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Abstract: The creative sector is one of the driving forces of total employment growth. Furthermore, economic studies suggest that the clustering of human capital might result in the polarization of economic development. 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 Florida (2002) such as Möller and Tubadji (2009). However, these approaches focusing on human capital are contrasted with a skill-based approach. It is concluded 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 forces for the concentration are local amenities and knowledge spillovers. These results are as well as confirmed for the high-skilled agents.

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

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1 Introduction

Explanations for the competitiveness of cities are manifold. A central point for the competitiveness of cities 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 places 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.

It is argued in the economic literature that sectoral specialization, or in contrast the so-called sectoral diversity, raises the rate of economic growth through positive externalities, i.e. knowledge spillovers and network effects (cf., for instance, Audretsch et al. 2009; Duranton and Puga 2000, 2001; Quigley 1998). The diverse composition of the localized economic agents is moreover regarded as a factor in the growth of cities. The main argument is that cities bring together diverse agents, thereby fostering the combination and transmission of ideas (Jacobs 1969; Florida 2002).

A pre-requisite for the generation of innovation and economic growth is, however, the regional endowment of economic agents, i.e. human capital. According to Lucas (1988) knowledge spillovers, generated by formal and informal interaction between people, are a possible explanation for persisting economic differences between regions. 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 arts and sciences (Lucas 1988, 38). Moreover, he points out the importance of cities in the knowledge transfer, since cities facilitate the accumulation of knowledge transfers and much of economics in cities are "creative" as arts or sciences it are.

Those arguments supports Florida's (2002) assumption about the importance of agents working in the creative professions. His research question of the creative sector originates from the economics of human capital. Florida (2002) argues that the

economic success and competitive advantages of both cities and regions is 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 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 results he concludes that skill complementarities are more important than knowledge spillovers, whereas Moretti (2004) find both, spillovers and skill complementarities important for the employment growth.

The primary motivation of the paper at hand is derived from Florida's (2002) assumption that the creative professions plays a crucial role on employment growth. Moreover, the work addresses the point that the creative sector fosters total employment growth, whereas it contributes further to the regional concentration of that specific employment group. 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 used 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 discussed in section 6, and the conclusion is made in the final seventh section.

2 Creative and high-skilled agents growth

The basic theoretical argument relies on a human capital model developed by Moretti (2004) and adjusted by Suedekum (2006, 2008). Suedekum's basic model investigates whether high shares of initial human capital (high-skilled agents) increase high-skilled employment growth and discusses the underlying relationship between human capital and total employment growth. It addresses the question whether human capital spillovers, i.e. externalities, 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. Consequently, human capital is assumed to have a social and public character (Lucas 1988). Moretti (2004) furthermore comes to the 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 cities with high shares of high-skilled agents further polarize or converge in time, depends on the strength of human capital externalities.

Suedekum (2006, 2008) also stresses the importance for his model, that local amenities of cities have to be equally distributed between the cities. The characteristics of local amenities may be linked to the share of creative agents as these effects their location, since creative agents are assumed to value those local characteristics. In consequence, if the local amenities are unequally distributed in space, high-skilled agents are, following to Suedekum's theoretical model, disproportionately distributed between cities. This, however, suggests to control for local amenities, as Rauch (1993), for instance, does in his empirical work on high-skilled agents. Suedekum (2006, 2008), Moretti (2004), and Rauch (1993) stressed 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, Moretti (2004) controls for unobserved characteristics across cities by using city specific fixed effects. Local amenities could also include cultural characteristics such as the diversity of economic agents or the share of bohemians. Both are regarded as a factor for the attraction of creative professionals (Boschma and Fritsch 2007; Shaprio 2006; Wojan et al. 2007). However, these findings are in contrast to Möller and Tubadji (2009), who find supportive results that the employees of the creative sector prefer to life in strong economic regions, but they do not find empirical evidence for Germany that bohemians matter on the attraction of creative agents.

However, Suedekum (2006, 2008) extends the model of Moretti (2004) to explore whether regions with low numbers of high-skilled agents converge 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 levels of skilled agents initially grow faster in employment than unskilled cities. More important, cities with initially high

shares of high-skilled agents face lower growth rates of such high-skilled employment afterwards. Hence, he does not observe self-reinforcing spatial concentration, i.e. he finds no converging tendency between regions. Interesting is Suedekum's observation and result that the total employment increase, since the low-skilled employment grows faster than the high-skilled employment decrease. Suedekum's model helps to explain whether the creative sector contributes to employment growth. Under the 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.

To sum up, the a self-reinforcing process, i.e. that high shares of pooled high-skilled agents lead to a higher growth rate of that specific employment group, is investigated by Suedekum. Whether there is in the long run a stable equilibrium of creative agents in the model, depends if human capital externalities do exists.

3 Data and variables

In order to measure the number of creative professionals, I use the most current "IAB Regionalfile 1975-2004" data which is published by the Nuremberg Research Data Center FDZ (2008).[1] The IAB employee's data is given on administrative districts (NUTS3) and refers 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 the samples time period is extraordinary long and the data census coherent in time. Employed agents subject to compulsory insurance deductions

[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.").

accounts self 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 described.

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

After the first data cleaning, around 10 percent of the observations have no information about education on the education variable, when the number of observations is 10,932,559. Since the education variable suffers from the relatively large number of missing, 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 are aggregated to the level of Germany's 74 planning regions.

Dependent variable I use one measure of economic 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 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. With this specification, I follow Suedekum's (2006; 2008) empirical work.

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.

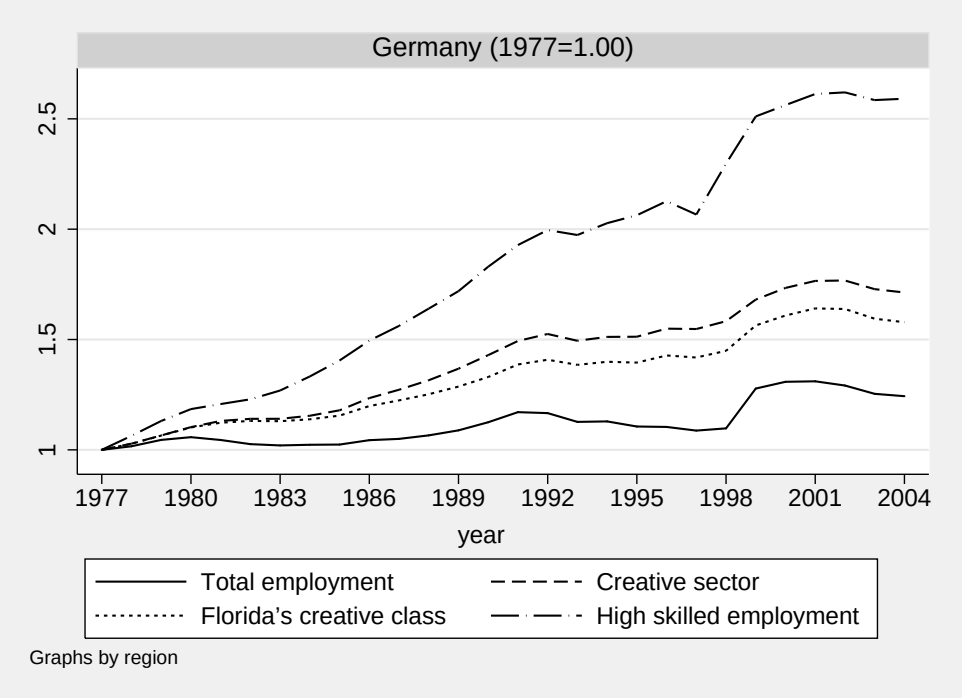
Since this paper presents some novel evidence for Germany, firstly I present some descriptive statistics. The mean over the three intervals of the total employment growth $\triangle EMP$ is 5.4 percent, for the growth of the creative sector $\triangle TE$ 12.4 percent, for Florida's creative class $\triangle CC$ 4.3 percent, and for the high-skilled agents $\triangle EDU$ 19.9 percent (cf. table 2). Figure 1 plots the development of the total full- and part-time 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) (**Alternative 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 that increases economic dynamism and the local atmosphere. Bohemians themselves are also, according to the assumption, an economic factor.

The alternative measure for the creative sector is the share of the creative class (variable CC), which is defined by Florida (2002) (**Alternative 2**). The variable CC

[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 (for a more detailed discussion on the definition cf. Florida 2002; Möller and Tubadji 2009; Wedemeier 2010b, forthcoming).

Figure 1: Total versus group specific employment development



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

captures the technological and economic creative ability of agents. Once again, the agent group of bohemians, i.e. BOH, is separately added in the empirical analysis.

Alternatively, the third measure is that of the share of high-skilled employment (variable EDU) (**Alternative 3**).

Table 1 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. The match between the creative sector and bohemians is considerably smaller (52.1 percent) than the ratio between CC and BOH (0.636). Interesting is also the relatively high correlation between the share of the high-skilled agents and the creative class (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 all three employment groups.

Table 1: Correlation between the different groups in 1977, 1986, and 1995

Variable	CS	BOH	CC	EDU
Creative sector (CS)	1.000			
Bohemians (BOH)	0.521	1.000		
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. Here the argument is that diverse professionals bring in diverse knowledge backgrounds into the production process. For operationalizing diversity, I measure the relative concentration of the creative sector among technological employees by using a Herfindahl-Hirschman-Index, $DIV_{it} = 1 - \sum_{k=1}^{k} s_{ikt}^2$, where s_{ikt} is the share of technological employees with profession k in region i in year t. This index thus takes into account only the diversity among the creative sector (variable DIV_CS). Here, the diversity of bohemians is not considered. For the alternative definition of the creative sector, i.e. the creative class, I 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 another nationality than German (DIV). Because of data restrictions, the diversity index by nationality is only available from 1995 on. 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 more differentiated knowledge increases 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 as well calculated with the IABS Regionalfile 1975-2004 (FDZ 2008) data.

Besides the diversity measures as independent variables, I consider various control variables usually applied in economic growth regressions. Control variables for the employment size of the planning regions are added (variable $log(EMP)$). I use further a variable measuring whether the planning region (variable AGG) has in the initial years 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, I include the variable AGG in interaction with BOH (bohemians). Moreover, I add an interaction variable for AGG and DIV (AGG_DIV), AGG and CS (AGG_CS), AGG and CC (AGG_CC), as well as AGG and EDU (AGG_EDU). 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.

Units of observation The regional level for the empirical analysis are Germany's 74 planning regions (Raumordnungsregionen). I obtain than three observations for each planning region (year 1977, 1986, 1995), and in consequence I get in total 222 observations. 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 2 shows the summary statistics of the variables with their mean, standard deviation (Std. Dev.), minimum (Min.), and maximum (Max.).

Table 2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
△EMP	0.054	0.076	-0.107	0.244
△CS	0.124	0.115	-0.150	0.833
△CC	0.043	0.086	-0.182	0.484
△EDU	0.199	0.113	-0.082	0.667
CS	0.067	0.022	0.022	0.142
CC	0.129	0.029	0.066	0.242
EDU	0.059	0.026	0.014	0.169
BOH	0.006	0.003	0.001	0.020
DIV_CS	0.899	0.013	0.813	0.919
DIV_CC	0.917	0.015	0.852	0.939
DIV_EDU	0.463	0.043	0.361	0.596
DIV	0.070	0.036	0.011	0.192
log(EMP)	8.247	0.675	6.960	9.920
AGG_BOH	0.002	0.004	0.000	0.020
AGG_NAT	0.027	0.045	0.000	0.192
AGG_CS	0.025	0.041	0.000	0.142
AGG_CC	0.045	0.072	0.000	0.242
AGG_EDU	0.023	0.038	0.000	0.169

Number of observation: 222; number of groups 74
Panel variable planning region: strongly balanced
Time variable: year 1977 to 2004

NOTE: Growth (△) for 1980-86, 89-95, 98-04; Control variables for 1977, 86, 95.
SOURCE: IABS Regionalfile 1975-2004, FDZ (2008), own calculations.

4 Econometric model and specification

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

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

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 $log(EMP)$, the variable is calculated by using the natural log of employment in the initial years. The last three variables AGG_BOH_{it-3}, AGG_DIV_{it-3}, and AGG_CS_{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 further estimated with the interaction terms and without the interaction terms. In general, in order to appropriately 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 long time lags improves concerns of reverse causality, therefore the initial independent variables are lagged by three years (1977, 1986, and 1995). The error term is ϵ_{it}. The second basic equation is:

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

where CC_{it-3} is the initial size of the creative class. DIV_CC_{it-3} is the diversity

of the creative class. Both variables are specified for the initial years 1977, 1986, and 1995. AGG_CC_{it-3} is an interaction term between CC_{it-3} and the region with high employment agglomeration AGG_{it-3}. The variables AGG_DIV_{it-3} and AGG_BOH_{it-3} are as well interaction terms. The other variables are given by the estimation equation (1). The third alternative equation is:

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

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 model (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. AGG_EDU_{it-3} is an interaction term between AGG_{it-3}, the regional employment with more than the 70th percentiles of employment, and EDU_{it-3}, the share of employees with high-skilled agents.

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 this employment specific growth rate separately to investigate a potential polarization or non-polarization of the regions. Again I split up the observations in three intervals and compute the growth rates for 1980-1986, 1989-1995, and 1998-2004. Control variables for the three intervals 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 number 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 development and on the group specific employment growth.

5.1 Total employment effects

The analysis is estimated with a fixed effects estimator (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 three equations on the total employment development. 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), alternatively suggest to calculate the standard errors (SE) with Driscoll-Kraay SE, correcting for CD. Moreover, the Driscoll-Kraay SE produces heteroscedasticity -and autocorrelation-consistent SE. Table 3 presents also the estimation results.

Creative sector: Alternative 1 First of all, as reflected in the R^2 of table 3, the overall fit of the estimation is good (62 percent). The estimated results indicate that the dynamics of the development of the technological employees and bohemians matter differently 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 hypothesized signs are as expected. Both coefficients DIV_CS_{it-3} and DIV_{it-3} are positive and both are significant at the 1 percent level (1.190 and 1.551), which leads to the assumption that the diversity of the employed agents with creative ability and different cultural-ethnic background is linked to the total employment growth and not the relative homogeneity of these two groups. The interaction term AGG_DIV_{it-3} is positively significant. The coefficient of the variable $log(EMP)_{it-3}$ is positive (0.034), but insignificant..

Florida's creative sector: Alternative 2 Again the number of observations is 222 and the Driscoll-Kraay SE are reported in parentheses. As reflected in the

Table 3: Total employment growth (1980-86, 89-95, 98-04)

	Dependent variable: △EMP					
Variable	Alternative 1		Alternative 2		Alternative 3	
TE	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_TE	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)
log(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_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)	
AGG_TE	-0.335	.	.	.	.	.
	(0.224)					
AGG_CC	.	.	0.056	.	.	.
			(0.151)			
AGG_EDU	.	.	.	.	-0.585**	.
					(0.211)	
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.

R-squared of table 3, the overall fit of the fixed effect regression is 61 percent. In general, the results indicate the same signs as for the above econometric equation (1), with the exception that the share of the agents employed as bohemians, BOH_{it-3}, in interaction with the AGG_{it-3} variable is negatively significant at the 1 percent level (-9.260). The variable $log(EMP)_{it-3}$ is marginally positively significant at the 10 percent level (0.098). Once again, the coefficient of the diversity of economic agents is positive and significant (0.795).

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

5.2 Group specific employment effects

Once again, I estimate the above three equations in a panel model. But, I change the dependent variable into the three group specific dependent variables, that are 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. The average absolute values are also very high. Therefore, I calibrated the standard errors with Driscoll-Kraay standard errors that are robust to cross-sectional dependence. The results are presented in table 4.

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

Dependent variable:	△CS		△CC		△EDU	
Variable	Alternative 1		Alternative 2		Alternative 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)
log(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_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)	
AGG_CS	0.707**	.	.	.	.	.
	(0.054)					
AGG_CC	.	.	0.218**	.	.	.
			(0.078)			
AGG_EDU	.	.	.	.	0.740*	.
					(0.279)	
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.

Creative sector: Alternative 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 agglomeration of employment AGG_{it-3}, 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: Alternative 2 The results of 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 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: Alternative 3 Table 4 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 coefficient for $log(EMP)_{it-3}$ is negatively significant (-0.245). 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 between the employed high-skilled agents and the agglomerated regions AGG_{it-3} is significant and positive, here at the 5 percent level (0.740).

6 Discussion

Using micro data for the observation period from 1977 to 2004, it can be concluded that the creative sector (**Alternative 1**) contributes differently to the total employment growth. The initial shares of CS_{it-3} increases the total employment. Holding the other variables constant, a one unit increase in CS_{it-3}will lead to a 3.6 percent change in futures total employment. When the focus lies on the interaction term of CS_{it-3} with the agglomerated region AGG_{it-3}, it is possible to argue that the effect comes not only from the agglomerated regions alone, but also from the periphery regions. The same holds true for the alternative estimations with the initial share of the creative class CC_{it-3} and the initial share of employed agents with university degree EDU_{it-3} (**Alternative 2** and **3**). The results are also in line with the empirical findings by, for instance, Möller and Tubadji (2009), Suedekum (2006, 2008), or Wedemeier (2010a,b). They find significantly effects coming from the creative professionals and/or high-skilled agents on employment growth. The coefficients for the variable BOH_{it-3} are positive in all three estimation equations and significant. In general, the results suggest that BOH_{it-3} matters in the context of economic development. 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 on Möller and Tubadji (2009) or Wedemeier (2010a,b), this result is not empirically supported. This can be mainly explained by differences in the methodology and by the regional level of investigation.

Regarding the assumptions of the diversity, the empirical findings are at odds. The assumption that the diversity of economic agents by creative professionals' diversity

foster employment growth. For DIV_CS_{it-3}, but also for the alternative estimation on DIV_CC_{it-3}, 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. 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

The assumption of the self reinforcing process is that the initial size of the creative sector contribute on the development of the creative professionals. The creative sector CS_{it-3} on the growth rate of the same group of creative professionals is negative and significant at the 1 percent level. It significantly reduces growth on the same employment group (-3.898). But, the interaction variable between the highly agglomerated regions - here calculated by the regional labor market size - and the initial share of technological employees is significant. I conclude that there is a self-reinforcing process within already highly agglomerated regions. Other less aggregated regions will decrease in average. Therefore, the polarization of creative professionals depends on the spatial type of observation. When I focus on the creative class CC_{it-3} (**Alternative 2**) the results are consistent and also significant at the 1 percent level, both for CC_{it-3} and AGG_CC_{it-3}. The negative value of the coefficient for CC_{it-3} is explained by the 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 on urban places. The results differ not eminently from the alternative econometric equation 3, which estimates the initial share of employed high-skilled agents on the growth of the same agents (**Alternative 3**). Here I find a positive coefficient for the interaction term AGG_EDU_{it-3}, 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 high- and medium-skilled workers are complements and not substitutes, which would explain that cities with already high shares of high-skilled agents will grow more moderate.

7 Conclusion

I find 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 on the group specific employment growth. In consequences, the neo-classical assumption of convergence 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 externalities are great enough within the agglomerated regions. 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 highly agglomerated regions.

The findings that a large initial share of the high-skilled agents on the growth of the high-skilled agents suggests that the high-skilled agents expand in the same way as the creative sector does: The regions with initially scarce human capital grow slower than regions with lower initially human capital shares, but, whether it is differentiated between the highly agglomerated and non-agglomerated regions, the neo-classical assumption turns to be wrong.

The results further suggest that cultural amenities are different distributed between the planning 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.

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Appendix A

Table A.1: Definition of the creative Sector (Alternative 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 (Alternative 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 (Alternative 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