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Creative professionals and high-skilled agents: Polarization of employment growth?

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Abstract: The creative sector is frequently regarded as one of the driving forces of total employment growth. Empirical studies suggest that the clustering of human capital might result in the polarization of employment growth. Since the creative sector's definition is motivated from the insights of the economics of human capital, this effect might also be relevant to the creative sector. Following these ideas, the objective of the present paper is to analyze the impact of the creative sector on total employment and on creative sector's employment growth in Western Germany's regions from 1977 to 2004. For the analysis, the definitions of the creative sector follow a technologically and culturally oriented definition and, alternatively, Florida's creative class (2002). These approaches focusing on human capital are contrasted with a skill-based approach. Using a fixed-effects panel model with time lags, I find evidence that the creative sector fosters the regional growth rate of total employment. The results show, moreover, that an initially large share of regional creative professionals pushes further the regional concentration of those professions in agglomerated regions. Driving force for the concentration of creative professionals are local amenities, measured by bohemians, and it is assumed that knowledge spillovers - possibly accelerated by the diversified composition of employment - contribute to this polarization. These results are as well confirmed for the high-skilled agents.

Keywords: regional employment growth, creative sector, human capital, bohemians, externalities
JEL-codes: J21, J24, R11, Z1

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1 Introduction

Explanations for the dynamic of regions are manifold. A central point for the competitiveness of regions is the ability of attracting high-skilled agents and creative professionals. A sophisticated and excellent regional skill structure is frequently regarded as a major condition for regional employment growth. In particular, the creative professionals - that are economic agents working in the fields of education, engineering, science, and arts - are supposed to be attracted to places most beneficial to creative and innovative activities (Florida 2002; Wojan et al. 2007). Moreover, today the most successful regions seem to be particularly concentrated in idea-producing industries (Glaeser 2008). The distribution of such places is unequal in space, which is one explanation for regional economic imbalances.

According to Lucas (1988) the external effects of human capital - generated by formal and informal interaction between people - are a possible explanation for persisting economic differences between regions. I.e. the average skill level of a group of agents might affect the individual level - the productivity level - of agents. Regions with this external effect probably performing more successful than other regions. Furthermore, Lucas argues that especially economic agents working in the fields of "arts and sciences - the creative professions" exchange specific ideas, i.e. the effect of external human capital is common to creative professions (Lucas 1988, 38). Both contribute to the growth of knowledge. Moreover, he points out that cities facilitate the accumulation of knowledge through the exchange of knowledge and attraction of skilled workers; and much of economics in cities are "creative".

Those arguments support Florida's (2002) assumption on the importance of agents working in the creative professions. Florida (2002) argues that the economic success and competitive advantages of both cities and regions are based on these creative professionals. They can foster creative processes, ending in innovation and regional employment growth. He further suggests that the regional abundance of creative professionals effects the employment growth of that specific professions. There are empirical studies investigating this effect of human capital, but not on creative professionals. Suedekum (2006; 2008), for example, finds a positive effect of the share of employees with higher education on low- and medium-skilled employment growth, but not on employment growth of the high-skilled. Because of the latter result he concludes that skill complementarities are more important than knowledge spillovers, whereas Moretti (2004) find both, spillovers and skill complementarities important for productivity and, consequently, employment growth.

The primary motivation of this paper at hand is derived from Florida's (2002) assumption that the creative professions play a crucial role for employment growth. The work addresses the point that the creative sector fosters total employment growth, and the further regional accumulation of creative professionals.

The rest of the paper is organized as follows: Section 2 brings up theoretical arguments relevant for total and sector specific employment growth. Section 3 presents the variables for the econometric model, whereas the model is presented in section 4. In the fifth section econometric results on

the studies interest are highlighted. The results are interpreted and discussed in section 6, and the conclusion is made in the final seventh section.

2 Employment growth of creative and high-skilled agents

The basic theoretical argument relies on a human capital model by Moretti (2004) and Suedekum (2006, 2008). Suedekum's basic model investigates the impact of high shares of initial human capital (high-skilled agents) on high-skilled employment growth. He addresses the question whether human capital spillovers are associated with the educational level of agents. There are private and social returns of human capital, i.e. as a result of a higher average level of human capital the average wages of all employment are higher: The skilled agents will affect the productivity level - for example, by knowledge flows - of less skilled agents, this will result in higher average wages. Consequently, human capital is assumed to have a social and public character. Moretti (2004) comes, for example, to the empirical result that the regional supply of college graduates raises the wage of less educated groups. He concludes therefore that the level of the average education has a social return. But, whether regions with high shares of high-skilled agents further accumulate high-skilled agents, depends on the strength of human capital externalities which will result in higher skilled wages.

Suedekum (2006, 2008) stresses in his model the importance of local amenities. High-skilled agents are assumed to values local amenities, and this effects as well as their location. Following Suedekum's model, if local amenities are unequally distributed in space, high-skilled agents are disproportionately distributed between cities. This also suggests to control for local amenities. Suedekum (2006, 2008) and Moretti (2004), but also for instance Rauch (1993), suggest in their models that those city characteristics are (relatively) time-invariant. This is especially true for geographical conditions such as weather or access to the sea. Therefore, in his empirical work Moretti (2004) controls for unobserved characteristics across cities by using city specific fixed effects. Local amenities could also include cultural characteristics such as the share of bohemians - agents working, for e.g., as artists, publishers, audio engineers - or the diversity of economic agents. Both are regarded as a factor for the attraction of creative professionals (Boschma and Fritsch 2007; Shaprio 2006; Wojan et al. 2007). These findings are in contrast to Möller and Tubadji (2009), who find that the creative professionals prefer to life in strong economic regions. But, they do not find empirical evidence for Germany that bohemians matter for the attraction of creative agents.

However, Suedekum (2006, 2008) explore whether regions with low numbers of high-skilled agents converge in employment to regions with high numbers of high-skilled agents. He further delivers empirical evidence for his model. As a result, the author finds that cities with high endowment of high skilled agents initially grow faster in employment than unskilled cities. Moreover, cities with initially high shares of high-skilled agents face lower growth rates of such high-skilled employment afterwards. Hence, he does not observe a self-reinforcing spatial concentration, i.e. he finds no diverging tendency in

high-skilled employment between regions. Under the model assumption of equally distributed amenities, Suedekum concludes that the strength of human capital externalities is not strong enough to raise the average employments wage. On the basis of this result, he concludes that high-skilled and low-skilled agents are imperfect substitutes, they are complementarities.

However, Suedekum's model may help to explain whether the creative sector contributes to employment growth, and, in particular, to the employment growth of the creative sector self. In the following, this effect is empirically tested and analyzed.

3 Data and variables

In order to measure the number of creative professionals, I use the "IAB Regionalfile 1975-2004" data which is published by the Nuremberg Research Data Center FDZ (2008).[1] The data refers to NUTS-3-regions and to workplace location. It is a representative sample of 2 percent of all German employees, who are subject to compulsory insurance deductions, and includes approximately 21 million employment career histories. A disadvantage is that civil servants, freelancers and self-employed are not recorded in this employment sample.

An advantage is that bohemians reported to the German Social Insurance for Artists (*Künstlersozialkasse*) - which is the most important insurance agency for employed and self-employed artists - are included in the data. Therefore, the results maybe considered reliable for statements on the role of bohemians on employment growth. The samples time period is extraordinary long and the data census coherent in time. Generally, employed agents subject to compulsory insurance deductions accounts for approximately 70 percent of the total labor force in Germany (Bundesagentur für Arbeit [Federal Employment Agency] 2007). In the IAB-Regionalfile 1975-2004, it is possible to identify 130 professional groups (by means of a three-digit code) and details on individuals' income, nationality, or working place. The sample is representative for German employees. In the following, the data cleaning, preparation, and the variables used for the econometric model are shortly described.

Data cleaning and preparation In a first step, only the years 1977 up to 2004 and the western German regions are included. I consider only one observation for each employed individual per year, the reporting date is December 31 of each year (Drews et al. 2007). Since the individuals working in the creative sector are assumed to work often with part-time labor contracts, both part-time and full-time employed individuals are observed. All agents in apprenticeship are excluded. Moreover, I drop all observations with no valid information on the occupation and all observations with missing

[1] NOTE: The analysis is based on data from the IABS 1975-2004. The data access is possible through a Scientific-Use-File which can be provided by the Nuremberg Research Data Center FDZ (2008) ("Die Datengrundlage dieses Beitrags bildet die faktisch anonymisierte IAB Beschäftigtenstichprobe (IABS 1975 to 2004). Der Datenzugang erfolgte über einen Scientific Use File, der vom Forschungsdatenzentrum der Bundesagentur für Arbeit im Institut für Arbeitsmarkt- und Berufsforschung zu beziehen ist.").

information on the region. After the first data cleaning, around 10 percent of the observations have no information on education. Since the education variable suffers from the relatively large number of missings, in a second step I impute values for missing education data by following the imputation procedure IP1 by Drews (2006) and Fitzenberger et al. (2005). In the last step of data preparation, the observations (10,932,559) are aggregated to the level of Germany's 74 planning regions.

Dependent variable I use one measure of growth, which is the total employment growth between the years 1977 and 2004 (variable $\triangle EMP$). Growth is calculated by using absolute employment data for the three intervals 1980-1986, 1989-1995, and 1998-2004, whereas, the growth rate is approximated by: $growth_t = ln(variable_t) - ln(variable_{t-1})$. I use only natural logs, i.e. logs to the base e.

I add variables for the employment growth of the creative sector (variable $\triangle CS$), alternatively I use Florida's definition of the creative class (variable $\triangle CC$), and the employed high-skilled agents (variable $\triangle EDU$).[2] Those variables are used in a further econometric application as dependent variables and shall capture the potential catching-up process between cities and regions. The mean over the three intervals of the total employment growth $\triangle EMP$ is 5.4 percent, for the growth of the creative sector $\triangle TE$ 12.4 percent, for Florida's creative class $\triangle CC$ 4.3 percent, and for the high-skilled agents $\triangle EDU$ 19.9 percent (cf. table 3). Figure 1 plots the development of the total employment and the respective development of the creative sector, Florida's creative class, and the high-skilled employment. The total number of employment has almost remained flat, the number of high-skilled employed individuals has more than doubled in 2004, but also the creative sector and Florida's creative class show a remarkable increase.

Variables for creative professionals and skill groups For the purposes of measuring the creative sector engineering, technical, scientific and IT professionals have been aggregated into a share of the creative sector (variable CS) (**Definition 1**). The group of technological employees is characterized as improving "technology in the line of business they pursue, and as a result, productivity and growth" (Murphy et al. 1991, p. 505). This group is considered as highly creative and innovative, i.e. with the ability of technological creativity. Furthermore, the second agent group of the creative sector, the bohemians (variable BOH), are included in the analysis as an independent variable. It is assumed that bohemians - which are agents working as artists, publishers, or audio engineers - are a location factor. Bohemians themselves are also, according to the assumption, an economic factor.

The second definition for the creative agents is the share of the creative class (variable CC), which is defined by Florida (2002) (**Definition 2**). The variable CC captures the technological and economic creative ability of agents. Once again, the agent group of bohemians BOH is separately added in the empirical analysis.

[2]The variables are described more in detail in the subsection on variables for creative professionals and skill groups and in the appendix A.1 to A.3.

Figure 1: Total and group specific employment growth

SOURCE: IABS Regionalfile 1975-2004, FDZ (2008), own calculations

Alternatively, the third measure is the share of high-skilled employment (variable EDU) (**Definition 3**). Table 1 summarize the three definitions.

Table 1: Variables definition

Human capital	Sector/group	Agents with...	Variable
Creative (human) capital	Creative sector	...the ability of technological creativity	CS
		...the ability of cultural creativity	BOH
	(Florida's) Creative class	...the ability of technological and economic creativity	CC
		...the ability of cultural creativity	BOH
Educational (human) capital	High-skilled agents	...an university degree	EDU

NOTE: Tables A.1 to A.3 in the annex give a detailed overview of the employment groups.

Table 2 presents the correlation matrix between the different group specific variables. It is obvious that the relative share of the creative class, that is CC, is relatively highly correlated with the share of employed agents with technological creative abilities (94.9 percent), that is the creative sector CS. The match between the creative sector and bohemians is considerably smaller (52.1 percent) than the

ratio between CC and BOH (0.636). The correlation between the share of the high-skilled agents and the creative class is also relatively high (91.5 percent).

All variables, the share of the creative professionals (creative sector and creative class), the share of the high-skilled agents, and the bohemians are calculated on the basis of the employment data IABS Regionalfile 1975-2004 from the FDZ (2008). Tables A.1 to A.3 in the annex give a detailed overview of the employment groups.

Table 2: Correlation matrix for the initial years 1977, 1986, and 1995 (average)

Variable	CS	BOH	CC	EDU
Creative sector (CS)	1.000			
Bohemians (BOH)	0.521	1.000		
(Florida's) Creative class (CC)	0.949	0.636	1.000	
High-skilled agents (EDU)	0.873	0.650	0.915	1.000

NOTE: Number of observations=222. SOURCE: IABS Regionalfile 1975-2004, FDZ (2008), own calculations.

Further control variables Jacobs (1969) suggests that professional diversity might contribute to the overall development of economies. The argument is that diverse professionals bring in diverse knowledge into the production process. For operationalizing diversity, I measure the relative concentration of the creative sector among technological employees by using an inverse Herfindahl-Hirschman-Index, $DIV_{it} = 1 - \sum_{k=1}^{k} s_{ikt}^2$, where s_{ikt} is the number of employees with profession k in region i in year t. This index thus takes into account the diversity among the creative sector (variable DIV_CS), excluding bohemians. I alternatively use a diversity measure for the creative class (variable DIV_CC), again the bohemians are excluded from the diversity index. Since, the education variable has six different characteristics, I construct a variable for the diversity by skill group (variable DIV_EDU).

As an additional measure of diversity, I apply the share of employees with no German nationality (DIV). Because of data restrictions, the variable is constructed by using the information if employees have a foreign or German nationality. Since the correlation between the employees by nationality and the share of employees with foreign nationality is more than 90 percent, I use this relative measure as a proxy to measure the cultural-ethnic diversity. Cultural-ethnic diversity is assumed to be important in the knowledge creation process, since the variety of knowledge stocks increase the possible combination of knowledge and knowledge networks (Audretsch et al. 2009; Florida 2002; Lee et al. 2004). The share of employees with a foreign nationality has been calculated with the IABS Regionalfile 1975-2004 (FDZ 2008) data.

Besides the diversity measures as independent variables, a control variable for the *log* employment size of the planning regions are added (variable EMP). I use further a variable measuring whether the planning region has in the initial years 1977, 1986, and 1995 more than the 70th percentiles of the

average total employment of all planning regions. Since bohemians are assumed to be highly concentrated in agglomerated regions, an variable measuring the interaction between agglomerated regions and CS (variable AGG_CS) is included in the regression equation. Moreover, I add an interaction variable for CC (variable AGG_CC), EDU (variable AGG_EDU), BOH (variable AGG_BOH), and DIV (variable AGG_DIV). With this specification I control for regional differences, since it is expected that higher shares of creative professionals are concentrated in regions with high employment concentrations and agglomerative characteristics.

Table 3: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
$\triangle EMP$ (Total employment growth)	0.054	0.076	-0.107	0.244
$\triangle CS$ (Creative sector growth)	0.124	0.115	-0.150	0.833
$\triangle CC$ (Florida's creative class growth)	0.043	0.086	-0.182	0.484
$\triangle EDU$ (High-skilled growth)	0.199	0.113	-0.082	0.667
CS (Share of creative sector)	0.067	0.022	0.022	0.142
CC (Share of Florida's creative class)	0.129	0.029	0.066	0.242
EDU (Share of high-skilled agents	0.059	0.026	0.014	0.169
BOH (Share of bohemians)	0.006	0.003	0.001	0.020
DIV_CS (Diversity index of CS)	0.899	0.013	0.813	0.919
DIV_CC(Diversity index of CC)	0.917	0.015	0.852	0.939
DIV_EDU (Diversity index of EDU)	0.463	0.043	0.361	0.596
DIV (Share of employees with no German nationality)	0.070	0.036	0.011	0.192
EMP (Log of total employment)	8.247	0.675	6.960	9.920
AGG_CS (Interaction *var* of CS and agglomerations)	0.025	0.041	0.000	0.142
AGG_CC (Interaction *var* of CC and agglomerations)	0.045	0.072	0.000	0.242
AGG_EDU (Interaction *var* of EDU and agglomerations)	0.023	0.038	0.000	0.169
AGG_BOH (Interaction *var* of BOH and agglomerations)	0.002	0.004	0.000	0.020
AGG_DIV (Interaction *var* of DIV and agglomerations)	0.027	0.045	0.000	0.192
Number of observation: 222; number of groups 74				
Panel variable planning region: strongly balanced				
Time variable: year 1977 to 2004				

NOTE: Growth ($\triangle$) for 1980-86, 89-95, 98-04; Control variables for 1977, 86, 95; Agglomerations are regions with more than the 70th percentiles of the average absolute employment of all planning regions (agg=1, otherwise=0). SOURCE: IABS Regionalfile 1975-2004, FDZ (2008), own calculations.

Units of observation The regional level for the empirical analysis are Germany's 74 planning regions (*Raumordnungsregionen*). For each plannng region three observations are calculated (three initial years 1977, 1986, 1995), i.e. in total 222 observations are obtained. I exclude eastern Germany (former German Democratic Republic, GDR, and the city of Berlin), since the economical, political, and social structure is still different from western Germany. More important, no data before 1992 are available for eastern Germany.

Table 3 shows the summary statistics of the variables with their mean, standard deviation (Std. Dev.), minimum (Min.), and maximum (Max.).

4 Econometric model and specification

In a cross-section time-series analysis, I investigate whether the creative sector has a positively impact on the total employment for the time period from 1977 to 2004. I have applied control variables that turned out to be important for the employment growth. According to that the basic regression equation for the growth of the total employment is:

$$\begin{aligned} &\triangle EMP_{it} = \beta_0 + \beta_1 CS_{it-3} + \beta_2 BOH_{it-3} \\ &+\beta_3 DIV\_CS_{it-3} + \beta_4 DIV_{it-3} + \beta_5 EMP_{it-3} \\ &+\beta_6 AGG\_CS_{it-3} + \beta_7 AGG\_BOH_{it-3} \\ &+\beta_8 AGG\_DIV_{it-3} + \epsilon_{it-3} \end{aligned} \tag{1}$$

where $\triangle EMP_{it}$ is the growth of the total employment in three intervals from 1980-1986, 1989-1995, and 1998-2004 in region i. Growth is approximated by subtracting the natural log of employment of the starting data point (1980, 1989, and 1998) from the natural log of the end data point (1986, 1995, and 2004). With this computation, I obtain three observations for each of the 74 planning regions.

CS_{it-3} is the share of creative sector and BOH_{it-3} is the share of the bohemians in the initial years 1977, 1986, and 1995. DIV_CS_{it-3} is the diversity measure for the professional diversity, which is measured by the variety of the creative sector in region i in year $t-3$. DIV_{it-3} is the diversity of employees (share of employees with foreign nationality) for the three initial years t. I control for the size of employment within the regions and cities EMP, the variable is calculated by using the natural log of employment in the initial years. The last three variables AGG_CS_{it-3}, AGG_BOH_{it-3}, and AGG_DIV_{it-3} are interactions terms. To give trust in the empirical results, the equation (1), but also the two following equations (2) and (3), are estimated with interaction terms and without interaction terms. In general, in order to model the relationship between the independent input and output variables, the input variables enter into the estimation with a time lag of three years. Using input variables with sufficient time lags improves concerns of reverse causality. The error term is ϵ_{it-3}. The second basic equation is:

$$
\begin{aligned}
&\triangle EMP_{it} = \beta_0 + \beta_1 CC_{it-3} + \beta_2 BOH_{it-3} \\
&+\beta_3 DIV\_CC_{it-3} + \beta_4 DIV_{it-3} + \beta_5 EMP_{it-3} \\
&+\beta_6 AGG\_CC_{it-3} + \beta_7 AGG\_BOH_{it-3} \\
&+\beta_8 AGG\_DIV_{it-3} + \epsilon_{it-3}
\end{aligned} \tag{2}
$$

where CC_{it-3} is the initial size of the creative class. DIV_CC_{it-3} is the diversity of the creative class. AGG_CC_{it-3} is an interaction term between CC_{it-3} and regions with a high employment agglomeration AGG_{it-3}. The variables AGG_BOH_{it-3} and AGG_DIV_{it-3} are as well interaction terms. The other specifications and variables are given by the estimation equation (1). The third equation is:

$$
\begin{aligned}
&\triangle EMP_{it} = \beta_0 + \beta_1 EDU_{it-3} + \beta_2 BOH_{it-3} \\
&+\beta_3 DIV\_EDU_{it-3} + \beta_4 DIV_{it-3} + \beta_5 EMP_{it-3} \\
&+\beta_6 AGG\_EDU_{it-3} + \beta_7 AGG\_BOH_{it-3} \\
&+\beta_8 AGG\_DIV_{it-3} + \epsilon_{it-3}
\end{aligned} \tag{3}
$$

where EDU_{it-3} is the share of employed agents with an university degree (high-skilled) in region i and time $t-3$. The other variables are specified as in the above equation (1), exceptions are the interaction term DIV_EDU_{it-3} and AGG_EDU_{it-3}. The variable DIV_EDU_{it-3} measures the diversity of six different education degrees.

Alternatively, I estimate all equations (1) to (3) with three alternative dependent variables which are $\triangle CS_{it}$, $\triangle CC_{it}$, and $\triangle EDU_{it}$. I analyze these three dependent variables separately to investigate a potential polarization of creative professional employment. Again I split up the observations in three intervals and compute the growth rates for 1980-1986, 1989-1995, and 1998-2004. Control variables are computed for 1977, 1986, and 1995.

5 Regression results

This section presents the regression results, which illustrate whether the share of the creative sector, the share of Florida's creative class, and the share of high-skilled employed agents contribute to employment growth in Germany's planning regions. I divide this section in two subsections to present separately the estimation results on the total employment and group specific employment growth. The resutls are interpreted and discussed in section 6

5.1 Total employment effects

The regression equations are estimated with fixed effects estimators (FE). With this technique it is possible to consider unobserved effects. Since each planning region has its own time-independent

characteristics that may or may not influence the predictor variables, the FE model controls for this. Having tested with a Hausman test, Breusch-Pagan-Lagrange multiplier (LM), and the joint tests, I conclude that the fixed effects estimator is adequate for all equations on total employment growth. Both for the estimation equation 1 and 2, the test results for the cross-sectional dependence (CD) of Pesaran's indicate substantial CD in the errors. They may arise because of the presence of neighborhood effects. Calculating Pesaran's average absolute values, there is enough evidence suggesting the presence of CD in the estimations. De Hoyos and Sarafidis (2006), but also Hoechle (2007), suggest to calculate alternatively the standard errors (SE) with Driscoll-Kraay SE, correcting for CD. Moreover, the Driscoll-Kraay SE produces heteroscedasticity and autocorrelation consistent SE. Table 4 presents the estimation results.

Creative sector: Definition 1 First of all, as reflected in the R^2 of table 4, the overall fit of the estimation is 62 percent. The estimated results indicate that CS and the initial share of bohemians matter on the total employment growth. The coefficient of the initial share of the creative sector is highly significant (3.587). The initial share of bohemians, i.e. BOH_{it-3}, is as well significant at any level. Both signs are positive as expected. The coefficients DIV_CS_{it-3} and DIV_{it-3} are significant at the 1 percent level (1.190 and 1.551), which leads to the result that the relative diversity of the employed agents with creative ability and different cultural-ethnic background is linked to total employment growth. The interaction term AGG_DIV_{it-3} is positively significant. The coefficient of the variable EMP_{it-3} is positive (0.034), but insignificant.

Florida's creative sector: Definition 2 Again the number of observations is 222 and the Driscoll-Kraay SE are reported in parentheses. As reflected in the R-squared of table 4, the overall fit of the fixed effect regression is 61 percent. In general, the results indicate the same signs as for regression equation (1), with the exception that the share of the agents employed as bohemians, BOH_{it-3}, in interaction with agglomerated regions (agg=1) variable is negatively significant at the 1 percent level (-9.260). Once again, the coefficient of the diversity of economic agents DIV_CC is positive and significant (0.795). The variable EMP_{it-3} is marginally positively significant at the 10 percent level (0.098).

High-skilled agents: Definition 3 The estimation results for the employed high-skilled agents are also highlighted in table 4. The R^2 of the FE estimation is around 80 percent. At a glance, the results are not so different from **Definition 1** and **Definition 2**. The coefficient of the share of the high-skilled agents EDU_{it-3} is positive and highly significant at the 1 percent level (4.494). But, the coefficient for the interaction variable share of high-skilled agents EDU_{it-3} and agglomerated regions is negatively significant at the 1 percent level, and the coefficient is -0,585. Also the coefficient of the variable DIV_EDU_{it-3} is negative at the significance level of 1 percent (-1.374).

Table 4: Total employment growth (1980-86, 89-95, 98-04)

	Dependent variable: △EMP					
Variable	Definition 1		Definition 2		Definition 3	
CS	3.587**	3.348**	.	.	.	.
	(0.091)	(0.103)				
CC	.	.	2.409**	2.240**	.	.
			(0.058)	(0.093)		
EDU	.	.	.	.	4.494**	4.259**
					(0.151)	(0.078)
BOH	12.082**	10.682**	12.748**	10.968**	2.671**	1.116
	(1.440)	(0.877)	(1.757)	(1.259)	(0.829)	(1.426)
DIV_CS	1.190**	1.290**	.	.	.	.
	(0.187)	(0.201)				
DIV_CC	.	.	0.795*	0.944**	.	.
			(0.325)	(0.334)		
DIV_EDU	.	.	.	.	-1.374**	-1.524**
					(0.127)	(0.120)
DIV	1.551**	1.684**	1.723**	1.855**	2.079**	2.180**
	(0.218)	(0.238)	(0.310)	(0.287)	(0.101)	(0.061)
EMP	0.034	0.041	0.098†	0.099†	-0.051	-0.033
	(0.044)	(0.044)	(0.056)	(0.055)	(0.031)	(0.028)
AGG_CS	-0.335	.	.	.	.	.
	(0.224)					
AGG_CC	.	.	0.056	.	.	.
			(0.151)			
AGG_EDU	.	.	.	.	-0.585**	.
					(0.211)	
AGG_BOH	-4.492	.	-9.260**	.	-2.557	.
	(3.377)		(2.446)		(3.156)	
AGG_DIV	0.453**	.	0.567*	.	0.395**	.
	(0.133)		(0.244)		(0.127)	
Constant	-1.715**	-1.853**	-1.996**	-2.120**	0.692**	0.621**
	(0.223)	(0.248)	(0.179)	(0.224)	(0.238)	(0.204)
local area fixed effect: YES; time period fixed effect: YES; N = 222						
R^2	62.22%	61.88%	60.93%	60.48%	80.35%	79.76%

NOTE: Significance levels= †: 10%, *: 5%, **: 1%; Driscoll-Kraay SE in parentheses; Control variables for 1977, 86, 95. SOURCE: IABS Regionalfile 1975-2004, FDZ (2008), own calculations.

5.2 Group specific employment effects

Once again, the above three equations are estimated in a panel model. But, the dependent variable is seperately replaced by the growth of the creative sector ($\triangle CS$), the growth of Florida's creative class ($\triangle CC$), and the growth of the employed high-skilled agents ($\triangle EDU$). In first tests, all results indicate that the fixed effects (FE) model is appropriate. Furthermore, the CD test of Pesaran's indicates cross-sectional dependence between the planning regions. Therefore, I calibrated the standard errors with Driscoll-Kraay standard errors that are robust to cross-sectional dependence. The results are presented in table 5.

Creative sector: Definition 1 The overall fit of the FE estimator is around 30 percent. The variable of interest, CS_{it-3}, is negatively correlated with the growth of the creative sector, furthermore, the coefficient is significant at the 1 percent level (-3.898). The coefficients for the interaction variable of CS_{it-3} and the regions with a high employment density are positive and significant at the 1 percent level (0.707). Interestingly, the interaction variable AGG_BOH_{it-3} is very highly significant (27.782), but BOH_{it-3} itself is negatively significant at the 1 percent level. Now both variables DIV_{it-3} and AGG_DIV_{it-3} are negative and highly significant (-0.466 and -1.097). The variable for the diversity of CS_{it-3} is positively significant at the 1 percent level (3.059).

Florida's creative class: Definition 2 The results for the estimation of the growth rate of the creative class go hand in hand with the above results of the creative sector. But, the overall fit is much higher (72 percent). CC_{it-3}, that is the share of Florida's creative class, is negatively correlated with the growth rate of the creative class $\triangle CC$. The coefficient is significant at the 1 percent level (-3.436). The interaction variables AGG_CC_{it-3} is positively correlated with the growth of Florida's creative class and the coefficients are significant at the 1 percent level (0.218). Again the coefficient of bohemians concentrated in highly agglomerated regions AGG_BOH_{it-3} is positively significant at the 1 percent level (23.926). BOH_{it-3} itself is negatively significant. Comparing the estimated results with the estimation without the interaction variables AGG_*_{it-3}, the coefficients and their signs and significance levels indicate in the same direction.

High-skilled agents: Definition 3 Table 5 also presents the estimation results for the initial share of employed high-skilled agents on the growth of the employed high-skilled agents $\triangle EDU$, the Driscoll-Kraay standard errors are reported in parentheses. The overall fit is 35 percent. Once again, the coefficient for the initial share of employed agents with higher-eduction EDU_{it-3}, is negative and significant at the 1 percent level (-2.997). The share of bohemians BOH_{it-3} is positively correlated, and in the case of AGG_BOH_{it-3} positively highly significant, on the growth of $\triangle EDU$. The result of the employed agents with foreign nationality DIV_{it-3} on the growth of the employed high-skilled agents is different in some aspects, since the coefficient is now positively highly significant at the 1

percent level. Once again the interaction term share of employed high-skilled agents and agglomerated regions is significant and positive, here at the 5 percent level (0.740).

Table 5: Group specific employment growth (1980-86, 89-95, 98-04)

Dependent variable:	△CS		△CC		△EDU	
Variable	Definition 1		Definition 2		Definition 3	
CS	-3.898**	-2.948**	.	.	.	.
	(0.323)	(0.366)				
CC	.	.	-3.436**	-2.838**	.	.
			(0.058)	(0.104)		
EDU	.	.	.	.	-2.997**	-2.632**
					(0.177)	(0.149)
BOH	-4.798**	2.519†	-12.351**	-7.165**	1.176	5.268**
	(0.486)	(1.319)	(0.997)	(1.286)	(0.929)	(0.334)
DIV_CS	3.059**	2.563**	.	.	.	.
	(0.448)	(0.546)				
DIV_CC	.	.	0.226	-0.316	.	.
			(0.266)	(0.244)		
DIV_EDU	.	.	.	.	-0.210	0.108
					(0.224)	(0.185)
DIV	-0.466**	-0.736**	-1.247**	-1.580**	0.468**	-0.026
	(0.139)	(0.241)	(0.239)	(0.219)	(0.148)	(0.115)
EMP	-0.221**	-0.242**	-0.285**	-0.283**	-0.245**	-0.272**
	(0.076)	(0.067)	(0.068)	(0.062)	(0.022)	(0.005)
AGG_CS	0.707**	.	.	.	.	.
	(0.054)					
AGG_CC	.	.	0.218**	.	.	.
			(0.078)			
AGG_EDU	.	.	.	.	0.740*	.
					(0.279)	
AGG_BOH	27.782**	.	23.926**	.	14.079**	.
	(3.198)		(0.798)		(3.295)	
AGG_DIV	-1.097**	.	-1.433**	.	-1.740**	.
	(0.257)		(0.128)		(0.076)	
Constant	-0.538	0.047	2.766**	3.193**	2.446**	2.515**
	(0.808)	(0.853)	(0.392)	(0.277)	(0.078)	(0.091)
local area fixed effect: YES; time period fixed effect: YES; N = 222						
R^2	31.83%	26.99%	72.26%	68.98%	34.76%	33.1%

NOTE: Significance levels= †: 10%, *: 5%, **: 1%; Driscoll-Kraay standard errors in parentheses; Control variables for 1977, 86, 95. SOURCE: IABS Regionalfile 1975-2004, FDZ (2008), own calculations.

6 Discussion

Using micro data for the observation period from 1977 to 2004, it can be concluded that the creative sector (**Definition 1**) contributes to total employment growth. The initial shares of CS increases the growth rate of total employment. Holding the other variables constant, a one unit increase in CS will lead to a 3.6 percent change in futures total employment. The same holds true for the two estimations with the initial share of the creative class CC and the initial share of employed agents with university degree EDU (**Definition 2** and **3**). The results are in line with the empirical findings by, for instance, Möller and Tubadji (2009), Suedekum (2006, 2008), or Wedemeier (2010). They find significantly effects coming from the creative professionals and/or high-skilled agents on employment growth. The coefficients for the cultural amenity variable BOH are positive and significant in all three estimation equations. In general, the results suggest that BOH matters in the context of economic growth. This is also discussed in the literature on the creative sector and on the attraction of human capital, and confirms Florida's assumption (2002) on the positive effect of the cultural input on economic development. Results from Falck et al. (2009) or Wojan et al. (2007), for instance, support this view. However, if I draw, for instance, on Möller and Tubadji (2009), this result is not empirically supported. This can be possibly explained by differences in the methodology and by the regional level of investigation.

The assumption of the self reinforcing process is that the initial size of the creative sector contributes to the growth rate of the creative professionals. The creative sector CS on the growth rate of the same group of creative professionals is negative and significant at the 1 percent level. It significantly reduces growth of the same employment group (-3.898). But, the interaction variable between highly agglomerated regions - here calculated by the regional labor market size - and the initial share of the creative sector is significant. I conclude that there is a self-reinforcing process within already highly agglomerated regions. In contrast, regions with lower shares of the creative sector catch-up in creative sector employment to the German mean. Therefore, the polarization of creative professionals depends on the spatial type of observation. The external effect of human capital might be greater in agglomerated regions than in periphery regions. Furthermore, the value of local amenities - here measured by bohemians and the ethnic-cultural composition of the employees - is also higher in agglomerated regions. Both effect the location of creative professionals (by possibly higher productivity and wages). When I focus on the creative class CC (**Definition 2**), the results are consistent to the results of the first definition and they are also significant at the 1 percent level, both for CC and AGG_CC. The negative value of the coefficient for CC is explained by spatial differences. This result is consistent with Florida's (2002) assumption of the self-reinforcing process on the creative class, which is that the creative class is heavily concentrated in urban places. The results differ not eminently from econometric equation 3, which estimates the initial share of employed high-skilled agents on the growth of the same agents (**Definition 3**). Here I find a positive coefficient for the interaction term AGG_EDU,

which indicates a further divergence process between the regions. This result is not consistent with the estimations presented by Suedekum (2006, 2008). He suggest that cities with already high shares of high-skilled agents will grow more moderate: Regions with low shares of high-skilled agents will catch-up to those regions with higher shares of skilled agents.

Regarding the assumptions on diversity, the empirical findings are at odds. The assumption is that the diversity of economic agents by creative professionals' diversity foster employment growth. For DIV_CS, but also for the alternative estimation on DIV_CC, the coefficient is positive and significant at the 1 or 5 percent level. The interpretation is that diversity matters for the development of the total employment growth, i.e. the diverse composition of the creative sector and Florida's creative class, and not the clustering of one specific creative profession. Nonetheless, the results indicate that the regional concentration of creative professionals matters for employment growth, but the creative professionals should be diverse in its composition. This has important consequences for economic and urban policies, since cluster strategies or complex networks and regional innovation systems are very often of relevance to policy makers.

To sum up, large shares of creative professionals lead to an increase in total employment, but also reduce the growth of the same employment group. The growth in total employment owerhelms the decline of creative professionals. On the contrary, the econometric results show that an initially large share of regional creative professionals further pushes the regional concentration of those professions in highly agglomerated regions. Driving forces for the concentration are cultural amenities (BOH, DIV), unobserved city specific characteristics (catched with the fixed effect model) and assumed knowledge spillovers. However, regions with lower shares of the creative sector catch-up in creative sector employment to the German mean.

7 Conclusion

The initial shares of the creative sector increase the growth rate of total employment. I find further that the initial share of the creative sector remains negative on the growth rate of the creative sector itself. The empirical findings for the creative class, that is the definition coming from Richard Florida, are also significantly and negatively linked to the group specific employment growth. In consequences, a convergence in creative professionals employment between the regions is observable. But in opposite, a significant divergence between the two region types - agglomerated and non-agglomerated - are observable. The results suggest that local amenities and assumed knowledge spillovers are great enough within the agglomerated regions to further accumulate creative professionals. In agglomerated regions, sector specific employment growth is positively dependent on the initial share of the creative sector, Florida's creative class, and high-skilled agents. There is a polarization tendency of sector concentrated professions in already highly agglomerated regions:

Regions with initially scarce human capital grow faster than regions with higher initially human

capital shares. But, when differentiating between the highly agglomerated and non-agglomerated regions, there is a diverging tendency between the two region types. The results further suggest that cultural amenities are different distributed between the regions. Agglomerated regions with an high concentration of bohemians effect the total creative sector development. The assumption that creative agents value the level of amenity seems to be realistic, since they are assumed to be more mobile than less creative agents.

References

Audretsch, D., Dohse, D. and Niebuhr, A. (2009). Cultural diversity and entrepreneurship: A regional analysis for Germany, *The Annals of Regional Science* . DOI: 10.1007/s00168-009-0291-x.

Boschma, R. and Fritsch, M. (2007). Creative class and regional growth: Empirical evidence from seven European countries, *Economic Geography* **85**(4): 391–423.

Bundesagentur für Arbeit [Federal Employment Agency] (2007). Sozialversicherungspflichtige Beschäftigung und Erwerbstätigkeit: Entwicklung und Struktur 2000-2007, Nuremberg. [Official statistical data].

De Hoyos, R. and Sarafidis, V. (2006). Testing for cross-sectional dependence in panel-data models, *The Stata Journal* **6**(4): 482–496.

Drews, N. (2006). *Qualitätsverbesserung der Bildungsvariable in der IAB Beschäftigtenstichprobe 1975-2001*, number 5/2006, Nuremberg Research Data Centre (FDZ) of the Federal Employment Agency at the Institute for Employment Research, Nuremberg.

Drews, N., Groll, D. and Jacobebbinghaus, P. (2007). *Programmierbeispiele zur Aufbereitung von FDZ Personendaten in STATA*, number 6/2007, Nuremberg Research Data Centre (FDZ) of the Federal Employment Agency at the Institute for Employment Research, Nuremberg.

Falck, O., Fritsch, M. and Heblich, S. (2009). *Bohemians, human capital, and regional economic growth*, CESifo Working Paper 2715, Center for Economic Studies (CES), Institute for Economic Research (ifo) and the Munich Society for the Promotion of Economic Research (CESifo GmbH), Munich.

FDZ (2008). IAB Regionalfile 1975-2004 (IABS-R04), Nuremberg Research Data Centre (FDZ) of the Federal Employment Agency at the Institute for Employment Research, Nuremberg. [Official statistical data].

Fitzenberger, B., Osikominu, A. and Völter, R. (2005). *Imputation rules to improve the education variable in the IAB employment subsample*, number 3/2005, Nuremberg Research Data Centre (FDZ) of the Federal Employment Agency at the Institute for Employment Research, Nuremberg.

Florida, R. (2002). *The rise of the creative class and how it's transforming work, leisure, community, and everyday life*, Basic Books, New York.

Glaeser, E. L. (2008). *Cities, agglomeration and spatial equilibrium*, Oxford University Press, Oxford and New York.

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence, *The Stata Journal* **7**(3): 281–312.

Jacobs, J. (1969). *The economy of cities*, 1 edn, Random House, New York.

Lee, S. Y., Florida, R. and Acs, Z. J. (2004). Creativity and entrepreneurship: A regional analysis of new firm formation, *Regional Studies* **38**(8): 879–891.

Lucas, R. E. (1988). On the mechanics of economic development, *Journal of Monetary Economics* **22**: 3–42.

Möller, J. and Tubadji, A. (2009). *The creative class, bohemians and local labor market performance: A mirco data panel study for Germany 1975-2004*, ZEW Discussion Paper 08-135, Centre for European Economic Research (ZEW), Mannheim.

Moretti, E. (2004). Estimating the social returns to higher education: Evidence from longitudinal and repeated cross-section data, *Journal of Econometrics* **121**(1/2): 175–212.

Murphy, K. M., Shleifer, A. and Vishny, R. W. (1991). The allocation of talent: Implications for growth, *Quarterly Journal of Economics* **106**(2): 503–530.

Rauch, J. E. (1993). Productivity gains from geographic concentration of human capital: Evidence from the cities, *Journal of Urban Economics* **34**: 380–400.

Shaprio, J. M. (2006). Smart cities: Quality of life, productivity, and the growth effects of human capital, *The Review of Economics and Statistics* **88**(2): 324–335.

Suedekum, J. (2006). *Human capital externalities and growth of high- and low-skilled jobs*, IZA Discussion Paper 1969, Institute for the Study of Labor (IZA), Bonn.

Suedekum, J. (2008). Convergence of the skill composition across German regions, *Regional Science and Urban Economics* **38**(2): 148–159.

Wedemeier, J. (2010). The impact of the creative sector on growth in German regions, *European Planning Studies* **18**(4): 505–520.

Wojan, T. R., Lambert, D. M. and McGranahan, D. A. (2007). Emoting with their feet: Bohemian attraction to creative milieu, *Journal of Economic Geography* **7**(6): 711–736.

Appendix

Table A.1: Definition of the creative sector (Definition 1)

Occupational title	IAB-Label
Creative sector (excl. bohemians)	
Mechanical and vehicle engineers.	63
Electrical engineers.	64
Architects and construction engineers.	65
Surveyors, mining, metallurgists and related engineers.	66
Miscellaneous engineers.	67
Chemists, physicists, chemical/physical engineers, mathematicians, and civil engineering technicians.	68
Mechanical engineering technicians.	69
Electrical engineers technicians.	70
Surveyors, chemical, physical, mining, metallurgists, and miscellaneous engineering technicians.	71
Miscellaneous technicians.	72
Biological/mathematical/physical-technical assistant, chemical and related laboratory technician workers.	74
Draft persons.	75
Computer related professions.	99
Statisticians, humanists, natural scientists, and pastors.	120
Bohemians	
Journalists, publishers, librarians, archivists, museum specialists.	107
Musicians, performing artists, performers, graphic artists, designers, decorators, sign painters, stage, image and audio engineers, photographers, artists, and professional athletes.	108

Table A.2: Definition of the creative class (Definition 2)

Occupational title	IAB-Label
Creative class (excl. bohemians)	
Mechanical and vehicle engineers.	63
Electrical engineers.	64
Architects and construction engineers.	65
Surveyors, mining, metallurgists and related engineers.	66
Miscellaneous engineers.	67
Chemists, physicists, chemical/physical engineers, mathematicians, and civil engineering technicians.	68
Mechanical engineering technicians.	69
Electrical engineers technicians.	70
Surveyors, chemical, physical, mining, metallurgists, and miscellaneous engineering technicians.	71
Miscellaneous technicians.	72
Foreman, work master.	73
Biological/mathematical/physical-technical assistant, chemical and related laboratory technician workers.	74
Draft persons.	75
Software programmers, computer related professions.	99
Statisticians, humanists, and natural scientists, and pastors.	120
Analysts, entrepreneurs, leading administration, opinion makers.	93-95
University professors, education.	118
Financial services.	80
Legal services, lawyers, officers, justice, and soldiers.	104
Bohemians	
Journalists, publishers, librarians, archivists, museum specialists.	107
Musicians, performing artists, performers, graphic artists, designers, decorators, sign painters, stage, image and audio engineers, photographers, artists, and professional athletes.	108

Table A.3: Definition of the skill groups (Definition 3)

Educational title	IAB-Label
Low-skill	
basic education, no vocational education.	1
gymnasium, no vocational education.	3
Medium-Skill	
basic education with vocational education.	2
gymnasium with vocational education.	4
High-skill	
university of applied science.	5
university.	6

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