over time has lost its leading position (Figure 1b). San Jose has come to rival San Francisco on each of the three indicators and, as we will see below (Table 2), on the basis of the composite measures even outstrips the 'City by the Bay'.

Figure 1b. Shifting hierarchies.



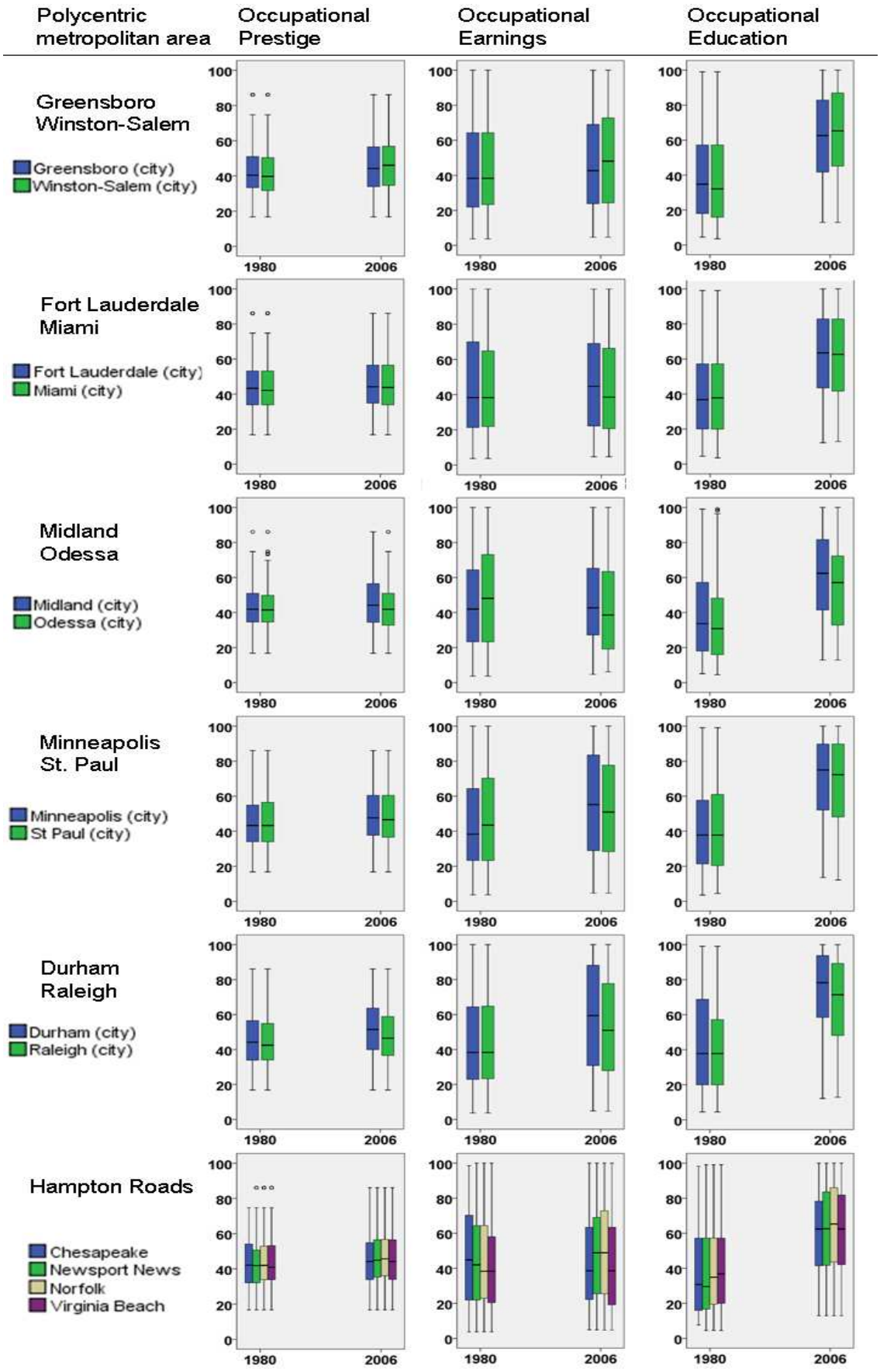
The other seven case study areas have in common that they lacked a leading city in 1980. None of the cities in these regions stood out from their neighbours in terms of occupational standings and as such represented a true reflection of the – currently – prevailing image of a fusion-type polycentric metropolitan region. In 2006, only the Tampa Bay Area still lacks a clear sense of hierarchy. As Figure 1c shows, in 1980 Tampa did a little better in terms of occupational earnings, but this difference slightly decreased in 2006, whereas in terms of prestige or educational level required the situation was very equal in both 1980 and 2006.

Figure 1c. Absent hierarchies.



However, the Tampa Bay Area seems to be the exception to the rule as in all other polycentric metropolitan areas lacking a clear hierarchy in 1980, there have emerged new hierarchies in 2006. Figure 1d shows that in each of these regions, there has come up one city with – to varying degrees - higher median occupational standings than its neighbour(s). In Greensboro-Winston-Salem, jobs of higher standing are nowadays more prevalent in Winston-Salem than in Greensboro. Fort Lauderdale outperforms Miami in the Miami-Fort Lauderdale region, thanks to better earnings notably. The same goes for Midland in the Midland-Odessa region, where earnings in 1980 were still lower than in Odessa, but that is now well ahead, also in terms of prestige and the educational attainment required for its jobs. In this particular case the emerging hierarchy seems not so much due to strong improvements in Midland, but rather to the loss of prestigious and better-paid jobs in Odessa. Minneapolis and St. Paul in turn, start from a situation where the latter has a slight edge in earnings. However, at present jobs in Minneapolis are of higher standing than in 'twin-city' St. Paul. In the Research Triangle Region, Durham accommodates substantially higher standing jobs in terms of prestige, pay and skills required than Raleigh in 2006, while the situation was – again - very equal in 1980. And in the Hampton Roads region, finally, several cities shared a quite similar standing of jobs in 1980, but in 2006 Norfolk has quite clearly come to stand out, as this is where the highest standing jobs, whether defined by prestige, earnings or education, can be found. Also here, a city as Chesapeake appears to even have lost ground as occupational earnings are concerned. Newport News, in contrast, sailed better as it changed from being the worst performer in the region to becoming second-best. On a more general note, Figure 1 also shows that the educational level required for jobs has risen remarkably across all regions and all cities: an observation that nicely ties in with the rise of a post-industrial, more knowledge intensive economy in the USA during the same period, and with the simultaneous general rise of the educational attainment level of the labour force (Barro and Lee, 2001).

Figure 1d. Emerging hierarchies.



The picture emerging from the above analysis is confirmed when we take a look at the two composite measures of occupational standing employed in this analyses: the Hauser Warren socio-economic index (HWsei) and the Nam-Powers-Boyd (NPB) occupational status score. Table 2 presents the mean values for these two measures (which are composed of various combinations of the occupational standing variables presented above),and also indicates whether the means for the cities in each year differ significantly or not.

The HWsei index and NPB status scores presented in Table 2, clearly show that in 1980 the mean occupational standing scores varied unequivocally only for three of our ten polycentric metropolitan areas (i.e. Baltimore-Washington, Dallas-Fort Worth, and the SF Bay Area). For two regions the indicators produce mixed results. For the Research Triangle Region the HWsei index records significant differences, but the leading position of Durham signalled by the HWsei is not confirmed by the NPB occupational status score. For the Tampa Bay area it is the other way round: the 1980 NPB status score for Tampa is significantly higher than for St. Petersburg, but the HWsei index gives both cities a similar average composite score. All other polycentric metropolitan areas had a balanced distribution of occupational standing of jobs in 1980.

The situation in 2006 is very different. Except for the Tampa Bay Area, all polycentric metropolitan regions now have one city where the occupational standing of the jobs is significantly higher than in its neighbouring city or cities. Table 2 also shows that this transformation took place between 1980 and 1990 in particular. An interesting case is the SF Bay area, where, as noted before, San Francisco was the leading city in 1980, but where San Jose has taken over since the 1990-2000 period. In the Hampton Roads multipolar area, Norfolk is now the leading city, but Newport News is a remarkable runner-up, given that it was the worst performer of the lot in 1980.

From Table 2 also follows clearly that the average values of occupational standing vary considerably across the polycentric metropolitan areas studied. Washington is by all standards the city with the highest standing jobs, while the Hampton Roads and Odessa bring up the rear. An important difference between the latter two is that the situation in Odessa did not improve (the average standing of jobs decreased), whereas it did in Hampton Roads. Cities that saw the occupational standing of their jobs grow considerably include Baltimore, Washington, Winston-Salem, Minneapolis, Raleigh, Newport News and particularly Durham and San Jose.

As noted, polycentric metropolitan areas, especially those of the fusion type, are generally typified as to lack a dominant city as top-level urban functions are supposedly spread more or less evenly over multiple cities. The analyses presented in this section suggest that, beneath the balanced image of such regions, there may be forces at work that either foster the formation of new intra-regional, inter-urban hierarchies or strengthen those that have been latently present for longer times. In nearly all polycentric metropolitan areas analyzed here, hierarchy between the major cities in 2006 is stronger than in 1980. In the next section we extend our analysis and examine how the jobs with the highest standing, i.e. the top-level jobs, are spread over the cities in the polycentric metropolitan areas.

Table 2. Hauser Warren socio-economic index and Nam-Powers-Boyd occupational status score of jobs in polycentric metropolitan areas.

Polycentric metropolitan area	City	Hauser Warren socio-economic index					Nam-Powers-Boyd occupational status score				
		1980	1990	2000	2006	Trend	1980	1990	2000	2006	Trend
"Baltimore Washington Metroplex"	Baltimore	36,0*	38,4*	40,1*	42,0*	16,6	52,3*	54,6*	55,7*	59,5*	13,8
	Washington	42,1*	43,5*	45,2*	47,1*	12,0	62,5*	63,1*	64,3*	69,0*	10,4
"Metroplex"	Dallas	37,1*	38,2*	38,6*	39,5*	6,7	55,3*	54,9*	54,6*	56,9*	2,9
	Fort Worth	35,2*	37,4*	36,9*	37,8*	7,4	52,0*	53,5*	51,0*	53,4*	2,7
"Piedmont Triad"	Greensboro	35,2	35,8*	36,7*	37,8*	7,5	51,6	50,9*	51,3	53,8*	4,1
	Winston-Salem	34,9	37,5*	37,8*	39,2*	12,2	51,4	53,3*	52,2	55,5*	8,0
"South Florida"/"Gold coast"	Miami	36,6	n.a.	36,7*	37,6*	2,6	53,8	n.a.	50,2*	52,8*	-1,9
	Fort Lauderdale	36,1	37,2	37,1*	38,2*	5,7	52,5	52,5	51,1*	54,1*	3,1
"Petroplex"	Midland	35,7	37,3*	36,5*	37,3*	4,5	52,5	52,4*	50,3*	53,1*	1,1
	Odessa	34,9	34,6*	34,7*	34,6*	-0,9	53,0	49,0*	47,6*	48,5*	-8,4
"Twin Cities"	Minneapolis	37,3	39,5*	41,4*	42,5*	13,8	54,9	56,3*	58,2*	61,2*	11,5
	St. Paul	37,7	38,4*	40,0*	41,5*	10,0	55,5	54,9*	56,1*	59,6*	7,4
"(Research) Triangle Region"	Raleigh	36,6*	38,2*	38,7*	41,0*	12,1	53,9	54,6*	54,2*	59,0*	9,4
	Durham	38,0*	40,6*	43,1*	44,5*	17,0	54,8	58,2*	61,2*	64,4*	17,6
"SF Bay Area"	San Francisco	39,3*	39,9	41,6*	42,5*	8,3	57,7*	57,1*	58,9*	61,3*	6,4
	San Jose	37,4*	40,2	42,0*	43,2*	15,5	54,8*	58,2*	60,2*	63,0*	15,0
"Tampa Bay Area"	Tampa	35,3	36,6*	37,7*	38,7	9,6	51,6*	51,6*	52,2*	55,2	6,8
	St. Petersburg	35,3	36,2*	37,2*	38,4	8,8	50,1*	50,7*	51,2*	54,6	8,9
"Hampton Roads"	Virginia Beach	$36,2^{a}$	36,6	$37,0^{a}$	$37,4^{a,b}$	3,3	51,6	$51,2^{a}$	$50,5^{a,b}$	$52,3^{a,b}$	1,3
	Norfolk	$36,3^{b}$	$37,2^{a}$	$38,4^{a,b,c}$	$39,7^{a,c}$	9,5	$53,2^{a}$	$53,1^{a,b}$	$53,2^{a,c}$	$56,2^{a,c}$	5,7
	Chesapeake	35,9	$35,6^{a}$	$36,3^{b}$	$37,0^{c,d}$	3,1	52,3	$50,2^{b,c}$	$49,9^{c,d}$	$51,8^{c,d}$	-0,9
	Newport News	$34,8^{a,b}$	36,4	$37,3^{c}$	$38,7^{b,d}$	11,2	$50,5^{a}$	$52,3^{c}$	$51,9^{b,d}$	$54,8^{b,d}$	8,5

* indicates statistically significant difference of the mean between the two cities (T-test; *p<0.01)
Multipolar Hampton Roads metropolitan area: a, b, c, d, indicate pairs with statistically different means (Bonferroni, p<0.01).

4. Distribution of Top-level jobs over the Cities (LQs).

There is much to learn about inter-urban hierarchies and leading cities from the distribution of top-level jobs in a metropolitan area. In this section we therefore take another look at our ten polycentric metropolitan areas and examine where the top-level jobs are located. Our approach is as follows. For each metropolitan region we defined the 20% of all jobs with the highest occupational standing[viii] on each of our five occupational standing variables. This implies that what are defined top-level jobs differs between the ten case studies areas: for instance: the 20% most prestigious jobs in the Baltimore-Washington Metropolex are different from the 20% most prestigious in the Midland-Odessa Petroplex area and so on. Likewise, the 20% most prestigious jobs in a metropolitan area are not necessarily the same as the 20% best-paid jobs or the 20% jobs requiring the highest educational attainment levels. For each city we calculated its share of the highest standing jobs relative to the total number of such jobs in all cities of the metropolitan area studied, taking into account the distribution of all jobs over the two cities. The common measure for this is the Location Quotient:

$$LQ_{hos} = (e_{hos}/e) / (E_{hos}/E)$$

where,

LQ_{hos} = location quotient for jobs that belong to the highest standing occupations in the city

e_{hos} = number of jobs belonging to the 20% highest occupational standing jobs in the city

e = total number of jobs in the city

E_{hos} = total number of jobs belonging to the 20% highest occupational standing jobs in all major cities of the metropolitan area

E = total number of jobs in all major cities of the metropolitan area

The results allow for easy interpretation. If $LQ_{hos}<1$, top-level jobs are underrepresented in the city compared to the area as a whole. If $LQ_{hos}=1$, the top-level jobs are spread evenly over the cities in the polycentric metropolitan area, taking into account the size of their labour markets. A value of $LQ_{hos}>1$ indicates that top-level occupations are overrepresented in that city. Obviously, the larger the LQ_{hos}-value is for a particular city, the more top-level occupations are concentrated here. Hence, a substantial difference in the LQ_{hos} values for a set of cities, points at the existence of a hierarchy between these cities. We calculated the LQ_{hos} for all cities, for all four years studied, and for all our five variables. Figure 2 presents the distribution of the 20% most prestigious, best-paid and most-skilled jobs over the cities in a polycentric metropolitan area over time, plotting the LQ_{hos}-value for 2006 against the value for 1980.

Figure 2. Evolution of the distribution of a) the most prestigious, b) best-paid and c) most-skilled jobs within polycentric metropolitan areas.

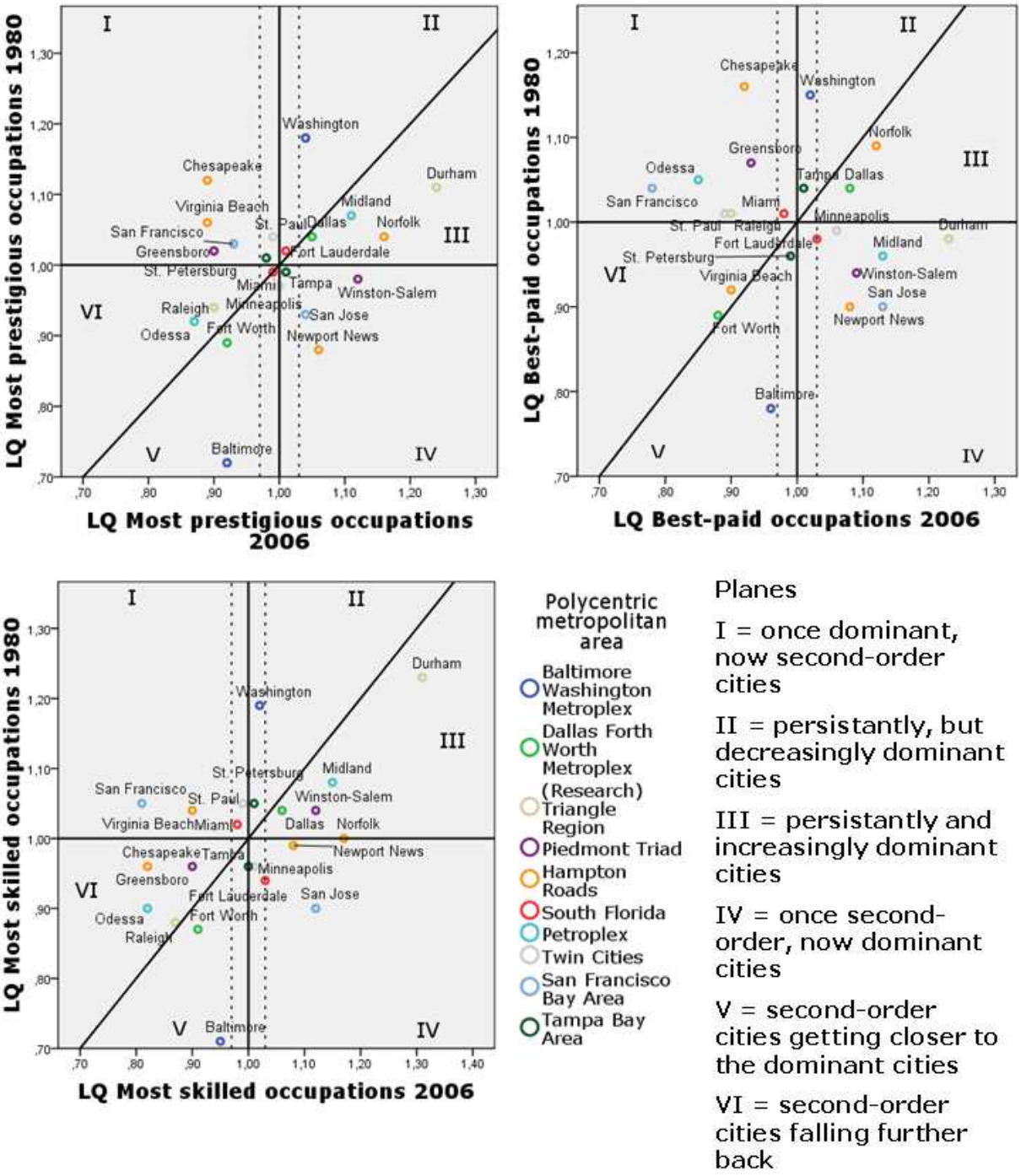


Figure 2 should be interpreted as follows. Cities located on the right side of the diagonal in the Figures 2a, 2b and 2c saw their concentration of jobs of high occupational standing increase over the 1980-2006 period. The contrary obviously holds for cities on the left-hand side of the diagonal. A position on, or close to the vertical axis at the LQ_{hos} = 1 value means that the city in question has about the number of jobs with high occupational standing one would expect given the size of the local labour market and expecting a balanced distribution between the cities. The two dotted vertical axes at the LQ_{hos} = 0.97 and LQ_{hos} = 1.03 value represent our self-defined limits within which we consider the difference between two or more cities belonging to the same metropolitan area to be too small to proclaim a hierarchy

between them - in 2006.. This holds for the two polycentric metropolitan areas in Florida (Miami – Ft. Lauderdale and the Tampa Bay area), and for the Twin Cities (with the exception of the best-paid jobs, which have increasingly concentrated in Minneapolis). Similarly, the vertical axis at $LQ_{hos} = 1$ for 1980, indicates a perfectly balanced distribution in 1980. Cities situated substantially above this line (we again apply a threshold of 1.03) were leading in 1980, while those situated substantially below (value < 0.97) were second-order.

The vertical and horizontal axes and the diagonal divide each figure in six planes, with the help of which we can characterize the evolution and current position of each city relative to its neighbour(s). Cities that lost a dominant position appear in plane I (i.e. San Francisco; Virginia Beach; Cheasapeake; St. Paul; Greensboro and Odessa when it comes to earnings). Cities located in plane II are still leading, but saw their dominance decline (Washington). Cities in plane III are also leading, but got more ahead of their neighbouring cities (Durham; Midland; Norfolk; Dallas). Plane IV contains the cities that bettered themselves. These are the new leading cities of their respective metropolitan areas (Winston-Salem; San Jose; Newport News). In plane V we find cities that have continued to lag behind their neighbouring city, but that have been busy catching up (Baltimore; Forth Worth to some extent). And finally, plane IV contains the cities that were already of secondary importance in their metropolitan area in 1980 and that witnessed a further deterioration of their position (particularly Odessa).

Raleigh provides an interesting case. In relative terms it is clearly outstripped by its neighbour Durham. However, in absolute terms it has about 65% more top-level jobs than Durham. Even though this used to be 85% in 1980, it might be not as secondary in the region as our results show. In all other polycentric metropolitan areas the leading city has also more top-level jobs in absolute terms. It shows that it is often but not necessarily the largest city (measured by the number of top-level jobs) that leads the region.

It may also be hard to conceptualize San Francisco as a second-order city in the SF Bay Area given its culturally and historically leading position in the region. Yet, it cannot be denied that the most prestigious, best-paid and most-skilled jobs are nowadays more concentrated in San Jose than in San Francisco. It is a clear demonstration of the rapid growth this part of the Bay Area has seen in the past 25 years or so.

A close examination of the evolutionary trends in the three types of occupational standing reveals slight differences when it comes to the positioning of cities. Most notably, cities that lag behind in terms of prestige or skills (education) are or have been sometimes leading in earnings (Raleigh; Greensboro; Odessa). An interesting general observation is that in 1980 prestige was more correlated with the educational attainment required for jobs (.87) than was prestige with earnings (.71). The correlation between prestige and earnings has risen by 2006 (.81), while education became slightly less strongly linked to prestige (.85). One does not necessarily need to have a higher education to be better-paid, though it helps, particularly in 2006 (.76 versus .57 in 1980).

Interestingly, when the cities of a metropolitan area are located in planes II and V this means that the hierarchy between them has been diminishing. This only holds for the Baltimore-Washington metroplex and, to a lesser degree, the Dallas-Fort Worth Metroplex (although not when earnings are concerned). However, these appear exceptions to the rule. When cities are located in plane I, III, IV and VI, this means that hierarchies within the polycentric metropolitan areas they are part of are deepening. Most cities are positioned in one of these planes. With the exception of the two metropolitan areas in Florida, and bearing in mind that differences between Minneapolis and St. Paul are not very substantial yet, all other polycentric metropolitan areas are characterized by a more profound hierarchy in 2006 than in 1980. Top-level jobs therefore seem to have a tendency to concentrate in one of the cities in a polycentric metropolitan area. These findings are underlined by the findings on the evolution of the distribution of jobs with the 20% highest scores on our composite measures of occupational standing, as can be seen in Table 3.

Table 3. Spread of the 20% most prestigious, most skilled and best paid jobs over the cities of the polycentric metropolitan areas in 1980, 1990, 2000 and 2006 (Location quotients).

Occupational standing		Hauser Warren Socioeconomic index (Prestige, Earnings, education)				Nam Powers Boyd (Earnings, education)			
	Year	1980	1990	2000	2006	1980	1990	2000	2006
Baltimore-Washington Metroplex	Baltimore	0.7	0.76	0.81	0.94	0.66	0.66	0.66	0.67
	Washington	1.2	1.13	1.09	1.03	1.22	1.18	1.16	1.16
Metroplex	Dallas	1.04	1.02	1.07	1.07	1.05	1.03	1.11	1.1
	Fort Worth	0.88	0.95	0.87	0.89	0.86	0.94	0.80	0.84
Piedmont Triad	Greensboro	1.03	0.92	0.91	0.9	1.05	0.92	0.94	0.96
	Winston-Salem	0.97	1.09	1.10	1.12	0.96	1.09	1.07	1.04
South Florida	Miami	1	n.a.	0.99	0.99	1.01	n.a.	0.99	0.98
	Fort Lauderdale	0.99	n.a.	1.01	1.02	0.98	n.a.	1.02	1.02
Petroplex	Midland	1.1	1.18	1.12	1.14	1.08	1.19	1.11	1.13
	Odessa	0.87	0.82	0.86	0.83	0.89	0.81	0.97	0.84
Twin Cities	Minneapolis	0.97	1.05	1.04	1.03	0.96	1.03	1.07	1.04
	St. Paul	1.04	0.92	0.93	0.95	1.05	0.95	0.89	0.93
(Research) Triangle Region	Durham	1.06	1.21	1.36	1.29	1.03	1.17	1.35	1.27
	Raleigh	0.97	0.89	0.85	0.88	0.98	0.91	0.85	0.89
SF Bay Area	San Francisco	1.06	0.94	0.82	0.79	1.07	0.89	0.86	0.81
	San Jose	0.87	1.04	1.11	1.13	0.85	1.07	1.08	1.12
Tampa Bay Area	Tampa	0.98	1.02	1.02	1.01	1.01	1.02	1.02	1.01
	St. Petersburg	1.02	0.98	0.98	0.99	0.99	0.98	0.98	0.99
Hampton Roads	Virginia Beach	1.06	0.98	0.94	0.91	1.1	1	0.95	0.88
	Newport News	0.88	0.95	0.98	1.06	0.88	0.95	0.98	1.07
	Chesapeake	1.16	0.95	0.91	0.85	1.09	0.93	0.94	0.89
	Norfolk	1.04	1.06	1.12	1.16	1.03	1.05	1.10	1.17

The composite measures of occupational standing in Table 3 summarize our findings on the distribution of the most prestigious, best-paid and most skilled jobs. Again we see increasing hierarchies between cities in seven polycentric metropolitan areas, two without clear hierarchies and one region in which the hierarchy has become less, but is nevertheless present. What Table 3 adds to our analysis is the more detailed time series considered. Most polycentric metropolitan areas show a consistent trend. For instance, Baltimore is steadily getting closer to Washington, and Norfolk has constantly increased its dominance. Some regions show a general trend that fluctuates slightly. For instance, Fort Worth got closer to Dallas in terms of its share of top-level jobs in throughout the 1980s, lost some ground in the 1990s, and slightly improved its position again after 2000. Likewise, Odessa bettered its position in the 1990s, but lost out to its neighbour Midland in all other periods. St. Paul, Raleigh and Newport News, in turn, since 2000 seem to be recovering some of ground that was lost in the two decades preceding the turn of the century. Generally, the magnitude of change was substantially higher in the 1980-1990 period than in the other periods.

5. Making sense of shifting fortunes and changing hierarchies

So while fusion-style polycentric metropolitan areas are often quoted to represent 'balanced' regions where functions are to a considerable degree equally distributed among the

constituent urban centres and where hierarchical relations between these urban centres are either largely absent or weakening, the above analyses into patterns of urban specialization on the basis of functional employment characteristics, have produced a much more variegated and dynamic picture. All but one of the ten North American fusion-style polycentric metropolitan areas studied, appear to be characterized by varied degrees of intraregional, inter-urban hierarchies, and in all but three areas these hierarchies over the past 25 years have been subject to movement, with the main direction being into the *strengthening* of hierarchies rather than into weakening. These findings may be labelled striking, or at least in contradiction with prevailing images and beliefs.

The next big question is of course: how come? Which factors determine the relative rise of one city and the – again relative – decline of another in fusion-type polycentric metropolitan areas? Or, to be more precise and tailor the question to our analysis: which factors or forces have led some cities over the past 25 years to accumulate top-level jobs (measured by prestige, earnings and required skills) at a faster rate than their neighbours forming part of the same polycentric metropolitan area?

In our attempt to give a beginning of an answer, the literature provides a helping hand. Among economic geographers and regional scientists, consensus is growing that a sound understanding of regional development and change requires the consideration of regional assets and intra-regional dynamics on the one hand and the impact of global circulations and extra-local dynamics, on the other. They are the focus of an extensive body of literature (often filed under labels such as 'new regionalism' or the 'new economic geography') that has emerged over the past two decades or so and that heralds, observes and substantiates the re-appreciation of (city-)regions as foci of economic development (e.g. Hall, 1997; Storper, 1997; Scott, 1998; Brenner, 2002; Wheeler, 2002; Phelps and Ozawa, 2003; Sassen, 2007; etc.). In order to gather some clues about the possible factors and forces at work in the ten polycentric metropolitan areas studies above, it is worth recapitulating its main line of argument.

In line with our own empirical analysis, most contributors to the debate on contemporary logics and dynamics of economic organization at the regional scale take a long-term perspective and see the emergence of a new international division of labour back in the 1970s as a starting point and key trigger of/for the urban and regional changes that the world has witnessed since then. It was in the 1970s that many western economies got introduced to the process of de-industrialization, and notably cities characterized by an industrial monoculture began to lose much employment and, seemingly, even their raison d'être (cf. Le Galès, 2002). Decline, however, after a while was followed by recovery when the rise of a number of 'post-industrial' economic activities (e.g. knowledge-intensive services, high-tech industries and cultural industries) in many places started to make up for the job losses incurred. The same combination of technological, regulatory and institutional changes that had enabled the development of a new international division of labour in the first place, continued to facilitate and boost international transactions and trade. Across the world, new arenas of production and consumption emerged and so contributed to the further expansion of what was becoming an increasingly global economy (Held et al., 1999). For many western economies this meant, on the one hand, that competition in notably the low value-added and standardised production segments of the economy only got more intense, but on the other, that new markets continued to present themselves for the more knowledge-intensive and high value-added products in which these economies started to specialize.

As for the spatial outcomes, most observers now agree that globalization and the post-industrial transformation push the regional level to the forefront and foster the formation of large city-centred or even polycentric regional arenas of production and consumption (Scott et al., 2001; Phelps and Ozawa, 2003; Hall and Pain, 2006; Scott, 2008). According to for instance Scott et al. (2001), it is notably the combination of both strong externalities and high heterogeneity of transaction costs that drives the formation of such large (polycentric) city-regions. They argue that since the 1970s, vast parts of the economy have come to operate under conditions of increasing uncertainty as production technologies change rapidly, competition has become more intensive, and demand less predictable. The resulting

de-standardization of production processes (enabled by computerization) and the search for greater product variety (both supply and demand driven) have triggered a shift toward more flexible modes of economic production and organization (Scott et al., 2001). Firms that face such conditions (to be found notably in today's leading sectors such as high-tech industries, business services, and a wide range of cultural industries), respond by organizing their production activities and their relationships with clients and suppliers (including employees) in highly flexible ways. This implies that they must have excellent, almost instant access to a wide variety of resources (including information and skills), which in turn requires relational and often also spatial proximity to the sources. These two forms of proximity (i.e. relation and spatial), which go often but not necessarily always hand in hand, facilitate the transfer of non-codified forms of knowledge and information and help to reduce search costs for all actors involved (i.e. suppliers, consumers, labour, etc.). Such benefits, finally, are a strong incentive for actors to co-locate and, hence, an important stimulus for the formation of dense urban and regional nodes (Storper, 1997; Gordon and McCann, 2000; Scott, 2008).

This is, however, just one part of the story. According to many 'new regionalist' scholars, the post-industrial transformation and the introduction of more flexible modes of production have thus not taken away, but reinforced particular incentives for co-location among economic actors. This, in spite of the fact that in the same past 25 years, the costs of several modes of transport and communication have drastically declined (e.g. long-distance shipping, telephone conversations, data transport, money transfers) and that in some cases at least, speed and reliability have significantly improved. Admittedly, these improvements have not really affected the costs of transactions involving face-to-face contact (these have remained relatively high and still tend to rise steeply as distance increases), but they do have enabled firms to sell their products on distant but increasingly accessible markets, to tap into faraway sources of low-cost inputs more easily, and to spatially unfold their production chains in search of better returns on investments. As a result, these firms and, concomitantly, the cities and regions they are located in, have become inserted in various kinds of supra-regional or global networks of intra- and inter-firm exchange, which also means that their fortunes have become at least in part dependent on the impacts of global circulations and extra-regional dynamics. An important addition is that the interplay between the local economy and the supra-regional or global networks of competition and exchange is strongly subject to increasing returns, and the regions, and within these regions the cities that are best endowed in these respects can, therefore, emerge as the 'essential spatial nodes' and 'engines' of today's global economy (Amin, 1998; Scott et al., 2001; see also Simmie, 2002, 2003; Bathelt et al., 2004; Coe et al., 2004, 2008; Cumbers and MacKinnon, 2004; OECD, 2006; Dewar and Epstein, 2007; Lang and Knox, 2008; Yeung, 2009).

Explanations for shifting fortunes

From the above we may derive two sets of clues as to why some of the cities in our case study areas over the past 25 years have accumulated more top-level jobs (measured by prestige, earnings and required skills) than their neighbours. The first set originates from the proposition that globalisation and the post-industrial transition have induced a new spatial-economic logic that fosters the formation of dense and in many cases polycentric urban and regional nodes or metropolitan areas. Following Sassen (2007), we may safely assume that such areas are home to multiple types of agglomeration economies. According to Kloosterman and Lambregts (2007) the latter concern notably urbanization economies and localization economies, with urbanization economies referring to the advantages arising from scale, diversity and spatial concentration and localisation economies signifying the benefits associated with specialisation and spatial concentration of like firms. Fusion-style polycentric metropolitan areas in particular, should in addition to these, also be susceptible to so-called 'economies of borrowed scale' (Phelps and Ozawa, 2003). As noted, these are likely to occur when the spheres of influence of nearby located cities start to interfere and when their functions and inhabitants begin to benefit from having access to more potential suppliers, customers, employers or employees. In such cases, cities, as it were, start to

'borrow size' from each other (Alonso, 1973; Phelps and Ozawa, 2003; Meijers and Burger, 2009), giving the inhabitants and economic actors access to greater urbanisation economies than would have been the case otherwise. It may be that the dynamic process that follows once cities' spheres of influence start to interfere, is characterised by increasing returns. A city that enters this process with a particular advantage (e.g. in terms of size [referring to urbanisation economies] or because it is already home to functions or industries that in the period to come will be 'leading' [referring to localisation economies]) may gain quicker and eventually more than its neighbouring cities and hence start to dominate the region (Hypothesis 1). To test this hypothesis, below we briefly examine if there exists a correlation between the size of a city's population in 1980 (a rough proxy for urbanisation economies) and the performance of the same city in attracting high-level jobs in the 25 years following.

The second set of clues can be derived from the proposition that regions are not stand-alone entities but plugged into global or supra-regional networks of production, cooperation, competition and exchange. Extra-regional connectivity is, however, seldom equally distributed across regional space, but often concentrated in a limited number of focal points. These may be port or airport cities (gateway cities), but also places with a high concentration of MNC activity, be it headquarter functions or otherwise (Taylor, 2004). It is notably in these places where the global meets the local (and from where effects may spill into the region) and where social and economic dynamics may be more intense, cross-fertilizations more frequent and innovative and value-creating capacities more developed than elsewhere. Throughout history especially such places have – at least temporarily – faired rather well and often better than places lacking external connectivity (Hohenberg and Hollen Lees, 1995). However, history also teaches that fortunes in this respect may change, sometimes even quickly and unexpectedly. During the past 30 years of strong globalization, many new places have emerged as gateway cities or as nexus between the global and the local, often (if not always) for good reasons related for instance to the presence of airport infrastructure, global command and control functions (Sassen, 2001) or more basic global production functions (Coe et al., 2004). Fusion type polycentric metropolitan areas are not exempted from this. It may well be that the process of globalization and its tendency to benefit (as well as create) well-connected places in particular, turns some places in these areas into winners while others stay relatively behind (Hypothesis 2). To test this hypothesis, we should look into the question where 'external connectivity' in the ten polycentric metropolitan areas during the past 25 years has been concentrated and explore how these focal points are linked to (i.e. likely to have contributed to above-average growth of top-level jobs in) the cities that during the same era have outperformed their neighbours. Possible indicators include the presence of (international) gateway functions for passenger transport (airports notably, or high-speed train stations); the presence of preferably supra-regional (that includes global) command and control functions; and the presence of production functions that are part of multinational corporations or otherwise well-developed supra-regional production networks. Here, we just perform a brief check using international airports as an indicator. Examination of the other indicators will follow later.

Shifting fortunes and the population size of cities in 1980

A city that has had a head-start over its neighbour may have been able to accumulate top-level jobs faster or may have seen its average occupational standing rise relatively more. One indication of this head-start is the population size, as size suggests that urbanisation externalities are higher. However, in nine metropolitan areas there is a leading city in 2006, but only three of them were also the largest city in 1980 (measured at the city-level[ix]). In other words, population size in 1980 appears negatively correlated with rising to dominance as most leading cities were smaller in 1980 than their neighbours. More refined analyses of particular advantages of cities at the beginning of this period are however needed.

Shifting fortunes and the location of international airports

Air travel over the past 25 years has expanded enormously. Airports in result have become key facilitators of external connectivity, granting a city or region direct and indirect links

with many other cities and regions elsewhere in the world. Each of the ten polycentric metropolitan areas studied in this paper is home to one or more airports. Often there is one clear 'major' airport for the region. Only in case of Baltimore - Washington, Miami - Fort Lauderdale, and San Jose - San Francisco, there are multiple 'major' airports. In order to see if proximity to the area's major airport helps to explain the 'shifting fortunes' of cities in the ten case study areas, we have located the major airports in each of the areas and confronted the results with the findings presented in sections 3 and 4 (Tables 2 and 3 notably). The result is presented in Table 4.

Table 4. leading cities and the location of the areas' major airport(s)

Polycentric Metropolitan Area	Major airport(s)*	Location of airport(s) in the area**	Area's leading city
Baltimore - Washington	- Washington Int. (IAD) - Baltimore/Washington (BWI) - Washington Nat. (DCA)	- near Washington - central - near Washington	Washington, with Baltimore closing in
Dallas - Ft Worth	- Dallas/Ft Worth (DFW)	- Central	Dallas
Greensboro – Winston-Salem	- Greensboro (GSO)	- near Greensboro	Winston-Salem
Miami-Fort Lauderdale	- Miami (MIA) - Fort Lauderdale (FLL)	- near Miami - near Ft Lauderdale	Ft. Lauderdale
Midland – Odessa	- Midland Int. (MAF)	- central	Midland
Minneapolis – St. Paul	- Minneapolis/St Paul (MSP)	- central	Minneapolis
Raleigh – Durham	- Raleigh/Durham (RDU)	- central	Durham
San Jose - San Francisco	- San Francisco (SFO) - San Jose (SJC)	- near SF - near San Jose	San Jose
Tampa – St. Petersburg	- Tampa (TPA)	- near Tampa	Undecided
Virginia Beach – Norfolk – Chesapeake – Newport News	- Norfolk (ORF)	- central	Norfolk, with Newport News closing in

* Major airports where defined with help of the ACI North America's 2006 ranking of the largest North American Airports measured by passenger traffic (179 airports in total). All airports that: a) appeared in the list; b) are located in one of the areas; and c) existed already in 1980 and have not been relocated since then, were included in the analysis. A quick scan of the airports' respective histories learned that these airports very likely also qualified as the areas' major airports in 1980 and the years following.
** Researched with help of Google Maps

Above all, Table 4 shows mixed results. First of all, in no less than five polycentric metropolitan areas the main airport is very much centrally located, which makes it impossible to argue that the leading cities in these areas might be leading because of their relative proximity to the area's main airport and gateway to the rest of the world. For the other five areas, the picture is far from clear as well. In the Baltimore – Washington area, Washington enjoys better access to the region's three major airports (from which Washington Dulles International offers the best international connections). Washington here is also the leading city, but in spite of poorer access to the airports, Baltimore is gradually closing in. In Greenboro – Winston Salem the major airport is located near Greenboro. However, Winston-Salem is quite clearly the area's leading city. In Miami – Fort Lauderdale, Miami is closest to the area's largest and most international airport, but Fort Lauderdale is, although by a fairly small margin, the leading city. Fort Lauderdale, however, is not deprived of extra-regional connectivity. It does have its own international airport, which, moreover, has been among the fastest growing airports of the USA in recent years. A similar story goes for the Bay area. Here San Francisco enjoys the benefit of being located nearest to the area's largest airport, but at the same time it is San Jose, with its own, considerably smaller but also rapidly growing airport, that qualifies as the leading city. In the Tampa bay area, finally, the airport is located closest to Tampa, but also here this does not translate into a clear leading position for the city vis-à-vis its neighbour St. Petersburg. If the analysis shows something, it would seem as if proximity to a region's major airport is *negatively* related to leadership in terms of top-level functions. The sample, however, is too

small, and results too diffuse to call this claim. However, evidence for a positive relationship (i.e. the effect that was predicted in the original hypothesis) does definitely not follow from this analysis.

6. Conclusion

This paper set out to explore shifts in the fortunes of cities in so-called fusion-type polycentric metropolitan areas (i.e. polycentric metropolitan areas that arise when the spheres of influence of nearby, historically distinct cities of roughly equal size start to interfere). It was triggered by the results of earlier research on the Randstad Holland, an archetypal, fusion-type polycentric metropolitan area. These results suggested that inter-urban hierarchies in this area have recently been strengthening: an interesting finding given that in the literature polycentric spatial development is generally associated with the diminishing of inter-urban hierarchies and polycentric metropolitan areas are often commended for their balanced spatial structure and the absence of leading cities.

To see if the Randstad Holland in this respect represents a unique case or that the observed phenomenon is more widespread, and that, hence, it is opportune to make further differentiations to the concept of polycentric metropolitan areas, ten US polycentric metropolitan areas were put under the microscope. A close look was taken at their internal dynamics and the extent to which they display evidence of shifting hierarchies and new hierarchy formation. This was done by recording if over the past 25-30 years 'top-level' economic functions have tended to concentrate in particular cities in these areas or not. Top-level functions were not defined in the traditional way on the basis of a sectoral classification of firms, but on a much more telling functional classification based on occupations and occupational standing of the work force employed in these cities instead. Two analyses were performed: one to establish whether the average and median levels of occupational standing in the cities making up the polycentric metropolitan areas differ and how these differences over the past 25-30 years have evolved. And another to examine how the areas' top 20% jobs – measured by prestige, earnings or education – are distributed between their main cities and, again, how this distribution has evolved. Both analyses were performed at two spatial scales, so as to account for possible sensitivities of our data in this respect.

The outcomes of the two analyses point in the same direction: except for one, all of the ten polycentric metropolitan areas studied appear to be characterized by varied degrees of intraregional, inter-urban hierarchies. Moreover, and more strikingly, in all but three of these areas, hierarchies over the past 25 years have been on the move, with the main direction being into a strengthening of hierarchies and not into weakening. The case of the Randstad Holland apparently is far from unique, and it seems therefore to be in order to call for a modification of our general understanding of what makes polycentric metropolitan areas so special. Clearly it is too easy to identify the process of polycentric spatial development simply with the diminishing of intra-regional, inter-urban hierarchies. The latter may be true for polycentric metropolitan areas that evolve as the result of a spatial decentralization process originating from a single large city, but the claim does not hold out for polycentric metropolitan areas that result from a fusion-mode or polycentric development. Behind the balanced and non-hierarchical image of fusion-style polycentric metropolitan areas lie hidden complex and sometimes strong functional hierarchies between the cities that moreover more often than not appear to be strengthening rather than weakening.

As to the logical follow-up question 'which factors determine the relative rise of one city and the relative decline of another' in fusion-type polycentric metropolitan areas, the paper has provided some building blocks for an analytical framework and, anticipating further research, performed some preliminary tests. Obviously, any research into this issue should take into consideration regional assets and intra-regional dynamics on the one hand and the impact of global circulations and extra-local dynamics, on the other. Our own preliminary testing of the impact of cities' population size and their proximity to the area's major

airport, as yet did not provide very clear clues. Nevertheless it is clear that here lies one of the major challenges for further research into the particularities of fusion-style polycentric metropolitan areas – one that hopefully will be taken up on both sides of the Atlantic.

7. References

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[i] Metropolitan regions are defined by the U.S. Office of Management and Budget (OMB), and the latest revised version (2007) of the 2000 definitional standards was used. An MSA contains a core urban area with a population of 50,000 or more. It consists of one or more counties and includes the counties containing the core urban area, as well as any adjacent counties of which more than 25% of employed residents work in the urban core. MSAs that are adjacent may be joined in order to form a Combined Statistical Area if the employment interchange is at least 25. Adjacent MSAs that have an employment interchange measure of at least 15 and less than 25 are combined if local opinion favors combination (OMB, 2000).

[ii] Note that by MSA we refer in this paper to Metropolitan Statistical Areas, as Micropolitan Statistical Areas are left out.

[iii] We relaxed this criterion slightly for Florida that is characterized by rapid urbanization after 1950.

[iv] Next to those mentioned in Table x, these include the following bi-polar regions: Allentown-Bethlehem, PA-NJ; Appleton-Oshkosh, WI; Bloomington-Normal, IL; College Station-Bryan, TX; Provo-Orem, UT; Santa Barbara- Santa Maria, CA. It furthermore includes three tri-polar regions: Albany-Schenectady-Troy, NY; Fayetteville-Springdale-Rogers, AR-MO; Palm Bay-Melbourne-Titusville, FL. In addition, there are three other multipolar polycentric metropolitan regions in the U.S.: Hartford-New Britain-Bristol-Middletown, CT; McAllen-Edinburg-Pharr-Mission, TX; Sarasota-Bradenton-North Port-Venice, FL.

[v] As the smallest geographical scale for which IPUMS census data is made available is the 'PUMA' (Public Use Microdata Area) in 1990, 2000 and 2005-7, and the 'county group' in 1980, we grouped the county groups and PUMA's that belong to each place and MSA in each year.

[vi] The reader is refered to the IPUMS website for additional information: http://usa.ipums.org/usa/

[vii] A boxplot graphically displays five statistical measures: the median, the upper and lower quartiles, and the minimum and maximum values. If any, als outliers are indicated.

[viii] Taking the 20% of jobs with the highest occupational standing yields similar results as taking the 10% of jobs with the highest occupational standing.

[ix] The position of Washington might be debated here. The city itself is smaller than Baltimore in 1980, but the metropolitan area is larger. With two exceptions, there was no meaningful data available on the size of the metropolitan areas in 1980, as in the other polycentric metropolitan areas, the constitutent cities were part of the same metropolitan area. Exceptions are Midland-Odessa, TX, and Miami-Fort Lauderdale, but here, the largest city is also located in the largest metropolitan area.

Appendix A. Results at the MSA level.

To be completed.