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DRUID Working Paper No. 07-17

The Geography of the European Creative Class: A Rank-Size Analysis

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August 30, 2007

Abstract:
Using novel statistical data, the paper analyzes the geographical distribution of Richard Florida's creative class among 445 European cities. The paper demonstrates that size matters, i.e. cities with a high proportion of creative class tend to get more creative through attraction of still more creative labor. More specifically, the distribution of the European creative class falls into three phases, each approximating a rank-size rule, with different exponents (i.e., inequality). The exponent for the smallest cities is profoundly more negative than for the middle-sized cities, and this tendency is stronger for the creative class than for the general population. Furthermore, the exponent of the largest cities is slightly less negative than the middle-sized cities, and this tendency is also stronger for the creative class. In order to explain this, the paper presents four propositions about how effects of large and small population sizes of cities may be more detrimental to attracting the creative class than attracting the population in general. Below a population size of approximately 70,000 inhabitants, there is a rapid drop of attractiveness to the creative class with decreasing city size. We propose that this may be because below this size, cities begin to drop below minimum efficient market sizes for particular creative services, below minimum labor market sizes for particular creative job types, and below minimum levels of political representation by the creative class. Above a European city population size of approximately 1,2 million inhabitants, the attractiveness of increasing city size for the creative class drops, and we propose that the creative class may respond particularly adversely to urban congestion.

Key words:
Jel codes:

ISBN 978- 87-7873-246-0

1. Introduction

This paper investigates the size distribution of the creative class among European cities, and proposes explanations for this distribution.

Richard Florida's theory of the creative class (2002a; 2002b; 2002c; 2005a; 2005b) has made a notable impact in both the policy world and among scholars (e.g. Gertler et al., 2002; Andersen and Lorenzen, 2005; forthcoming; Montgomery, 2005; Boyle, 2006; Raush and Negry, 2006; Weick and Martin, 2006). Very simplified, Florida (2002a; 2002b; 2002c) argues that in a globalized economy where innovation constitutes competitive advantage, it is possible to analytically identify a component of the labor force that, by virtue of its technical, social, and/or artistic creativity applied on the job, adds particular economic value. This *creative class* within the labor force has particular preferences for work and private life. In addition to preferences for high-quality housing, work empowerment, and specialized consumption resembling those of highly-skilled labor, Florida is able to demonstrate empirically that the US creative class (which he empirically captures by selected job types) prefers to locate in cities with particular high levels of cultural offers, ethnic diversity and tolerance towards non-mainstream lifestyles (as captured by an array of now somewhat disputed indicators). Florida further claims that as a result of this preference-driven pattern of location of the creative class, diverse and ethnically and culturally rich cities prosper economically, as innovation-intensive films must pursue the creative labor into these cities — a remarkable reversal of the industrial logic of labor-follows-capital. Florida seeks to give credence to this claim by using (even more disputed) indicators for regional economic growth, such as proportion of highly skilled labor and hi-tech industries (for an overview of the critiques of Florida's argument, see Peck, 2005).

Regardless of the political and scholarly disagreements of whether and how the creative class may be important for regional economic growth, Florida has succeeded in demonstrating that a particular and growing group within the labor force has a remarkable location pattern. It is to the analysis of this geography of the creative class, rather than its alleged economic importance, this paper is devoted.

Florida (2002) hints that the distribution of the creative class does not only follow the preferences of the creative class for cultural offers, ethnic diversity and tolerance, it may also be *scale free*. In a scale free distribution, cities do not flock around an average size of the creative class (as they would in a normal distribution), rather, they are organized in a hierarchy where the size of the creative class drops steadily from a few cities with high values to still more cities with small values. This is a kind of distribution that has been observed for many natural as well as cultural phenomena. Famous analyses of such distributions encompass Zip's (1949) analysis of the distribution of words in the English language (a few words score high values (=occur very frequently), many more score much lower) and Pareto's (Reed, 2001) analysis of wealth in European populations (20% of the people hold high wealth values while 80% have relatively low values — the empirical background for sometimes referring to the scale free distribution type as *the 80/20 rule*). Scale free distributions are captured mathematically by estimating the value of each observation as its rank in the hierarchy with a given *exponent*. For example, Zipf (1949) stipulated that

$$P(r) = k*r^{-q}$$

where P(r) is the value (occurrence) of a word in the English language, r is its rank, k is a scaling constant, and q is the exponent of the distribution (inverted in the equation above, as it has a negative value in the rank-size distribution's downward sloping curve).

In a population with a scale free distribution of values, the lower the rank of an observation the higher its value, scaled in a way that is particular for that particular population. In the population, the negative exponent describes the downward slope of the scale free distribution: With an exponent of -1, an observation has double the value of the observation one rank lower, with an exponent of -2, it has four times the value. Because of the relationship between an observation's value (size) and its rank in scale free distributions, they are also called *rank-size* distributions, and the mathematical expression of them is, given the importance of the exponent (the power to which an observation's rank is raised), often called a *power law*. The general explanation for rank-size distributions is Gilbrat's principle of *proportionate growth* (Sutton, 1997)[1]: "Rich beget richer" when not only absolute growth, but also growth rates, are higher for high values.

[1] Strictly speaking, that proportionate growth leads to a rank-size distribution is a *hypothesis* rather than a *causal explanation*: That proportionate growth, ceteris paribus, leads to a rank-size distribution does

It may be only a part of a population that is distributed according to the rank-size rule. For observations with very small values, growth may be non-proportionate (or growth rates may be so neglectable) that these observations conform poorly to the rule. For example, the rarest words in the English language are so esoteric that their use is random and unpredictable. In statistical analysis, observations that have too small values to be a part of the rank-size "system" are often omitted or "cut off" from the analysis in order to get a good fit (Yule, 1924). Other populations may contain different phases, the distribution of all following rank-size rules, albeit with different exponents. For example, among the richest few of Italy's population, wealth may beget more wealth in a much more dramatic way than is the case for the middle class. For such distributions, scholars should not seek to cut off observations that do not fit to the rank-size rule, but in stead find the transitions between the phases with different exponents.

In economic geography, a great many phenomena are rank-size distributed, but without doubt, the most thoroughly researched (not the least in regional science) is the distribution of population among cities (e.g, Richardson, 1973; Rosen and Resnick, 1980; Caroll, 1982). Economic geographers (e.g., Simon, 1955; Krugman, 1996a) typically also evoke proportionate growth in order to explain *urban hierarchies* with rank-size distributions: The growth rate of a city population is assumed to be higher the larger the city size, and the more pronounced this tendency, the more negative the exponent in the urban rank-size distribution. In an urban hierarchy, the value of the exponent depends upon the extent to which the bigger cities develop more specialized urban functions (service offer and job types)(Criställer, 1933) and invest in infrastructures creating advanced job options and educational opportunities, attracting still higher numbers of immigrants. Economic geography has devoted special analytical attention to the top and the bottom of the distribution of population among cities. In some such distributions — for instance, in small or developing economies — the one or few biggest cities have economical and possibly political *primacy*, monopolizing public administration, universities and inward investments to such an extent that they are propelled beyond the proportionate growth pattern in the rest of those economies' urban hierarchy (Richardson, 1973; Henderson, 1988; Ades &

not imply that every *real life* rank-size distribution is caused by proportionate growth. However, proportionate growth is by far the dominant hypothesis.

Glaeser, 1995; Krugman, 1996b; Moomaw and Shatter, 1996). The population of primary cities may hence not conform to the rank-size rule (in which case scholars will exclude them from statistical analysis), or they may follow a rank-size rule with a different (i.e., more negative) exponent than the rest of the city hierarchy. Concerning the bottom of a distribution of cities, it is an important question whether there is a minimum city size under which cities drop out of the rank size hierarchy. Simon (1955) suggests that when there is such a minimum size in a distribution of cities, scholars should cut off the observations below the threshold in order to calculate the exponent of the urban hierarchy, but also provide a viable theory of the rank-size system's "birth rate": How and when the smallest cities grow above the size threshold and become a part of the urban hierarchy.

Florida's suggestion of a rank-size distribution of the creative class is hence somewhat uncontroversial to most economic geographers: "Creative begets more creative", as cities with a higher number of creative people are particularly good in attracting more creative people. Together with Robert Axtell (Axtell, 2001; Axtell and Florida, 2006), Florida has since dedicated attention to exploring the micro-foundations of proportionate city growth, applying mathematical modeling in order to (successfully) test if a model assuming agglomeration and proportionate growth of the creative class can produce a rank-size distribution. However, there has been little *empirical* investigation of the questions we address in this paper:

a. Whether the creative class is indeed rank-size distributed;
b. Whether the distribution is continuous or exhibit phases that conform more poorly to the rank-size rule or have different exponents, and if so, why;
c. Whether the tendency to proportionate growth and urban inequality (as measured by the exponent) is different from the general population and if so, why.

One reason for the lack of such empirical research is that a thorough investigation of the distribution of the creative class among cities takes a significant number of observations (Thomas, 1985). Florida (2002) operating in the USA, includes 268 cities in his survey.

This paper draws upon an integrated database of 445 cities across 8 European countries, and hence, it can set out to address the questions above. It investigates the size distribution of the creative class and compares it to the size distribution of the general population among European cities, and it proposes possible explanations for this distribution. In its analysis, the paper initially confirms that the distribution of the European creative class follows a rank-size rule, and suggests that cities with a large size of the creative class tend to get more creative through attraction of still more creative labor. The paper suggests consumer preferences and social networks as explanations for the proportionate growth of the creative class. Subsequently, the paper looks into three distinct phases of the distribution of the European creative class, each approximating a rank-size rule with different exponents. The paper explains these phases and their exponents by presenting four propositions about how effects of large and small population sizes of cities may be more detrimental to the creative class than to the population in general. The 147 smallest cities have a particularly high negative exponent. We propose that this may be because below this size, cities begin to drop below minimum efficient market sizes for particular creative services, below minimum labor market sizes for particular creative job types, and below minimum levels of political representation by the creative class. The exponent for the largest 15 cities has a less negative value than the 283 middle-sized cities. In order to explain this, we propose that the creative class may respond particularly adversely to urban congestion problems.

The paper is structured thus. The next section presents our analysis of the rank-size distribution of the European class, and proposes an explanation for why the size of creative class in a city grows proportionally to city size. The paper's third section analyses in more detail the different phases of the rank-size distribution and compares them to the distribution of the general population. The section proposes four mechanisms causing the negative value of the exponent of the smallest cities to be above that of the rest of the distribution, and the exponent of the largest cities to be below. The paper is rounded off by a brief discussion and conclusion section.

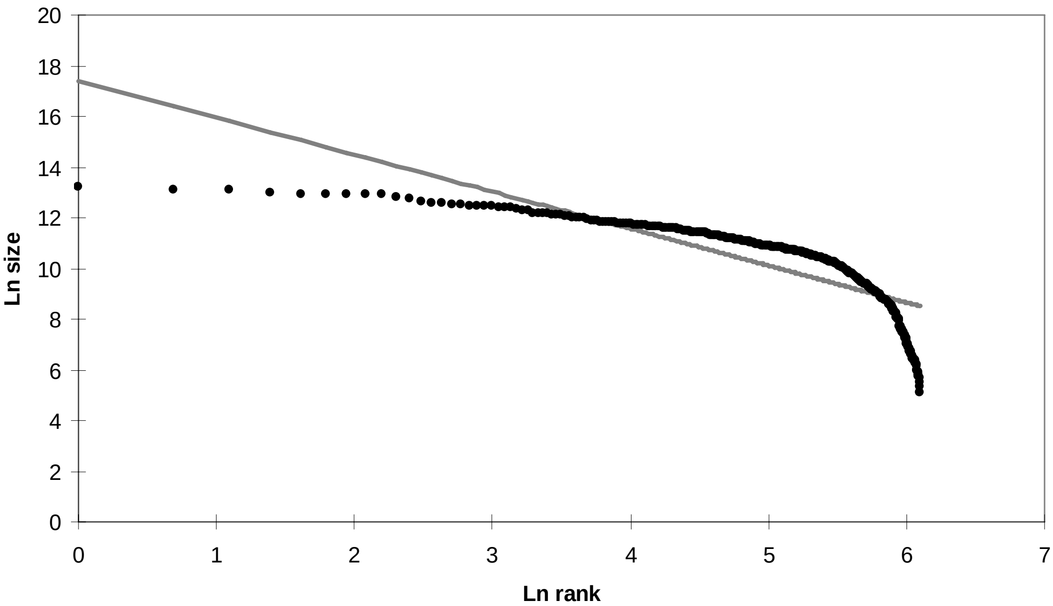
2. Rank and Size in the Distribution of the European Creative Class

The paper uses an original database of the population, the creative class, and a variety of indicators of diversity, cultural offer, tolerance, and economic performance, in the 445 NUTS 4 city regions in 8 countries in Europe at comparable levels of economic development: Denmark, Finland, Germany, the Netherlands, Norway, Sweden, Switzerland, and the UK.[2] For definitions of how we measure the size of the creative class and other variables, see appendix 1.

The Distribution of the European Creative Class

Figure 1 below shows the distribution of the creative class among the 445 European cities in the year 2000. The figure shows a graph where the logarithm of the size of the creative class of each city is plotted against the logarithm of the rank of the city. On such a log-log plot, a pure rank-size distribution will show as a straight line, with the exponent revealed as the slope of the line (for information on calculation of the plots used in the paper, see appendix 2).

Figure 1: The rank-size distribution of the European creative class (2000)



Slope coefficient: -1,459
Adjusted R^2: 0,668
N: 445

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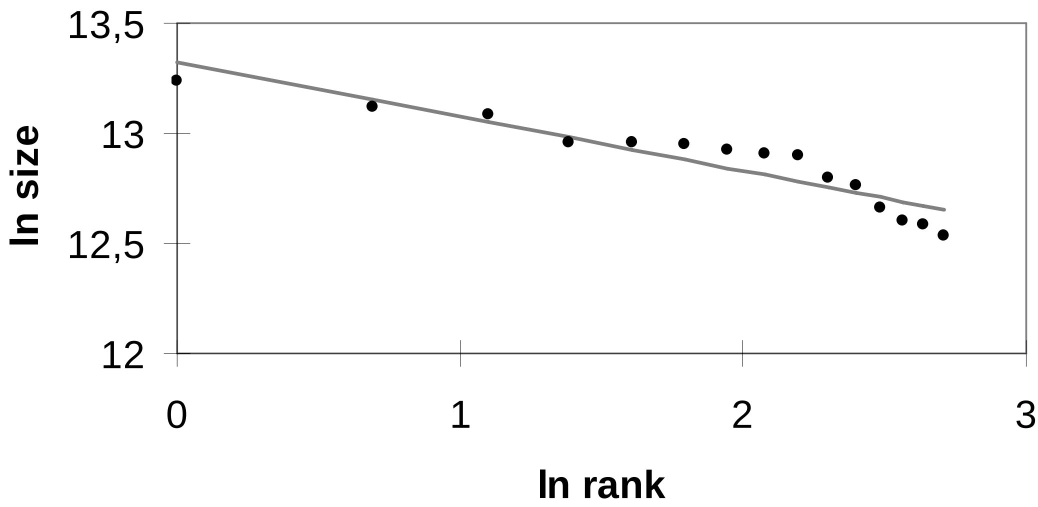
[2] The database was designed and collected 2003-2007 under the research project *Talent, Technology and Tolerance in European Cities: A Comparative Analysis,* by 8 European partner universities. The cross-country collaboration was coordinated by Björn Asheim (Lund University), and Mark Lorenzen (Copenhagen Business School) managed the Danish project.

The figure confirms that the European creative class is distributed according to a rank-size rule, albeit the fit to the rule is not very impressive, with a R^2 of 0,668. The exercise prescribed by rank-size scholars and outlined in the previous section, cutting off the lower tail of the distribution in order to get a better fit, yields a R^2 of 0,839, but as this excludes more than half of the cities (247) from the representation, it cannot be said to be a very satisfactory solution. It makes much better sense to represent the distribution of the European creative class as three phases, each rank-size distributed, but with different exponents. Figure 2 below shows the distribution of the European creative class split up thus.

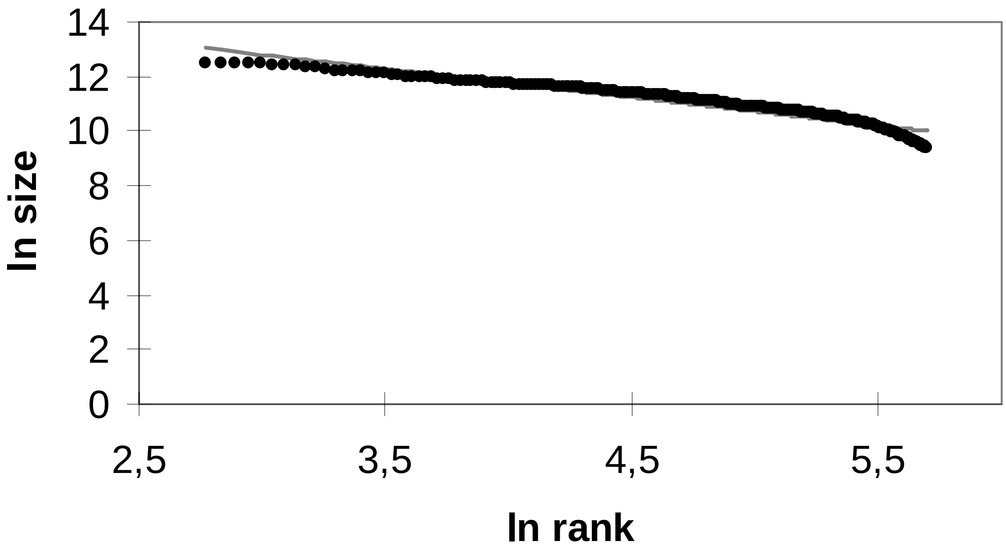
Figure 2: Phases of the rank-size distribution of the European creative class (2000)

Top phase



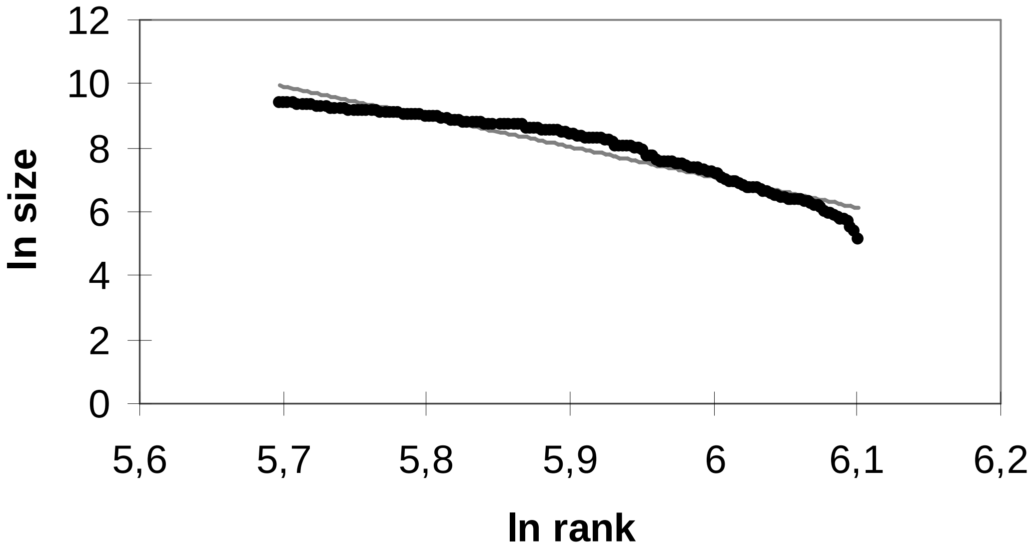
Slope coefficient: — 0,245
Adjusted R^2: 0,853
N: 15

Middle phase



Slope coefficient: -1,036
Adjusted R^2: 0,920
N: 283

Bottom phase



Slope coefficient: -9,482
Adjusted R^2: 0,930
N: 147

Each phase in figure 2 has a remarkably good fit to a perfect rank-size rule: The phase consisting of the 15 cities with the largest sizes of the creative class has a R^2 of 0,853, the phase of the 283 middle-sized cities has a R^2 of 0,920, and the R^2 of the phase of the 147 smallest cities is 0,930. The second row in table 1 below lists each phase's exponent, fit to the rank-size rule, number of cities included, plus the size of the population and the creative class in the lower threshold city, i.e. where we chose to distinguish the phase from the next in order to obtain the best fit.

Table 1: Exponents, fit, and thresholds of phases of the rank-size distributions of the European creative class, population, and bohemians (2000)

	Top phase	**Middle phase**	**Bottom phase**
General population	Exponent: -0,380 Fit (R^2): 0,967 N: 26 Lower threshold: *Hampshire*, with a population of 1,244,700	Exponent: -1,169 Fit (R^2): 0,888 N: 293 Lower threshold: *Tromsø*, with a population of 73,673	Exponent: -7,428 Fit (R^2): 0,886 N: 124
Creative class total	Exponent: -0,245 Fit (R^2): 0,853 N: 15 Lower threshold: *Helsinki*, with a population of 1,207,737 (276,555 members of creative class)	Exponent: -1,036 Fit (R^2): 0,920 N: 283 Lower threshold: *Porvoo*, with a population of 72,295 (12,064 members of creative class)	Exponent: -9,482 Fit (R^2): 0,930 N: 147
Bohemians	Exponent: -0,74 Fit (R^2): 0,942 N: 38 Lower threshold: *Mittleler Oberrheim*, with a population of 987,500 (6,005 bohemians)	Exponent: -1,502 Fit (R^2): 0,936 N: 281 Lower threshold: *Kristianstad*, with a population of 101,060 (267 bohemians)	Exponent: -14,849 Fit (R^2): 0,922 N: 126

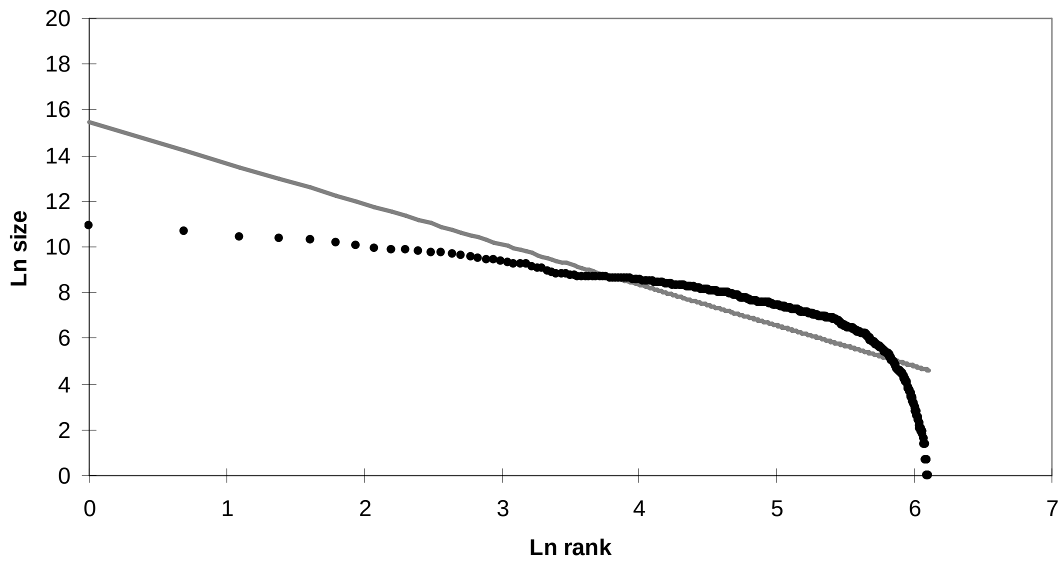
Hence, we can claim that in general, the European class is indeed distributed according to the rank-size rule. If we accept the proportionate growth hypothesis as explanation for rank-size distributions, we may conclude that creative European cities indeed beget more creative: The larger a city's size of creative population, the more the creative population grows. Before the paper proceeds to query into the differences between the three phases of the distribution, let us briefly discuss possible explanations for this overall proportional growth.

The Creative Ethos and Proportionate Growth

One explanation for the proportional growth of the European creative class may be that it is attracted to the specialized urban services and infrastructures arising with a high creative class presence — for example, non-mainstream cultural offers and specialized research and education institutions. The growing attractiveness of larger cities is even more pronounced for a special subgroup within the creative class, which Florida (2002b; 2002c) calls *bohemians*. This subgroup (constituted by e.g. artists, designers, and writers) is more engaged in applying artistic forms of creativity than Florida's two other subgroups: The *creative core* (e.g. researchers, engineers, and doctors), applying mostly technical creativity; the *creative professionals* (e.g. managers, finance people, and lawyers), mainly applying creativity in a generic and managerial sense (for more detailed definitions, see appendix 1). Whereas the creative professionals is the largest subgroup, the creative core has the highest skill levels and accounts for most of the economic value produced by the creative class. However, even if the bohemians are relatively few and account for only a modest part of the creative class' economic growth, according to Florida, this group is the most critical consumers of urban services with the most specialized preferences, and is pioneering the preferences of the creative class in general. Drawing upon e.g. Brooks (2001) and Robinson and Godbey (1997), Florida (2002) claims that technically and socially creative people to a growing extent identify themselves with artists. Thus, aspects of the preferences of the bohemians disseminate to the rest of the creative class, creating its "bourgeoisie-bohemian" — or, affectionately, "bobo" (Brooks, 2001) — ethos.

Our data support Florida's claim in this respect. As illustrated in table 1 above, the exponent of the bohemians (for all three phases) is much higher than for the rest of the creative class. This is an indication that bohemians are more sensible to city size than the total creative class, and a suggestion that the proportional growth of the bohemians is greater. Florida (2002b; 2002c) compares the bohemians to "a canary in the coalmine": Due to its preferences for consuming even more specialized services that the rest of the creative class, this group is the first to shy cities with a poor service offer. If we look at the rank-size graph of the distribution of the bohemians among the European cities, as shown in figure 3 below, it shows the same tendency as the total creative class (as shown in figure 1 earlier), but it has an even more dramatic drop-off below a certain city rank.

Figure 3: The rank-size distribution of European bohemians (2000)



Slope coefficient: -1,777

Adjusted R^2: 0,660

N: 445

Social Networks and Proportionate Growth

Another explanation for the creative class' high proportional growth can be found in network theory (e.g. Wasserman and Faust, 1994; Burt, 1992; Barabasi et al, 2000; Barabási, 2002; Watts et al, 2002). This theory is also concerned with proportional growth — that of networks. It suggests an explanation of proportionate growth of networks, namely *preferential attachment* of new links to nodes in networks: The nodes with most pre-existing links to other nodes are strongest in attracting new links (Barabási, 2002).

We may explain the proportionate growth of the creative class in cities by considering one category of networks, *social* networks — i.e., where network nodes are people, and network links consist of social relations. Ceteris paribus, the larger the population of a city, the more social relations it will have to outside people. As immigration to a city is often proportional to the number of social relations between its inhabitants and potential immigrants (Gans, 1962; Tilly, 1990; Granovetter, 1995; Portes, 1995; Gold, 2001), bigger cities with more social networks attract most immigrants. In this social network perspective, the reason the creative class has a high proportional growth is that it is very networked. People involved in creative work (whether in technical, social or artistic senses) benefit immensely from participating in numerous social networks, and the most creative people are often the nodes in social networks with most links (Uzzi and Spiro, 2005, Powell et al., 2005). The fact that much creative work is also organized in temporary projects (Lorenzen and Frederiksen, 2005) enhances the tendency of the creative class to participate to complex and shifting value chains and networks. As creative people often both socialize and collaborate professionally with other creative people, the rich social networks of the creative class have immense potential for attracting more creative people.

The growth of the number of members of the creative class in a city may not just be due to *immigration*, it may also be because people simply *shift job type* into the creative class category — for example, when a IT engineer is hired by a big corporation to do development work in stead of maintenance, when a graduate starts his own company, or when somebody finally realizes his artistic aspirations by getting his manuscript published. For this type of creative class growth, the importance of social networks also causes significant proportionate growth of the bigger cities: Cities with more networks yield most entrepreneurial opportunities (Burt, 1992; Granovetter, 1995; Casson and Giusta, 2007).

3. Market Size, the Creative Environment, and Congestion

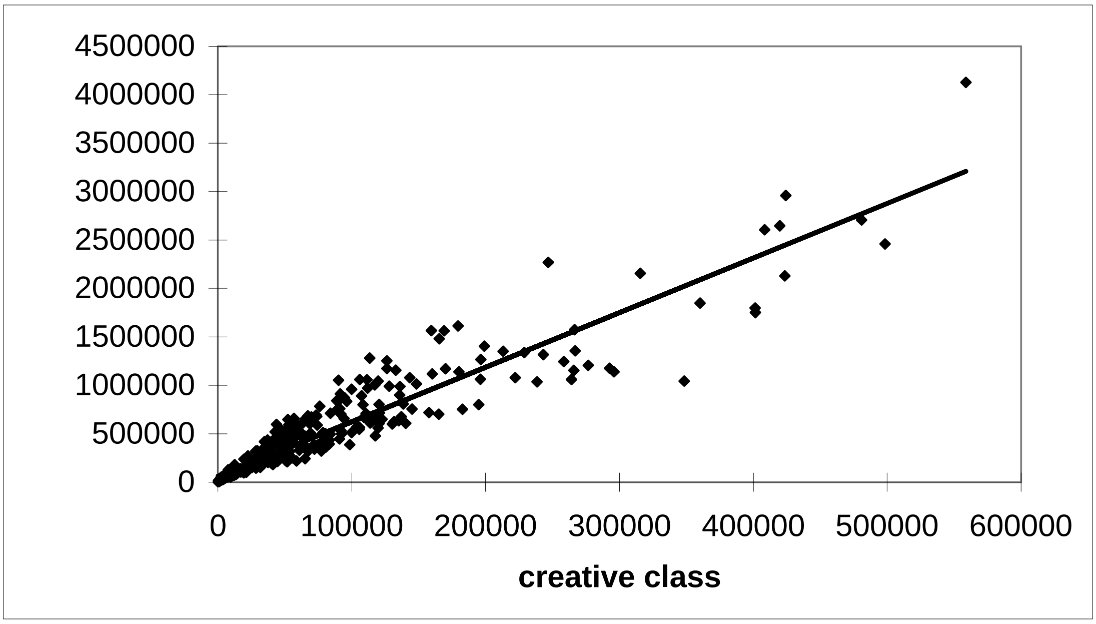
We shall now take a closer look at the three different phases of distribution of the European creative class. As listed in table 1, they exhibit remarkably different exponents. The most striking feature of the distribution is the high exponent of the cities with the smallest size of the creative class: Nine times the exponent of the middle phase, and 39 times that of the top phase. For the smallest cities, there seem to be very large adverse effects of having a small creative class. Another evident feature in the distribution of the creative class among European cities is that it shows no urban primacy.[3] Rather than the S-shape of urban hierarchies with primacy (Stewart, 1958; Vapharsky 1969; Rosen and Resnick, 1980; Caroll 1982), figure 1 shows that the largest cities in fact slightly underperform compared to the rest of the distribution.

[3] That the distribution shows no urban primacy is not surprising, given the data base integrates city data for 8 European countries. This blurs the effects of potential urban primacy within each country.

For these cities, the positive attraction effects of increasing size of the creative class are not as profound as for the rest of the distribution.

The present section of the paper is devoted to explaining these different exponents of the smallest and the largest cities. Our explanations all rest upon mechanisms related to *general population size* — i.e., the total number of inhabitants in cities (including, of course, the creative class, but also the rest of the labor force plus those outside the labor force). We have calculated the distribution of the general population of the 445 European cities, and the results are also presented in table 1. The distribution generally resembles that of the creative class, and is also best represented as three phases each with good fit to a rank-size rule (the R^2 for the fit of the whole distribution to the rank-size rule is only 0,723, compared to the much better fits if we split it into the phases listed in table 1). Table 1 shows that the creative class' tendencies to drop off in small and large city populations sizes can also be found for the general population: The bottom phase (the smallest cities) has much the highest negative exponent, and the top phase (the largest cities) a slightly less negative exponent than the middle-sized cities phase. As illustrated in figure 4 below, this is not a coincidence: The size of the creative class also generally co-varies with population size.

Figure 4: The correlation between the European population and creative class (2000)



Slope coefficient: 5,633
Adjusted R^2: 0,887
N: 445

The correlation between the population and the creative class, and their similar distributions of growth patterns, suggest that *population size and growth patterns influence creative class size and growth patterns*: In general, the European cities with the largest general populations attract the most creative class. Given the explanations for proportionate growth of the creative class outlined in the previous sections of the paper, it is not surprising that a city's population size and growth are positively correlated with its size and growth of the creative class: The city functions and infrastructures in cities with large populations are bound to attract the creative class as well as the general population, and the abundance of social networks in large cities also positively influence the immigration and entrepreneurial opportunities of both the general population and the creative class. This also means that the adverse growth effects for the cities with the smallest and largest general populations influence the growth of the creative class. In fact, it can be argued that such effects translate very directly from the general population to the creative class. Quite remarkably, the city sizes of the phase transitions are remarkably similar. The population of the threshold cities (where distinguishing the phases from each other provided the best rank-size fits) are roughly the same for the general population and the creative class: The transition from the top phase to the middle phase phase takes place around approximately 1.2 million inhabitants for both the creative class and the general population, and they share a shift to the bottom phase around 70,000 inhabitants.

However, with a coefficient of 0,887, the correlation in figure 4 is not perfect. This is, as can be seen in table 1, because even if the general population and the creative class both have a higher exponent for the bottom phase and a lower exponent for the top phase, the tendency of the distribution to dropping off at both ends is more profound for the creative class. The negative exponent for the bottom cities is higher for the creative class than for the general population, and the exponent for the top cities is slightly less negative. The differences in exponents suggest that even if the size and growth of the creative class co-varies with the size and growth of the general population, and even if the adverse growth effects of the smallest and the largest cities set in around the same city population size for both the general population and the creative class, the *diseconomies of small and large city population sizes are greater for the creative class than for the general population.*

The difference in diseconomies is greatest for the smallest cities: From the middle phase to the bottom phase, the negative exponent of the creative class distribution grows 815%, compared to 535% for the general population. For what this is worth as illustration, table 1 hence lists adverse effects of small population size for the creative class that are 1.52 times those of the general population. However, a difference in diseconomies is also traceable for the largest cities: For the creative class, the exponent drops 76 % from the middle phase to the top phase — an effect 1.13 that of the general population (the exponent of which drops 67%).

In the remainder of this section, we present four propositions about mechanisms related to the size of the general population, in order to explain such diseconomies of small and large city sizes. We first turn to the smaller cities. In the following, we present three propositions about different types of diseconomies of small city populations — two based upon economic considerations, the third resting upon logics from political economy.

Market Size and Creative Services

We may explain the diseconomies of smaller cities by reconsidering a classic economic notion: The degree of any type of economic specialization is limited by the extent of the market for it (Smith, 1776). Put differently, any product, service, or job will be offered only if it has enough buyers (i.e., interested consumers or qualified job-seekers). In the formative years of economic geography, Criställer (1933) adopted this insight in his notion of a *threshold* for urban functions, i.e., the minimum number of city inhabitants needed to support the offering of a service or good. Adopting Smith's (1776) and Criställer's (1933) insights, we shall argue that because there are minimum efficient market sizes for particular services and job types, there are city size thresholds below which creative people cannot find the services they demand, or the jobs they are qualified to do. Attractiveness to the creative class falls particularly rapidly with city size in the bottom phase of the distribution, because it is in this phase many of the market size thresholds are found.

In the following, we will first discuss the size threshold for city services, focusing upon those that may have a particular importance for the creative class. Subsequently, we will turn our attention to the size threshold for creative job types that are of particular relevance to the creative class.

First, considering creative services, we propose that in the bottom city phase, we find many of the market size thresholds for creative services: Many cities here have too few inhabitants to constitute sufficient consumer bases to sustain the specialized services demanded by the creative class. Let us exemplify which services we are talking about. In a recent survey of the Danish creative class' consumption of *cultural offers* (Andersen and Lorenzen, forthcoming)[4], the creative class is shown to consume less spectator sports than the rest of the work force, and resemble it with respect to culture consumed at home (such as TV, video, recorded music, computer games, and magazines) and consumption of mainstream public culture (such as cinema, zoo, theme parks and evening classes). However, when it comes to more specialized public culture offers, the survey shows that the creative class has a significantly different consumption pattern, as shown in table 2 below.

Table 2: Cultural Offers Consumed by the Danish Creative Class, 2004

Cultural Offer	Estimated parameter for the creative class (positive likelihood relative to benchmark group)
Attend classical concerts	0,99
Visit art exhibitions	0,81
Visit art museums	0,78
Perform arts, such as music, dancing, or acting	0,63
Visit libraries	0,63
Visit museums	0,62
Visit heritage sites	0,58
Visit landscapes	0,52
Visit historical architectures	0,48
Go to the theatre	0,39
Do city walks	0,31
Walk/bike in nature or to work	0,31
Participate to sports	0,30
Attend rock/jazz concerts	0,26

Source: Trine Bille, as published in Andersen and Lorenzen (forthcoming).

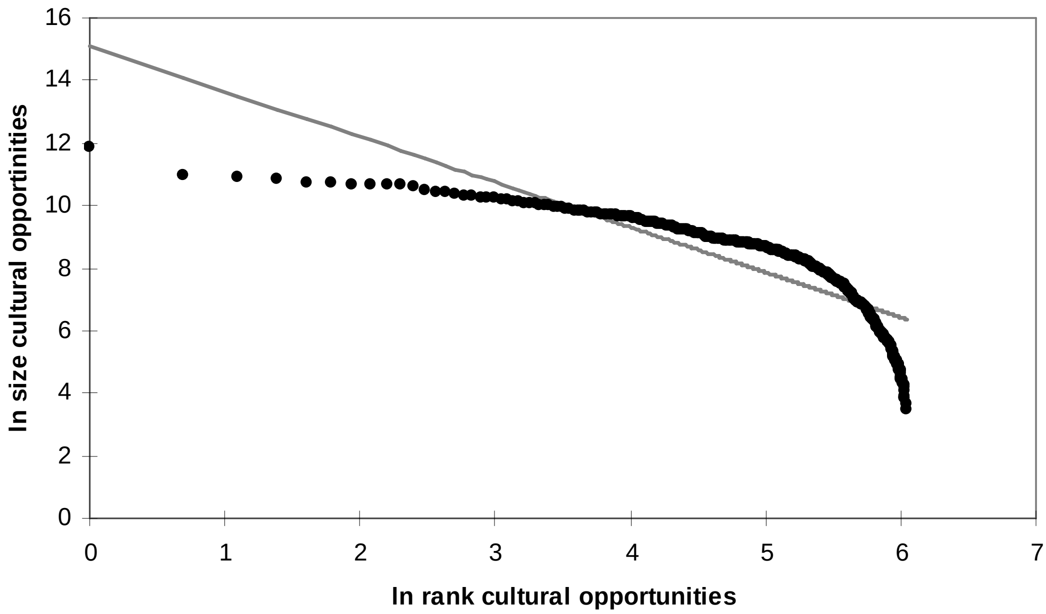
Note: The survey is based upon another data base than the current paper, and the creative class is hence defined somewhat differently, emphasizing technical and artistic creativity. This approximates Florida's subgroups the *creative core* plus *bohemians*.

[4] The survey controls its results for the effects of education level, age, gender, income level, and geographic location.

Table 2 lists how much *more likely* members of the Danish creative class are to consume a range of cultural offers relative to a benchmark group in the labor force (constituted by selected service occupations). It can be seen that the creative class is by far the most eager consumers of very specialized cultural offers, such as concerts, museums, theatre, and city architecture. As such specialized services and cultural opportunities demand large consumer bases, they are predominantly found only in larger cities. Smaller Danish cities are hence at a notable disadvantage as far attracting the creative class on the basis of cultural offers is concerned.

Figure 5 illustrates that there are minimum efficient market sizes for cultural offers in Europe. It presents the European cities' distribution of an index for cultural offer (based on its number of employed within cultural services — for a more detailed definition, see appendix 1).

Figure 5: The rank-size distribution of European cities' cultural offer (2000)



Slope coefficient: -1,444
Adjusted R^2: 0,725
N: 420

Note: The database does not contain data on cultural opportunities in Switzerland. Thus, the Swiss city regions are excluded (N=420).

Evidently, we are talking about one more rank-size distribution here, and also one with three phases with different exponents. The exponents, fits and thresholds of the phases we get by dividing the distribution are presented in table 3 below.

Table 3: Exponents, fit, and thresholds of phases of the European cities' cultural offer (2000)

	Top phase	**Middle phase**	**Bottom phase**
Cultural offer index	Exponent: -0,451 Fit (R^2): 0,933 N: 32 Lower threshold: *Cheshire*, with a population of 675,300	Exponent: -1,295 Fit (R^2): 0,917 N: 262 Lower threshold: *Nyköping*, with a population of 80,820	Exponent: -8,149 Fit (R^2): 0,948 N: 126

If we compare table 3 to table 1, we can see that the distribution of cultural offer shifts into a bottom phase around the same threshold as the general population and the creative class: For cities smaller than 80,000 inhabitants, the distributions begins to slope with a high negative exponent. This lends credit to our proposition that the cities in the bottom phase begin to drop under minimum efficient market sizes for the offer of particular cultural services. The drop of cultural services has an exponent higher than the drop of the general population, which may contribute to explaining the even steeper exponent of the creative class in the bottom phase: They respond more adversely to decline in cultural offer than the general population. However, the effects are much more profound for the "canary in the coalmine", the bohemians. As listed in table 1, their size in the bottom cities has the most dramatic rapid drop-off of all population groups, with a negative exponent much higher than the total creative class and almost double that of the general population. The drop-off of cultural services offer may help to explain this: The bohemians are arguably the keenest consumers of cultural offers (Florida, 2002b; 2002c). They are also the least tolerant to small city sizes: The threshold for bohemians entering the bottom phase is a population size of approximately 100,000 inhabitants — 25,000 more than the city size where the distributions of the general population and the total creative class exhibit adverse attraction effects of decreasing city size. That the strong drop-off of bohemians takes place around a larger city size than the size where the strong drop-off of cultural services takes place, suggests that while cultural offers matter, there are other factors influencing the bohemians' distribution.[5]

Market Size and Creative Jobs

Our second proposition applies the logic of the market size threshold to the labor market. We propose that in the bottom city phase, we find many of the labor market size thresholds for creative job types: Many cities here have too few inhabitants to sustain the specialized jobs filled in particular by the creative class. Florida (2002a; 2002c) points out that the creative class has particular economic importance for *hi-tech industries*. Incidentally, hi-tech jobs are also a fine example of job types with a notable city population size threshold. Figure 6 below plots the distribution of European cities' number of hi-tech jobs (for a definition of what we included as hi-tech jobs, see appendix 1).

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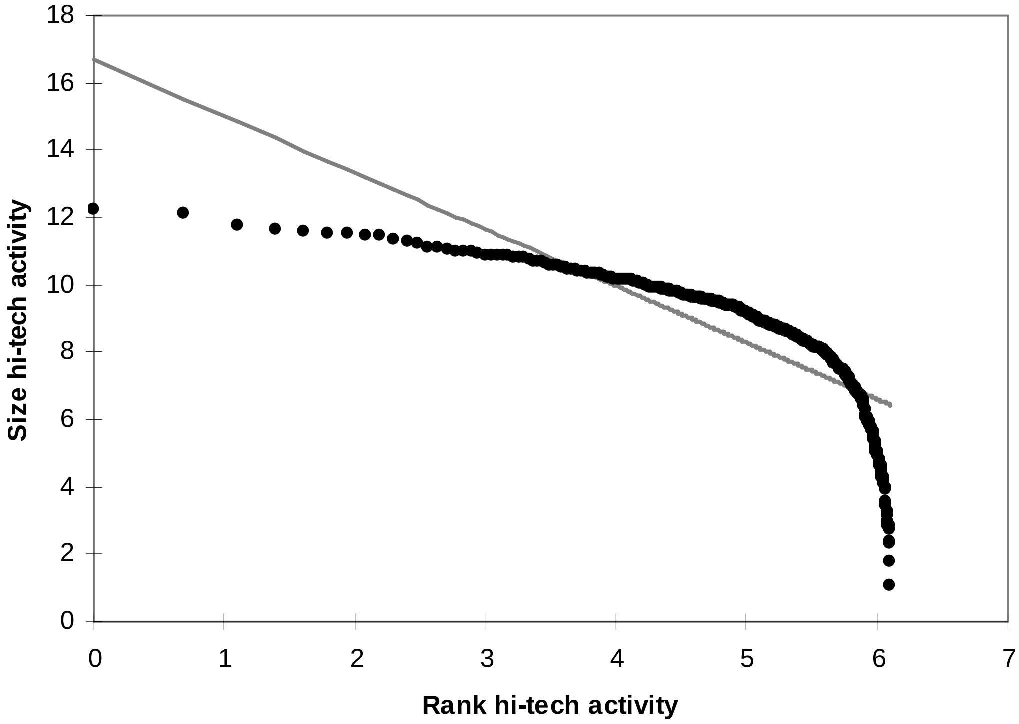
[5] It should be noted, however, that the European distribution of cultural offers also show a high negative exponent in the middle phase — an exponent that more resembles that of the middle phase exponent of bohemians than those for the general population and the total creative class. That the cultural offer begins to decline notably in the middle phase may help to explain the drop-off for bohemians around city sizes larger than the rapid drop-off of cultural offer.

Figure 6: The rank-size distribution of European cities' number of hi-tech jobs (2000)



Slope coefficient: -1,680
Adjusted R^2: 0,664
N: 445

The distribution of hi-tech jobs in European cities follows a rank-size rule and demonstrates three phases with different exponents. The exponents, fits and thresholds of the phases are presented in table 4 below.

Table 4: Exponents, fit, and thresholds of phases of the European cities' number of hi-tech jobs (2000)

	Top phase	**Middle phase**	**Bottom phase**
Hi-tech jobs	Exponent: -0,470 Fit (R^2): 0,976 N: 26 Lower threshold: *Hertfordshire*, with a population of 1,037,200	Exponent: -1,500 Fit (R^2): 0,919 N: 319 Lower threshold: *Randers*, with a population of 112,611	Exponent: -17,0605 Fit (R^2): 0,918 N: 100

A comparison of table 4 to table 1 shows that the distribution of hi-tech jobs shifts into a bottom phase with a exponent much higher than the bottom phase of the population, lending support to our proposition that the creative class exhibits a steeper drop-off of smaller cities' attractiveness because the creative class responds more adversely to decline in the number of hi-tech jobs than the general population. It is also evident from a comparison of tables 4 and 1 that the threshold city population size where the bottom phase sets in is around 110.000 inhabitants, much higher for hi-tech jobs than the cultural offer discussed above. Hence, the minimum efficient market size for the offer of hi-tech jobs is higher than for cultural services. Below 110.000 inhabitants, these job types disappear with an exponent so high that we may effectively talk about a Criställer-type of threshold for this urban function.

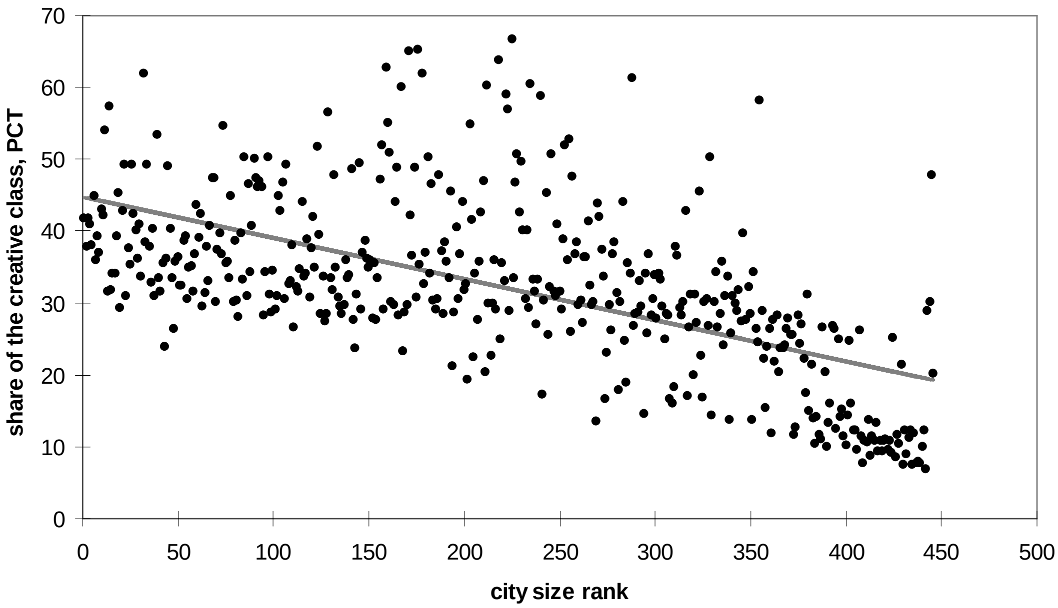
While the rapidly declining presence of hi-tech jobs in smaller cities may partly explain these cities' decline in attractiveness to the creative class, it should be noted that the drop-off of hi-tech jobs takes place for cities with approximately 40,000 more inhabitants more than where the creative class starts to shy them. Our example of hi-tech jobs is hence only part of the story. There are many other specialized job types that may disappear with declining city size and effect the distribution of the creative class more than the general population.

Population Size and Creative Environment

We shall now supplement our propositions of the roles of minimum market sizes with a proposition about a somewhat different mechanism related to city population size. Our third proposition about diseconomies of small cities is that small cities may have a less creative *environment*. Florida (2002c; 2005a) argues repeatedly that cities that are most attractive to the creative class, apart from being diverse, rich in cultural offers, and tolerant, also boast a creative "environment". Focusing upon measuring the attraction of diversity, cultural offer, and tolerance, Florida is however remarkably vague on what a creative environment consists of. For the purpose of the analysis in this paper, we shall define a creative environment as the use of public resources in ways that allow for and stimulate creativity. We shall assume that a creative environment comes about when the creative class influences professional and public decision-making, and proxy a such influence with a high *share* of the creative class of the local work force. Ceteris paribus, the higher such share, the more does the creative class constitute a part of professional, everyday, and political life in such cities, and the more political decisions — about the use of public spaces, funds, and other resources— will accommodate the creative ethos.

We already know that the *number* of members of the creative class in a city is generally correlated with the city's general population size. But, as shown in figure 7 below, the *share* of the creative class in a city's labor force exhibits a different behavior: After declining along with population rank, the share of creative class drops off suddenly for smaller cities.

Figure 7: The correlation of European city population rank and share of creative class (2000)



Slope coefficient: -0,057
Adjusted R^2: 0,360
N: 445

Figure 7 shows the European cities, ranked by population size, plotted against how big a share (in percent) of their resident labor force is constituted by the creative class.[6] The figure shows two tendencies, one for low rank numbers (i.e., the largest cities), and one for cities with ranks higher than 400 (i.e., the smallest cities). For the largest cities, there is quite some divergence of their labor forces' share of creative

[6] The reason for presenting the correlation between cities' shares of the creative class and their population *ranks* — and not sizes — is pragmatic. The correlation between population size and share of the creative class has a much lower correlation coefficient. This is due to the different scales — e.g. there might be a great difference in size between the city with rank 1 and the city with rank 10 but only a small difference in size between the city with rank 101 and 110.

class: Even if the share of creative class generally declines slowly the higher the city rank number, cities of approximately the same size boast quite different creative class shares. For cities with ranks above 400, corresponding to population sizes below approximately 25,000, their size is very determining for their share of the creative class: There is a very strong correlation between a high city rank number and a small creative class share, and no labor force in a city smaller than 25,000 people boasts more than 10% creative class.

Figure 7 hence suggests that there is a population size threshold for the creative class's share of a city's labor force. Above the threshold, there is scope for becoming creative irrespective of size, and even medium-sized cities may attract high shares of creative class to their work forces. Conversely, below this threshold, a city's labor force is very little creative, and cities show an unrelenting tendency to get less creative with decreasing population size. In the case of the European cities, the population size threshold for a creative share of higher than 10% of a city's work force was approximately 25,000 inhabitants. As the creative class, ceteris paribus, looses political influence in the cities smaller than this threshold, some of these cities may slowly accumulate adverse political decisions from creative people's point of view, and hence develop weak creative environments.

After dedicating attention to the three above propositions regarding diseconomies of small city size, we shall now turn to explaining the diseconomies of the largest cities.

Size and Congestion

Our proposition to explain the less negative exponent of the cities with the largest populations evokes a classical theme in economic geography: These cities are subject to diseconomies of scale in the guise of urban *congestion* problems. While there are scale economies of urban infrastructures up to a certain point, the largest cities, which are also the cities with highest growth rates, may be chronically behind with respect to investing in basic infrastructures. Ironically, the most populated cities that have managed to develop world-class specialized urban functions and infrastructures such as universities and airports, are sometimes lacking in basic infrastructures, such as public transport capacity and pollution (and sometimes also crime) control. Even more importantly, housing prices and other living costs grow disproportionately in large cities with high growth rates. As argued by Colby (1933), Myrdal (1957), and Hirschman (1958), such urban congestion serves to spread or “centrifuge” growth from large cities.

Colby (1933), Myrdal (1957), and Hirschman (1958) all argued that strong congestion would *generally* spin growth off large cities, but later research has shown that such centrifugal forces may be operating more selectively (for a discussion, see Gaile, 1980). We shall propose that centrifugal forces are at play in the distribution of the European creative class, because even if such forces act upon the general population as well as the creative class, the latter is more prone to *respond* to them. This can be seen quite clearly in table 1: While the transition to the top phase with less negative exponent takes place around the same city size for the general population and the creative class, approximately 1.2 million inhabitants, the slope in the top phase is less steep for the creative class. This lower negative exponent of the top phase indicates that congestion effects in the largest cities counteract the growing attractiveness with city size most for the creative class. The reason is that the creative class, having higher average incomes (Florida 2002c; 2005) and more frequently working in temporary projects and shifting work places (Lorenzen and Frederiksen, 2005), is more mobile than the general population.

The bohemians again stand out as a special group within the creative class. While the curve in their top phase has a steeper slope than the general population has in its top phase, it is less steep than the total creative class. This suggests that the bohemians respond more to congestion than the general population, but less than the rest of the creative class. The reason is likely to be that the bohemians are less affected by congestion in the guise of housing prices as some of them tend to live in cheaper housing in large cities’ bohemian neighborhoods, but also that they have much lower income levels, and hence mobility, than the rest of the creative class (Andersen and Lorenzen, forthcoming). Table 1 also shows that while not being able to respond so profoundly to congestion, the bohemians however have a lower tolerance towards it: The threshold city population around where the bohemians begins to shy large cities is approximately 990,000, around a quarter of a million inhabitants fewer than for the both the general population and the total creative class.

4. Discussion and Conclusion

The paper analyzed the rank-size distribution of creative class among 445 European cities. It answered its research questions thus:

a. The European creative class is indeed rank-size distributed;

b. The distribution of the European creative class exhibits three phases with different exponents, due to diseconomies of small and large city sizes;

c. Compared to the general population, the tendency of proportionate growth of the European creative class shows 1.52 times more the disadvantage (higher negative exponent) of declining city size for the phase of cities with fewer than 70,000 inhabitants, and 1.13 less pronounced advantage (less negative exponent) of growing city size for the phase of cities with more than 1.2 million inhabitants.

In order to explain the differences between the three phases of the distribution, the paper argued that the detrimental growth effects of small and large city *population sizes* are more profound for the creative class than for the general population, and developed four general propositions on how population size influences the creative class:

P1. *The creative class may suffer from a lack of particular creative services in cities with too small populations to constitute viable consumer bases for such services*. We exemplified this for the European case by pointing out that cultural offers of European cities are also distributed according to a rank-size rule, with cities with fewer than approximately 80,000 inhabitants exhibiting a rapid drop-off of cultural offers.

P2. *The creative class may suffer from a lack of creative job types in cities with too small populations to constitute viable labor markets for such job types*. We illustrated this for the European case by showing that hi-tech jobs are also rank-size distributed in Europe, with cities with fewer than approximately 110,000 inhabitants rapidly dropping below viable labor market sizes for such jobs.

P3. *The creative class may shy cities with small populations because of their less creative environments, arising from a lack of political representation by the creative class.* We exemplified this for the European case by demonstrating that the creative class significantly loses its share of the local labor force in cities below approximately 25,000 inhabitants.

P4. *The creative class may respond particularly adversely to urban congestion in cities with large populations*. We illustrated this for the European case by pointing out that when a city's population is larger than approximately 1.2 million inhabitants, the slope (exponent) showing the proportional growth of cities flattens more for the creative class than for the general populations.

From a policy angle, our propositions are novel in the sense that they suggest that the appropriate strategy for improving a city's attractiveness to the creative class depends much upon the size of that city. The smallest cities are extremely vulnerable to size effects: A decline of the number of inhabitants is very detrimental to attractiveness to the creative class, and a primary concern of the smallest cities could be to coordinate efforts and collaborate in order to constitute more viable consumer and labor markets for the services and jobs that are most attractive to the creative class. The smallest cities that want to attract more of the creative class should also be careful not to allocate public resources in ways that render them still less attractive to this component of the labor force, even if it has low levels of political representation. The attractiveness of middle-sized cities is also dependent upon their population size, but with the lower exponent in this phase of cities, there is greater scope for these cities for experimenting with designing more unique profiles in order to attract the creative class. The cities with most inhabitants have by far the greatest advantage with respect to attracting the creative class. However, if the very largest cities should not erode this advantage, a primary concern is to manage their population growth without lowering their attractiveness to the creative class — through investing in appropriate public transport capacity, pollution and crime control, and allowing for a diverse offer of housing that accommodates a diverse population, including the creative class and the other population groups who contributes to the cities' ethnic and cultural diversity and environment.

The paper complements the work of Florida (2002a; 2002b; 2002c; 2005a; 2005b) in several ways. First and foremost, it presents a large-scale analysis of the rank-size distribution of the creative class. Regardless of the debate around the problem of urban hierarchies and scale free distributions alleged to by, amongst others, Florida (2002c), the analysis presented in this paper is the first of its kind. Based on data for 445 cities (as compared to Florida's (2002c) 268 observations), it suggests that while the creative class follows the rank-size rule, it does do in different phases, and these phases show more dramatic differences than the phases of the distribution of the general population. Two of the explanations we propose rest on large city congestion and small cities' less creative environment, respectively. However, our two remaining propositions are more controversial as they touch upon a classic theoretical dilemma in economic geography: The relationship between the rank-size argument and the central place argument. We point out that even if the European urban hierarchy conforms to the rank-size rule, it does not do so as one linear slope with a continuous gradient: Below a particular population size, the distribution shifts to a phase with a particularly high negative exponent (a higher level of proportionate city growth). The transition is very evident for the total creative class, and even more conspicuous for the bohemians. Arguing that the transition to a bottom phase is really the sign that many small thresholds begin to appear in the urban hierarchy — those of the minimum efficient market sizes for different services and job types — we introduce Criställer's (1933) argument about urban functions into our rank-size argument. However, this is not a full-blown transit to the central place camp: When we talk about "threshold", we mean the transition to a phase with another exponent — not, as Criställer would have it, clearly defined "steps" of cities with similar sizes and offer of urban services and job types. It would be unrealistic to think an urban hierarchy sports such steps. In stead, we point out that below a particular threshold city size, the offers of services and job types fall away with quite some variation, without clear steps — but on average, *faster* than for cities above the threshold.

A second addition to the existing literature is, of course, the European context for the analysis of the creative class. Even if various analysts (see e.g. Florida, 2005a; 2005b) have given European cities and countries various "creative rankings" with respect to their proportions of hi-tech labor, cultural offer, diversity, and tolerance, there have been no surveys of the European creative class carried out with a scale and detail matching that of Florida's (2002a; 2002c) analysis of the USA, and Gertler et al.'s (2002) analysis of Canada.

The third contribution of the paper we want to stress here is that it is based upon cross-country data. This means that the paper has potential for contributing to the literature on the rise of *global* urban hierarchies. Over the last decades, the discourse on urban nodes in global networks (Amin and Thrift, 1994) and the growth of "global cities" (Hall, 1998) has gained momentum. Now, with globalization in the guise of increased international glows of trade, capital, and people, global urban hierarchies may be undergoing changes (Castells 1989; Hall 1998; Soo, 2005). Even if the data presented in this paper is not exactly global, it is pioneering in a creative class context in integrating data for 8 European countries. This cross-country integration has proved valuable for our ability to include the *entire* population of cities in our analysis: The total population of the 445 cities shows no urban primacy that should be cut off[7], and can also be split up into three phases with very good fit to the rank-size rule, hence avoiding a painful cutting off of an "unruly tail" of observations.

The paper points forward in several respects. Foremost, in order to explain the distribution of the European creative class, the paper presents four general propositions that should be subjected to future empirical scrutiny. Furthermore, as the paper addresses a cross-country urban hierarchy, its considerations and suggestions may prove of importance for future analysis of global urban hierarchies, within the broader globalization research agenda. Future work based on the same database could, of course, encompass an analysis of whether the European urban hierarchy has undergone changes during the last decade (apart from, of course, expanding the data base).[8] Thus, the paper pays homage to a fine scholarly tradition: Of raising more questions than it answers. Given the limited scholarly attention dedicated to the creative class compared to the policy hype it has received recently, there seems to be ample room within economic geography for addressing these and related questions.

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[7] In our data set, Finland and Sweden show some urban primacy, but the combination of data from all the countries levels this effect.

[8] The 8 countries in the data base have been carefully selected, so there would be some problems of integrating more countries. See appendix 1 for a discussion.

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Appendix 1: On the data base and the definitions employed

The data used in this paper is the result of a common European project with participation from Denmark, Finland, Germany, the Netherlands, Norway, Sweden, Switzerland, and the UK. We chose countries with a high level of economic development for reasons pertaining to availability of data, in order to avoid very large effects of different political regulation regimes upon the distribution of the creative class, and in order to avoid problems with integrating data from economically less-developed countries with high urban primacy with countries with more perfect rank-size urban hierarchies (for problems of incorporating less developed countries into such data sets, see Soo, 2005).

Partners from all countries have participated developing the variables in the dataset to ensure the best possible homogeneity between the European countries as well as possibilities for comparability between European and North American analyses of the creative class. The source of the data varies between the European countries. Data for the Nordic countries (Denmark, Finland, Norway and Sweden) is register data supplied by the national statistical bureaus, containing accurate information on the whole population. For the remaining countries, data is national census data supplied by the national statistical bureaus, containing information on a substantial and representative sample of the national populations.

To ensure comparability between the European countries, city regions are used as unit of analysis. The European countries use slightly different definitions of a city region, however they all correspond to Eurostat's NUTS 4 regions.

The point of departure for each variable in the dataset is the indicators developed and presented by Florida (2002c) in his analyses of the creative class. This paper employs the following variables:

- *Population*: Number of all inhabitants (residents).
- *The creative class*: The share of the employed residents occupied within creative professions defined as ISCO: 211, 212, 213, 214, 221, 222, 231, 232, 233, 234, 235, 243, 244, 247, 1, 223, 241, 242, 31, 32, 341, 342, 343, 345, 346, 245, 3131, 347, 521.

- *Cultural offer index:* The number of employees in a city region working in industries with NACE: 80, 85.
- *Hi-tech jobs*: the share of the employees in the city region, who work within hi-tech industries defined as NACE: 244, 300, 321, 322, 323, 331, 332, 333, 334, 335, 341, 342, 343, 353, 642, 721, 722, 723, 724, 725, 726, 731, 732, 742, 743, 921.

The creative class is further divided into three subgroups:

- *The creative core*: The share of the employed residents occupied within specific (technical or educational) creative professions defined as ISCO: 211, 212, 213, 214, 221, 222, 231, 232, 233, 234, 235, 243, 244, 247.
- *The creative professionals*: The share of the employed residents occupied within specific (generic or managerial) creative professions defined as ISCO: 1, 223, 241, 242, 31, 32, 341, 342, 343, 345, 346.
- *Bohemians*: The share of the employed residents occupied within specific (artistic) creative professions defined as ISCO: 245, 3131, 347, 521.

Appendix 2: On the methods employed in calculating and plotting the distributions

A rank-size distribution is a correlation of the size of a variable for a group of observations with the rank of those observations on the same variable. We have employed a quite mainstream method (see e.g. Gabaix, 2005; Gabaix and Ioannides, 2003) in order to calculate and plot the distribution of the creative class, the general population, the cultural offer and high-tech jobs, among the 445 European cities.

All cities were ordered by the value of the observation (i.e., of the number of members of the creative class, total population, employed in cultural industries, and employed in hi-tech industries — for definitions, see appendix 1). The largest observation was given rank 1, the second largest rank 2 etc. We plotted the values as a graphic plot, the log of the rank is placed on the y-axis and the log of the size of the corresponding observation on the x-axis. As noted by Gabraix and Ioannides (2003: 6), perfect rank-size distributions should then appear as *".. something very close to a straight line."* This is an indication that the distribution is scale free (Barabási and Albert, 1999).

One may choose to cut off the lower tail of observations if it has no scale free distribution, in order to obtain a fit to a rank-size rule (Gabaix, 2005) — or, as in the case of our analysis where no cut-off was made, it may be necessary to split the distribution up into phases with better fit to the rank-size rule. Where to make the cut-off point, or where to split the distribution into phases, is a matter of individual judgment. We have chosen to split the distributions into phases so as to maximize each phase's correspondence between observed and predicted values — i.e., the adjusted R^2 of the graph in each phase. For the R^2 values achieved, please confer to tables 1, 3, and 4.

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