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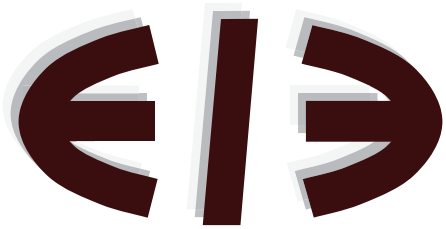

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Abstract

Though the measurement and implication of human capital on economic growth has been well established since the works of Becker in the 1960s, recently Florida has argued that creative class is superior to human capital in explaining economic growth. The underlying difference between the two scholars is a measurement approach in which while Becker uses education as indicator of human capital Florida employs occupation as an identifier of the creative class. We exploit administrative data from the Institute for Employment Research (IAB) over the years 1998-2008 and employ system GMM to estimate and compare the effects on regional economic performance of human capital and creative class in Germany where economic performance is measured by GDP growth, employment growth and wage growth. The estimation unveils that analysis of regional economy through creative class in place of human capital can be used as an alternative approach yet the creative class, as has been praised by Florida, is not found to be superior to human capital in explicating economic performance of regions. Indeed, albeit the share of creative class (creative core and creative professionals) and university graduates have positive and robust impacts on GDP growth it is by no means the share of university graduates that have a far greater impact on economic growth. The opposite holds for employment growth and is inconclusive for wage growth. This finding may imply that the creative class driven economic development is directed towards more labor intensive forms of development whilst human capital is directed towards the form of development characterized by specialization and high capital intensity.

Key words: creative class, human capital, economic performance and dynamic panel

JEL Classification: R11. O31.O52

1. Introduction

Literature has emphasised the reasons why occupations that apply a high content of creativity and/or knowledge tend to locate in particular areas and how in doing this they can serve local markets, generate economic growth, and benefit local communities overall (Florida, 2002; Markusen, 2004; Sacchetti et al., 2009). These impacts have been related to the presence of broader conditions. Development policy, in particular, has long emphasised the role of developing supporting institutions that can foster innovation, trade, job expectations and opportunities for entrepreneurship (Krugman, 1990; Markusen, 2004; OECD, 1993; 1996). Industrial growth policy became popular in particular after a wider recognition of Isard's work on the method of regional analysis (Isard, 1960) and the establishment of economic theories for which the economic performance of a region significantly depends on its export capability and share. Following these, many regional analysis techniques (such as location quotients, shift shares and input-output analysis) have been developed to examine regional industrial structure, industry cycles, industrial linkages and industry-related variables. Indeed, many states have established industry task forces and launched strategic plans to develop specific target industries that could improve the business environment, create new jobs and eventually boost the overall economic performance of a region (Koo, 2005; Markusen, 2004).

Social elements, complementary, have been argued to increase community development and regional competitiveness, nurturing use of creativity and critical judgement across communities and facilitating the attraction and retention of creativity-intensive occupations and talents more generally. Specifically, community involvement has been argued to give space to creative thinking and innovate on issues of public interest through for example use of public fora for discussion and deliberation within communities (Sacchetti and Sugden, 2009; Young, 1990). The promotion of social innovation relates also to innovative forms of production governance, typically those of the social economy that places at the centre social objectives and cooperation (Borzaga and Defourny, 2001; European Union, 2013). Moreover, the advantage of territories has been interpreted through the specific features of social capital, whose presence puts inter-personal links, cooperative attitudes, trust and reciprocity at the core of behavioural patterns (Fukuyama 1995; Putnam 1993) and may be thought in terms of enablers of innovation and creativity. Along these lines, Florida (2002) has emphasised the role of diversity, tolerance and openness of a society, since the arts and creativity more broadly are argued to flourish in societies that are open to multiple and daring perspectives.

Albeit concurring with the opportunity of considering the idea of creativity more generally, as a potential for any human activity or occupation as in Sacchetti et al. (2009) and Sacchetti and Tortia (2013), for the scope of this study we use a selective approach, going from the encompassing perspective that looks at the creative content of any job in any sector, to a consideration of specific occupations characterised by a high degree of creative contents. These are occupations defined by an ability "to identify and problematize a situation in a particular domain in a new and relevant way thereby transforming inter-subjective

understanding into new action and, therefore, bringing something into existence using intelligence and imagination" (Sacchetti and Tortia, 2013).

In order to identify creative occupations, we refer to the concept of the creative class defined by Florida (2002), which includes professions where the scope of the job allows identifying problems, proposing new solutions or combining existing knowledge in new ways. In his approach, Florida focuses on the creative content of individual occupations rather than industrial sectors as an integral part of ensuring economic growth. This crucial passage is discussed also by Markusen (2004) who establishes that the utility of targeting occupations is in their ability to transversally generate positive territorial externalities by stimulating entrepreneurship, recruiting and retaining talents, and serving multiple industrial sectors. Industrial classifications, moreover, would underestimate the presence of artists tout court. Within this approach occupational measures (i.e. Standard Occupational Codes, SOC) are argued to be best positioned to measure creative occupations not only with respect to conventional industrial measures (i.e. Standard Industrial Code, SIC) but also with respect to education, that is the other major indicator of human capital (HC).

Human capital as a driver of economic growth and of regional economic performance has been well established following the works of Becker (1960) and Shultz (1961). This literature has measured HC through education and tested its impacts and implications on households' economic conditions at the macro level. Some considerations on why regional growth studies can benefit from measuring HC by occupations, besides conventional education attainments, can help the interpretation of differential impacts, if any, on economic growth. Specifically, each measurement reveals an underpinning conceptual approach. Take, as a magnifying lens, the classic work by Sen (2002) on functioning (to be understood as outcomes, or people "doings") and capabilities (or the freedom to achieve a particular functioning). When focusing on education, the HC approach gives attention to one specific functioning or outcome, which is the analytical skill achievement, regardless of its creative content and actual application to production activities. Conversely, by focusing on occupations, the creative class approach directs attention to another type of functioning, i.e. the creative achievement, regardless of the actual education achievement. Occupational achievements, from this perspective, are an indication of the real doings of an individual in his/her job position, where s/he can apply and regenerate knowledge, critical thinking and skills, potentially creating spinoffs and additional occupation. Education, on the other hand can be regarded as an outcome that measures a potential occupation, and does not necessarily overlap with doings or the use of the skills learned, such as when educated individuals are unemployed or under-utilised within their occupational role.

In our specific case, creative class occupational categories capture also individuals who may not have a higher education degree (e.g. a self-taught artist, manager, policy maker …) and whose work is valued for skills developed in the creative practice of the arts or profession. Albeit of course this is very much consistent with educational skills, it is occupation, rather than education, that provides an indication of the presence of industrial activities that can

absorb a creative and skilled labour force. In this sense HC (educational skills; creative occupations skills) and the presence of a regional industrial base are complementary aspects of a knowledge-based economy: you need skills to transform creativity into a tangible output; you need creativity and critical judgement abilities to make your skills applicable; you need a production outlet to have an opportunity to apply your skills.

The purpose of this study is twofold: 1) to estimate and compare the impacts of creative class as well as human capital on regional economic performance in Germany on the basis of rich panel data over the years 1998-2008, and 2) to measures the extent to which Bohemians might affect the share of other creative class (creative core and creative professional) in a regional setup. It is evident that the implications of a conventional human capital measure, as popularized by Becker (1960) and Schultz (1961), and creative class as theorized by Florida (2002), have been extensively studied at regional level without taking a comparative analysis in Germany of which of the two indicators would better explain regional economic performance. We take Germany as case study because of the relatively high economic performance of the country with respect to other European areas, the existence of strong regional economic policy that has received considerable attention, and the availability of data that fits into the Florida concept. This way the paper intends to contribute the following:

First, while the impact of HC on regional economy in Germany or elsewhere has actually been analysed by a number of scholars, such contributions have measured human capital only by educational qualification- a conventional measure which does not take into account the creative class method. Our study intends to address this gap by measuring human capital through educational qualification and of another variant of human capital, i.e. creative class by occupation and estimate how the two approaches affect regional economy. In this respect measuring regional economic performance through Becker's and Shultz's approach or through Florida's creative class method will help to appreciate differential impacts on growth of the education-based and of occupation-based approaches.

Second, an analysis of the regional economy impacts based on occupations instead of education qualifications have not been attempted in a thorough and fully convincing way in the German context. Available studies grossly indicate that creative class occupations seem to boost economic performance of regions. Nevertheless, existing studies of the impact of creative class on regional economy do not seem to offer replicable methods, nor are they able to provide a comprehensive analysis to support regional labour market policy as well as regional economic policy. Our study, using a rich dataset and applying rigorous method intends to address these.

Third, regional economic development is increasingly becoming dependent on the knowledge-content of economic activities, which is anchored to the presence of individuals with the professional background and experience defined by the creative class. Here, as anticipated, creative occupations define the actual ability of individuals to apply knowledge, exert critical judgement and intuition to economic activities, in a way that education cannot do, as the latter mainly reflect competence with respect to codified/analytical knowledge. Knowledge is not

defined solely as analytical but also as synthetic and symbolic. A study of regional economy through educational attainments and creative class occupations will, therefore, be relevant in understanding how useful the two approaches to harnessing human capital for policy making.

Fourth, an occupation-based study can give inputs in identifying the kind of occupations that contribute to employment growth at the regional level. A final contribution is to do with the use of robust longitudinal data set as well as dynamic panel model. Previous creative class studies have mainly been concerned with associations between creative class and regional economic growth. Besides, the estimation of regional economic development effects of creative class including much of Florida's and related works employ simple regressions of cross-sectional data. These attempts do not capture unobservable regional fixed effects, endogeneity problems and time dynamics. Since our study uses rich administrative panel data it would allow us to estimate both cross-section features and time series dynamic effects of the creative class on regional economies. Besides, use of dynamic panel (GMM) addresses endogeneity and reverses causality issues where previous studies fail to account.

This paper has seven parts. The forgoing has the introduction which highlights the need to take into account the creative class approach as a contemporary and alternative option to human capital in the analysis of regional economy, the motivation as well as the contribution of the paper. In the following we provide the conceptual issues of the creative class as framed by Florida (2002) along with the criticisms of the concept. Then we provide some theoretical reflections of the creative class along with empirics. In part four we provide the econometric models and estimation strategies for regional economic performance (as measured by regional GDP growth, employment growth and wage growth). In part five descriptions of the panel data used for the study and summary statistics are presented. Part six, which is the main part of the paper, provides estimation results and discussions. Finally, we provide conclusion.

2. The concept of creative class and critiques

Florida's creative class concept refers to "people who are engaged in complex problem solving areas that involve a great deal of independent judgment and require high levels of intellectuality. These people are primarily paid to create and have considerable autonomy and flexibility than others" (Florida, 2004). Basically, he divides the creative class into creative core and creative professional where within the creative core we find the following professions: "scientists and engineers, university professors, poets and novelists, artists, entertainers, actors, designers and architects, as well as the thought leadership of modern society: nonfiction writers, editors, cultural figures, think-thank researchers, analysts and other opinion makers. Whether they are software programmers or engineers, architects or filmmakers, they fully engage in the creative process…" (Florida, 2002). The outcomes are "new forms or designs that are readily transferable and broadly useful-such as designing a product that can be widely made, sold and used; coming up with a theorem or strategy that can be applied in many cases; or composing music that can be performed again and again" (Florida, 2005). Besides the creative core are what Florida calls "creative professionals" who

“work in a wide range of knowledge-intensive industries such as high-tech sectors, financial services, the legal and healthcare professions, and business management”(Florida, 2005). Here is the strong overlap of creative professionals with educational achievements. These people, in fact, “engage in creative problem-solving, drawing on complex bodies of knowledge to solve specific problems. Doing so typically requires a high degree of formal education and, therefore, a high level of human capital” (Ibid).

His contribution appears to be impressive and an alternative approach to replacing human capital by creative class which can be measured on the basis of who does what (occupation) instead of through the conventional system of educational qualification that does not necessarily tell the real activity of an individual. However, creative class has received a number of criticisms, regarding: a) the elusiveness of the creative class concept; b) the causal relations and interpretations of creative class and c) the policy implication of the creative class (Andersen, et al., 2010). Asheim and Hansen (2009) for example recommend that breaking the creative class into less heterogeneous subcategories is necessary in order to better understand the dynamics of the knowledge economy else it is not possible to guarantee all groups of creative class to have same preferences, for example, either all would like to live in places where people climate is nice or in places where there are conducive business climate. Another comment regarding the elusive concept of creative class is made by Glaeser (2005) who addresses the similarity between creative class and human capital. Based on an evidence of strong associations between highly educated people and regional growth Glaeser argues that Florida gives the creative class credit for causing regional growth where growth is actually generated by human capital.

On causal relations, Florida has been attacked on the basis of the unconvincing causal relationships of creative class and economic growth that he established. Scott (2006) argues that Florida has not expressed the necessary and sufficient conditions that make creative individuals come together and remain in a particular place over a reasonable long period of time. Rather, entrepreneurial and innovative energies are stimulated by a differentiated local production system favouring the importance of a business climate as a source for innovativeness rather than just people climate. By this Scott maintains that it is business that generates economic growth and not necessarily creative people that produce growth. Similarly, Malanga (2004) suggests that Florida only focuses on a very small part of the economy when emphasizing the high-tech industries as prime economic drivers. These industries only account about 8% of the total employment in which Florida probably leaves out some very important dynamics of the economy. Hansen and Niedomysl (2009) indicate that creative class is vaguely more selective in their choice of destination compared to people outside creative class. They demonstrate that people belongs to the creative class in Sweden move for jobs rather than attractive neighbourhoods indicating that the causal relation in the Swedish context is in favour of people moving for jobs rather than jobs moving to people.

As per policy implications, the creative class approach of regional economic development appears to have a supply side policy. It draws policy prescriptions on the basis of rather simple

theoretical underpinnings and unconvincing justifications. Following Florida's creative concept, creative city ideas have been applied by policy-makers including in Nordic city regions. Peck (2005) has in this regard warned that the tendency to put Florida's ideas into practice as supply-side policy merely to satisfy creative employees is dangerous. The idea that creativity increases the competitiveness of cities sustainably does not take into account the structural differences of cities, historical variations, power of the life cycle that cities which have been more prosperous and creative once could fall into being decay and unattractive, and the possibilities of the power of other explanatory variables that could shape cities the way they are. The creativity driven policy prescriptions for cities seem to end up having same method of city competitiveness which is not convincing. Albeit Peck appreciates the role that creative class and creativity plays in economic development efforts, creative class based economic development policy can have problems including the race to attract talent and mobile workers may remove focus from important local challenges such as large socio-economic inequalities. Moreover, it would be very likely that many regions will focus on same type of policy initiatives in order to comfort highly educated people and, therefore, try to attract same creative people. Such attempt, in reality, is hard to implement.

Table 1: Creative class by occupation

Creative people	**Occupation**
Creative core	Physicists, biologists, chemists, mathematicians, statisticians, geologists, computing scientists, engineers, architects, professors, faculty members, researchers, think-thank experts, data and information experts.
Creative professional	Economists, decision scientists, legal scientists, health professionals, high level politicians, senior officials, business experts, intelligence and detective workers, social workers, anthropologists and related.
Bohemians	Photographers and image and sound recording equipment operators, writers, performing artists, artistic, entertainment and sport associate professionals, fashion and other modelists.

Source: Authors' construction using ILO (1993), Florida (2002) and Boschma and Fritsch (2009)

We appreciate the contributions of Florida and the criticisms he received and adjust the earlier creative class categorisation by separating Bohemians (artistic professions) from the creative core to isolate impacts of different professions. For our classification we follow the insights of Boschma and Fritsch (2009) as well as use ILO (1993) profession classification system. Accordingly, the first group, the creative core includes individuals who work in hard sciences, engineering, intelligence sciences, applied sciences, computing as well as in high-level design areas. The second group, creative professionals, who are also called associate professionals,

are engaged in health sciences, legal science, business and economics, finance, decision sciences, political sciences, social sciences, humanities and police inspection areas. Bohemians or artists appear as a separate category in the third part as shown in Table 1.

3. Creative class: Theory and empirics

The central indicators of the creative class are occupations[1], especially creative occupations, to which their implications for economic growth have been acknowledged by scholars including Mather (1999), Theodore (1999) and Thompson and Thompson (1985). However, the popular recognition of creative class has come into effect following Florida's bestselling book: "The rise of the creative class: And how it's transforming work, leisure, community and everyday life". The main aspect of the argument is that the creative class which is measured by occupation is superior to education which measures HC in explaining the performance of regional and local economies. The theory also argues that-unlike mainstream economics which takes the growth performance of regions as a function of business climate- regional economic development need to be approached from the point of view of a region's capability to attract talented individuals, through availability of amenities and openness of society.

This tenet can be articulated into three main theories. The first states that creative class is the crucial driver of regional economic development. The second focuses on the economics of location of specific factors (regional features) which attract creative class. The third addresses the economics of Bohemians and their impact in attracting other creative class professions. We focus on the first and third of the tenets, since our aim here is to analyse the distinctive impacts of creative class occupations on the one hand and education on the other on economic growth as well as how bohemians might affect the share of other creative classes in a region.

Creative class is a motor for regional economic development: The central idea is that creative class is a critical engine of regional economic development. Proponents of this theory support the view that creative class outperforms education as a measure of HC in boosting the productivity and competitiveness of a region. A region with good number of creative or innovative people tends to be competent sustainably (Markusen, 2006). Such contexts imply that regional economic growth is not primarily based on particular industries such as high-tech operated by high level HC, but on creative people who are not tied to specific industry. This thought seems to undermine sector-based regional economic development taking the emphasis off the role of agglomeration externalities, regional specialization or localization economies (Glaeser et al., 1992).

The creative class approach differs from industry-driven regional development in that the latter emphasizes knowledge spillovers between firms and industries. Besides, whereas the conventional industry approach takes sectorial innovation as a precondition for regional economic development, a creative occupation approach considers the capability to generate

[1] For details of how occupation can be used as indicators of creative class or human capital readers are invited to refer the works of Markusen et.al, (2008).

innovation of the creative class as a preferred way of sustaining regional economic development (Stolarick and Florida, 2006). This view supports the works of Zucker et al. (1998) and Almeida and Kogut (1999) who identify that transfer of knowledge and skills embodied in people, instead of firms, are crucial for economic growth and spillover.

The theorised relation between creative class and economic growth is praised by some scholars as an improvement of the method used to examine the relationship between HC and regional economic development (Marlet and van Woerkens, 2004). Creative class indicates economic performance via occupation outcomes and therefore better explains economic growth than the traditional means of educational attainment in which accumulation of innovative capital is to depend on formal education through codified knowledge and formal training. Indeed, HC per se cannot contribute to regional economic development if the educational qualification obtained is not invested in forms of relevant employment (if what one knows is not practiced). It is the capability in creating ideas, inputs, processes and products which matters more for economy. The claim is that regions with a concentration of creative occupations are likely to generate innovation in any sphere of society, through new ideas, concepts or technologies and increase the propensity of entrepreneurial atmosphere which is often seen as a requirement for sustained economic advancement.

A number of studies, although with improvable methods, have attempted to test this theory. These include the works of Mellander and Florida (2011), Florida et al., (2010), Florida and Mellander (2009), Florida et al. (2008), Stolarick and Florida (2006), Boshchma and Fritsch (2009), Lengyel and Sagvari (2010), Moller and Tubadji (2009), and Mellander and Florida (2011) study the impact of creative class, super-creative and creative professional against the conventional educational attainment on regional wages per capita in Sweden where wage is taken as an indicator of regional growth. The finding indicates that creative class outperforms conventional educational attainment measure. Besides, occupations in the arts and culture play a significant role. These findings are consistent with Marlet and van Woerkens (2004) who argue that occupational measures may well set a “new standard” for measuring human capital and deserve more attention in empirical studies of regional growth.

Florida et al. (2010) study on Canada’s regional growth between 2001 and 2006 also shows, using educational attainment and creative class, that both measures are strongly associated with regional income. However, the creative class variable is significant while the education variable is not. Of the two main groups that make up the creative class, creative professionals are more strongly related with regional income than the creative core. Similar results are observed from Florida and Mellander (2009), Florida et al., (2008) and Stolarick (2006). Florida et al. (2008) finding shows that creative class outperforms conventional educational attainment when measuring regional labour productivity (measured by wages), whereas conventional education measures of human capital better measure regional income.

Boschma and Fritsch (2009) analysis of a cross country study of creative class and its impact on regional economic performance in over 450 regions of seven European countries reveals a positive robust effect on employment growth and new business formation. The result supports

the view that the occupation-based creative class indicator is a more significant measure for HC than formal education. Whilst supporting Florida's view, yet the corroboration is based on simple regression model that does not take into account endogeneity as it is based on cross-sectional data that are not able to capture the cross-section and time dynamics across time.

On the contrary, Lengyel and Sagvari (2011), who estimate effects of educated labour and creative occupations on regional development using cross-sectional data in Hungary, suggest that the share of educated labour has a bigger effect on regional development than the share of creative occupations. This supports the classical view that HC measured by education plays a major role in economic development as opposed to the views of Florida and his empirical findings (Florida et al., 2008; Mellander and Florida, 2011).

Moller and Tubadji (2009), using dynamic panel, analyse the effects of creative class on regional employment growth for West Germany. Like Boschma and Fritsch (2009) the study extracts artists from the rest of the creative core in order to study the separate effects of the arts and the sciences. In this way they find that agglomeration of creative class (creative core excluding artists and creative professionals) increases the propensity of economic performance of a region and outperforms conventional indicators of HC. Nevertheless, the estimation does not support another of Florida's view that creative workers flock where Bohemians live. Besides, they identify that creative class is, rather attracted by favourable economic conditions such as by employment growth or wage. Similarly, Hansen et al. (2010) analysis of the effects of creative class on regional development shows that the relationship between regional developments, the creative class, people and business climate are positive. Whereas larger regions favour Florida's arguments, the findings from smaller regions do not support them.

Creative class flocks to where Bohemians live*:* Florida (2002) assumes that where there are more Bohemians, there will be more creative class-the former attracting the latter. This theory is constructed based on the observations of large urban regions of U.S. with a population of more than 100, 000. The approach, as it has been framed for large urban regions, is more suited for regions whose population is large enough, making the application of the theory in rural regions or regions with small urban sizes, if not impossible, difficult. This begs the question concerning the relation between the creative class and rural economic development as well as for regions of small urban areas such as in many European countries, whose urban areas are so small compared to urban areas in U.S. and Canada where Florida espouses his theory. Fritsch and Stuetzer (2008) estimation of the effect of Bohemian on creative core and creative professional in Germany reveals a positive and significant effect. This study, however, uses cross-sectional data and as such the positive impact of Bohemia on creative class cannot be taken for granted since the estimation is not in a position to capture reverse causality and endogeneity problems one of the critical aspects of impact studies. Moreover, it seems that the estimation is underspecified. The studies of Boschma and Fritsch (2009) which use cross-sectional data for regions in Europe reveals that Bohemians attract the creative core and creative professional as well as the creative class to a significant level. Florida's (2002a) study shows that Bohemians play an important role in regional economy not only by being

involved in innovative activities themselves but also by creating atmosphere that attracts other intellectuals who have ripe talent in solving so many regional social and economic problems.

Glaeser's (2005) indicates that the effect of Bohemians (or those who work in the artistic kinds of occupations) on creative class is not robust. He is, in fact, at odds with Florida's popularization of the creative class theory, and defends the idea that the creative class is just a human-capital surrogate. Also Moller and Tubadji (2009) reject the view that Bohemians attract a significant share of the creative class. These authors instead note that it is the labor market and other incentives that play positive roles in attracting the labor force of the creative class. Besides, they argue that the decision to move into a new place is not due to the presence of Bohemians but to other economic factors.

4. Econometric model and estimation strategy

In order to estimate the impacts of human capital and creative class on regional economic performance (GDP growth, employment growth and wage[2] growth) and compare the results as well as analyse the creative class impacts of the share of Bohemians we use a dynamic panel model that has the following form (Arellano, 2003):

$$y_{i,t} = \alpha y_{i\,t-1} + \beta x' + \omega_i + \varepsilon_{i\,t} \qquad i = 1...N \ \ and \ \ t = 2..,T \qquad (1)$$

Where y regional economic performance as measured by GDP, employment or wage in region i in year t, $y_{i\,t-1}$ is economic performance of a region in the previous year (also called the lagged dependent variable), α is coeffieiceint of the lagged dependent variable, x' are sets of share of creative class or human capital, β is coefficient of creative class or human capital, ω_i is time-invariant error, and $\varepsilon_{i\,t}$ is time-variant error term. Put differently, ω_i is an unobserved region-specific time-invariant effect which may be correlated with variables of x' but not with $\varepsilon_{i,t}$, and $\varepsilon_{i,t}$ is an independent and identically distributed (iid) error or idiosyncratic term with $E(\varepsilon_{i,t}) = 0$ *for all i and t*.When all the required variables of our interest are included; equation (1) is converted into the following estimable model:

$$y_{i\,t} = \alpha y_{i\,t-1} + \beta x'_{i\,t} + \lambda k' + \theta yr* + \omega_i + \varepsilon_{i\,t} \quad with \ \ i = 1...N, and \ t = 2,...,T \qquad (2)$$

Where, k' is set of control variables, λ is coefficient of control variables, $yr*$ is year dummy included in order to control some unobservable shocks, θ is parameter of year. The potential problem that arises in using the above model is that the lagged dependent variable, regional economic performance, will be correlated with the time-invariant region

[2]The three indicators of regional economic development have actually been fundamental variables being used in the analysis of economic development in mainstream economics.

fixed effect error terms ω_i whereby, eventually, $y_{i\ t}$ will be correlated with ω_i . This inflates coefficient of lagged dependent variable and, hence, creating Nickel (1981) upward panel bias which in turn results in instability and endogeneity. This is also called the pooled OLS upward panel bias which can lead into inconsistent estimation. Such problem can be minimized by within (fixed effects) transformation technique through demeaning. When demeaning is used the transformed variables on the right-hand side of equation (2) will be correlated with demeaned error term $(\varepsilon_{i\ t} - \bar{\varepsilon}_i)$. So does $(y_{i,t-1} - \bar{y}_{i-1})$ where $y_{i-1} = \frac{1}{T-1}\sum_{t=2}^{T} y_{i,t-1}$ is negatively correlated with demeaned error term. This way within estimator-unlike pooled OLS- provides consistent estimation. However, the problem of the within estimator is that the sum of parameters of lagged dependent variables has a tendency of downward panel bias (Nickell, 1981) even if these variables are not serially correlated with $\varepsilon_{i\ t}$. If the spell of $T \to \infty$ then the downward bias of the within estimator will be minimized. Nevertheless, evidences show that even for T=30 fixed effects estimator has downward bias.

The panel bias also called the Nickell (1981) panel bias will be captured by introducing first differencing where an application of this option to equation (2) results in the following:

$$\Delta y_{i\ t} = (\alpha - 1) y_{i\ t-1} + \beta \Delta x'_{i\ t} + \Delta \lambda k' + \Delta \theta yr^* + \Delta \varepsilon_{i\ t} \quad with\ \ i = 1...N, and\ t = 2,...,T \qquad (3)$$

Now the fixed-effects error term has been purged and that the equation has become a growth function where our main purpose lies. Substituting the general regional economic performance growth equation (3) by a more specific regional economic performance indicator- real GDP growth- we obtain the following:

$$\Delta GDP_{i\ t} = (\alpha - 1) GDP_{i\ t-1} + \beta \Delta x'_{i\ t} + \Delta \lambda k' + \Delta \theta yr^* + \Delta \varepsilon_{i\ t} \quad with\ \ i = 1...N, and\ t = 2,...,T \qquad (4)$$

With the assumption that $E(GDP_{i\ t}\ \varepsilon_{i\ t}) = 0 \quad for \quad i = 1,...,N \ \ and \ \ t = 2,...,T$

Now, since the time-invariant variable (ω_i) is kicked out, the estimation is supposed to be consistent and unbiased (Ahn and Schmidt, 1995) and that the two popular GMM estimators can be used. These are difference GMM (Anderson and Hsiao, 1981; Holtz-Eakin et al., 1988; Arellano and Bond; 1991) and system GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998). There are two forms of difference GMM: one-step difference GMM and two-step difference GMM. Similarly, we have one-step system GMM and two-step system GMM. The use of difference GMM estimator suffers from large finite sample biases when instruments available are weak. In case of persistent series (value of autoregressive order, α, is close to unity) and the variance of the fixed effect (ω_i) increases relative to the variance of disturbances (ε_{it}), the instruments (lagged levels of the variables for subsequent first differences) are weak (Trufat, 2006).

Blundell and Bond (1998) and Blundell et al. (2002) simulations show that D-GMM [3]estimator, in situation of weak instruments, is biased downwards in the direction of within group estimator. The bias can be detected by comparing first differenced GMM results of the autoregressive parameter with that of pooled OLS and within estimator. We expect a consistent estimate of GMM, in the absence of finite sample biases, if it lies between pooled OLS and within estimators (Nickell, 1981). One can also test if the series are persistent, that is, the closer α to unity, the more likely that there exists bias due to weak instruments. Besides, since first difference uses deep lagged values of the dependent variable to instrument dependent variable this works at a cost of reducing sample size. This problem will be enormous if data are unbalanced and if deep lags are to be used.

Under such conditions system GMM works well since it subtracts averages of future values instead of lags. System GMM (Hsiao, 2003; Arellano and Bover, 1995; Blundell and Bond, 1998) reduces problem of finite sample biases associated with D-GMM due to weak instruments where S-GMM [4]estimates a system of equations in both first differences and in levels. In the first-difference equations *lagged level values* of the variables are used as instruments while in levels equations one uses *lagged differences* as instruments. This estimation strategy requires additional $T-3$ moment conditions to be valid: $E[\Delta\varepsilon_{i,t-1}(\varepsilon_{i,t}+\omega_i)]=0 \;\; for \;\; t=4,\; 5,...,T.$ These moment conditions can only be fulfilled when the change of labor productivity is not correlated with region-specific effects ω_i and with the epsilon of the next period (the region does not have knowledge about future shocks).

The implementation of D-GMM or S-GMM will depend on which fulfills better requirements of serial correlations and over identification. While Arellano-Bond AR (1) and AR (2) test existence of serial correlation the Sargan /Hansen test inform existence or absence of over identification. The GMM estimator is consistent if there is no second order AR (2) serial correlation in the error terms of the first differenced equation. The null hypothesis that errors are serially uncorrelated is tested against the alternative and not rejecting the null hypothesis shows the validity of the assumption of no second order serial correlation. The Sargan or Hansen test is diagnosis of over-identifying restrictions that tests the validity of sets of instruments. The set of instruments used are valid if there is no correlation between instruments used and error terms. The null hypothesis that the instruments and the error terms are independent is tested against the alternative and failure to reject the null hypothesis suggests that the instruments used are valid. If robust option is used, the Hansen test of over identification can be used to check whether the instruments used are over or under identified. In this study we use the system GMM estimator not only because we found the results based on this to be consistent and unbiased but also the model does not significantly reduce the sample size of the unbalanced data we have. The estimation procedures for the employment growth, wage growth as well as growth of creative class share follow the same approach to which we do not provide here in the interest of space.

[3] Difference GMM estimator
[4] System GMM estimator

5. Data and descriptive statistics

The data for this study cover from 1998-2008 and are obtained from the individual panel, establishment panel, and establishment panel history from the Sample of Integrated Labor Market Biographies (SIAB) of the Institute for Employment Research (IAB) of Germany while data on GDP are obtained from the Federal Statistical Office. The individual panel contains employment histories of 1.6 million employees who are subject to paying social security, a two percent representative sample of employees in Germany over 1975-2008. The sample, which has more than 200,000 employment spells per year, provides precise information on daily wages, working days as well as further individual characteristics for all individuals who contribute to social security system. Among the excluded are self-employed, civil servants, part-time workers and apprentices. Since the study is based on annual data we consider all full time employees who are employed on the 30th June of each year. In addition to detail information on professions, data contain personal characteristics of workers including gender, age and education as well as basic information about employer (industry affiliation, location and firm size). There are 132 profession/occupation categories each with three-digit code ranging from 011 to 996. An advantage of this sample is the inclusion of regional professional composition of employed persons. Further advantages are the high validity and up to date nature of the data (Wedemeier, 2010).

Based on the three-digit codes assigned to each occupation and employing Florida's (2002) theory, we classify creative class into creative core and creative professional. The creative core or the super creative core include experts that work in hard sciences, engineering, technology, teaching and research centers. These are individuals registered in the employment database as physicists, biologists, chemists, mathematicians, statisticians, geologists, computer experts, engineers, architects, faculty members, teachers, researchers, think-thank workers, and information experts. The second group of employees: creative professionals are experts who are registered in SIAB database as health professionals, economists, business analysts, juries, public service administrative workers, managers, senior officials, politicians, legislators, senior officials, business professionals, police inspectors, detectives, sociologists and anthropologists. Besides, we use the approach of Boschma and Fritsch (2009) as well as Moller and Tubadji (2009) to extract Bohemian as separate groups of professionals. These experts are archived in the database as creative writers, performing artists; photographers and image and sound recording equipment operators, entertainers, sports associate professionals; fashion and other models (construction of the creative class is presented in Table 1, Annex).

Educational qualification is categorized into six levels where the SIAB has archived: The first primary /lower secondary /intermediate or equivalent education without vocational qualification, the second is primary /lower secondary /intermediate or equivalent school education with vocational qualification, the third is upper secondary school (Abitur) without vocational qualification, the forth is upper secondary school (Abitur) with vocational qualification, the fifth has to do with degree from a university of applied sciences (Fachhochschule) and the last category is that of a university degree qualification. In Germany

having vocational training- in addition to completion of lower or primary, junior or secondary school- plays a critical role for employment. For this reason we aggregate the six groups of education into three: 1) primary, junior and lower secondary without vocational certificate + upper secondary graduates without vocational training (1+3), 2) primary, junior and lower secondary with vocational certificate + upper secondary graduates with vocational training (2+4), and finally degree in applied sciences (Fachhochschule) + university degree (5+6). Educational as well as occupational data are all obtained from individual panel.

We also use the establishment panel which contains information on median wage and industry classification. The establishment panel has also information on work place- an important constituent on which the whole analysis of this paper is based. Moreover, we got regional (NUTS3) GDP and consumer price index (CPI) from Federal Statistical Office of Germany where nominal GDP is converted into real GDP using CPI of the 1995 constant price. Further, data on population, region area, and location of industry as in East or West Germany are obtained from establishment panel history (BHP). Observations with no valid information have been dropped. Absence of valid information for some territories has reduced the total number of regions for this study to be 394. This number is about 95% of the total number of regions (NUTS2) in Germany making our data and analysis at regional level almost complete.

An important aspect in the study of the role of the creative class and human capital in economic performance at regional level is identifying the share of the creative class as well as human capital (tertiary level graduates) because knowing the share can give insights on how the regional economy can behave in response to the proportion of creative class or human capital. The data reveal that about 12% of the creative class in Germany is taken up by the creative core which perfectly matches with the results of Florida (2002) who identifies that the share of the creative core comprises 12 percent of all U.S. However, his empirical evidence that about 40% of the labor force in U.S. is creative class (aggregate of creative core and creative professional) is not congruent to our result where the share of creative professionals (CP) alone is found to be 55% (Table 2) which is well over the sum of the creative core (CC) and creative professional in case of U.S.. The share of creative core and creative professional in a region appears to be 77 % (12% core creative +55% core professional) a figure nearly two times the case in the U.S. It should, however, be taken into account that if the share of the creative core and creative professionals (77%) were taken from total labor force, then the share would have been significantly lower than 77%. The share of the number of primary, junior and upper secondary school graduates without vocational training (HC1) is 12%; share of employees with primary, junior and upper secondary school graduates with vocational training (HC2) comprise 48% and those with applied university and university graduates (HC3) comprise 13%. We can understand from these figures that the share of employees with vocational certificates-making nearly half of the sample-is driven by a peculiar feature of Germany's education system which emphasis on practical trainings. In fact a lower, intermediate or upper secondary school graduate without vocational training can hardly get a job. Even if there is a job, the available job would most likely be low wage and temporary.

Table 2: Share of creative class and human capital from total full time employees

Variable	Obs.	Mean	Std. Dev.	Min	Max
CC	4334	.1232055	.0985651	.0012193	.7616361
CP	4334	.545367	.3853518	.0021115	2.200282
BOH	4334	.0781418	.0809868	.0002079	.6205924
HC1	4334	.1171703	.1072213	.0002571	.7898449
HC2	4334	.4833066	.3438793	.002221	.946403
HC3	4334	.1300728	.1006053	.0009151	.7171118

There is strong evidence that the presence of a large share of tertiary level graduates in a region is likely to show the presence of a large of share of creative class because the creative or innovative class is an individual with high level of education (Glaeser, 2005). We find that the correlation between creative class and human capital is strong and that the association among the six variables (three of them creative class and the other three human capital indicators) is positively and strongly correlated to each other with all the correlation level being more than 0.8 (Table 3). The details indicate that the level of associations between creative core and lower, intermediate and high school graduates without vocational training (HC1) appears to be 0.935, between creative core and HC2 0.905, between creative core and HC3 931. Similarly, we find that the correlation between creative professionals and HC1 is 0.904, between creative professional and HC2 0.996 and between creative professional and HC 3 is 0.889. Moreover, there is a strong relationship between Bohemians and HC 1 (0.951), Bohemians and HC 2 (0.876) and Bohemians and HC 3 (0.897). Such positive and strong correlations between the creative class and human capital (HC) seem to prove that creative class and human capital may mean same with different names. However, it is not possible to justify with correlation without making rigorous analysis which is the next part of discussion.

Table 3: Correlation between creative class and human capital

	CC	CP	Boh	HC1	HC2	HC3
CC	1					
CP	0.901*	1				
BOH	0.958*	0.875*	1			
HC1	0.935*	0.904*	0.951*	1		
HC2	0.905*	0.996*	0.876*	0.896*	1	
HC3	0.931*	0.889*	0.897*	0.834*	0.873*	1

6. Estimation results and discussion

In this section we present estimated econometric results of regional economic performance. The results are reported in four models: regional GDP growth, regional employment growth, regional wage growth and creative class growth models. All the variables in all the four models are presented in growth values and are discussed thoroughly in order to provide evidence on whether the case in Germany based on the panel data we employed could corroborate or reject the view that creative class is superior to human capital in explaining regional economy. Besides, the result of the fourth model which is expressed in shares provides interpretations of the tests of Florida's theory that Bohemians attract creative class.

Creative class, human capital and regional economic growth: We first provide results of the regional real GDP [5]growth impacts of the creative class and human capital and compare whether creative class or human capital better explain regional economy. In order to determine the maximum possible lag lengths for regional real GDP (and for all other models too) we first estimate autoregressive models and examine whether the lagged values we checked have significant impacts on the dependent variable. We take, as a rule of thumb, only those lags that have robust impacts. For the regional GDP we find that lagged dependent variables of up to three lags have significant impact on growth of GDP (Table 2, Appendix). Therefore, we take three lags of the dependent variable for the GDP growth model and that since the lags of dependent variable of a higher order than three are not significant, we present results using up to three lags only. All estimations use xtabond2[6] which is developed by Roodman (2009).

When the two-step system GMM estimator is used the coefficients of the lagged dependent variable regional real GDP behave exactly as required while he creative class or human capital is used as explanatory variable. The estimator fulfills the requirement of the dynamic panel model because it is found that the sum of the coefficients of the lagged dependent variable of two-step system GMM estimator lies between the pooled OLS and within estimator. To be more specific we find that the sum of the coefficients of the lagged dependent variables GDP is 0.981 in the pooled OLS, 0.335 in the fixed effects, and 0.885 in the two-step system GMM when creative class is used as explanatory variable. In the same manner when human capital is used as independent variable the sum of the coefficients of the lagged dependent variable GDP is found to be 0.976 in the pooled OLS, 0.335 in the fixed effects, and 0.937 in the two-step system GMM. Since GDP is a near unit root process, it is well-known that estimates in pooled OLS model are biased upwards and fixed effects are biased downwards (Baltagi, 2008). We have also checked GMM difference (not included in the table) where we found that the estimates are far less than the fixed effects estimator. Using Monte Carlo experiments

[5] It should be noted throughout this paper that since nominal GDP is changed into real GDP using GDP deflator all GDP figures and interpretations shall be considered as real GDP.

[6] The syntax has three parts: the first lists the dependent and explanatory variables, the second part is for *gmm* style which lists a set of endogenous and predetermined variables and a third part is for the ivstyle which contains strictly exogenous or exogenous variables. Xtabond2, unlike the previous xtabond, instruments the lagged dependent variable using gmm style and iv style as well as uses system GMM estimator which provides a much more efficient and consistent estimate than the difference GMM estimator.

Blundell et al. (2002) and Blundell and Bond (1998) show that the coefficients for the lagged dependent variable are strongly biased downwards in the GMM difference model in case of near unit root processes. Following this observation we exclude difference GMM estimator. The estimates in the GMM system, however, lies between the upper bound of the OLS model and the lower bound of the fixed effects model. Thus, we use the two-step system GMM in estimating regional GDP growth.

Following identification of lag length 3 and the two-step system GMM estimator we estimate and compare the regional GDP growth impacts of creative class and human capital over the years 1998-2008. The first column in Table 4 reports the effects of creative class (disaggregated into creative core, creative professional and Bohemia) on regional GDP while the second column provides results of the impacts of human capital [categorized into human capital 1 (HC1), human capital 2 (HC2) and human capital 3 (HC)] on regional GDP. In addition, we include employment (EMP), industry size (IND) and population density (POP) as control variables. Because regional GDP could be affected by a host of factors that may not be captured by regional specific effects we include year dummy in order to control unobservable shocks (Roodman, 2009).

We find that the first two lags of GDP have positive and significant impacts on current GDP. More specifically, the first and second lag of GDP has affected positively and significantly contemporaneous regional GDP growth at $p< 1\%$ level. In the first column one can see that a 1% increase in the first lag of GDP is attributed to a 0.81% rise in regional real GDP, a 1% growth of the second lag of GDP has an effect of increasing current GDP by 0.11%. The first lag of GDP has, therefore, more impact than the second lag as the coefficient of the parameter for the first lag appears to be more than the coefficient of the second lag. In the second column too, the first and second lag of GDP have robust and positive impacts on growth of current regional GDP where a 1% increase in the first and second lag of GDP have respectively increased current regional GDP by 0.86% and 0.12%. The third lag of GDP has, however, negative and significant impact on current GDP growth in both creative class and human capital driven regional GDP growth model.

Florida's (2002) theory that the creative class plays a critical role in regional economic growth appears to be supported by our estimation to which the shares of the creative core and creative professionals have each positive and robust impact on growth of regional GDP. A 1% increase in the share of the creative core in a region is followed by a 0.58% increase in the growth of contemporaneous regional GDP. The same is true for the creative professionals where a unit percent increase in the share of the creative professionals have contributed to the growth of regional GDP by about 0.23%. One can, however, observe that though the regional GDP growth impacts of the share of creative core and creative professional are found to be robust at 1% level, it is the creative core that plays a bigger impact (the elasticity of real GDP growth with respect to creative cores is more than with respect to creative professionals). The creative class theory identifies the creative core and creative professionals to be university graduates for whom the creative core work in areas of hard science, engineering, research and teaching

activities while the creative professionals are engaged in other occupations as associate innovators. Since science and related areas happen to be of high significance for growth our estimation result that the creative core is superior to creative professionals in explaining regional GDP and of regional economy clearly corroborates the theory. However, contrary to the contribution of Florida the impacts of the share of Bohemians on regional GDP growth are not only negative but also significant at 1%. One may infer that professions of music, culture, promotions, film, designs and the related have discouraging effect on economic performance.

Employment (EMP) and industry size (IND)-as control variables-have contributed immense to regional growth. An increase in the number of the labor force tends to boost growth of regions by about 0.11%. The result is an indication of the condition that increases in employment is followed by a higher level of productivity growth. Growth of firm size should also have a much higher effect on regional productivity to have a robust impact on regional growth. On the contrary, the effects of population density have a negative and considerable impact on the economic growth[7] of regions. This is consistent with economic theory that an increase in population density discourages growth and overall development when aggregate population growth emanates from growth of inactive labor force, particularly, young and old.

In the second column the effects of human capital and control variables on regional GDP growth are presented. As expected, the share of human capital 1 (HC1), that is, the share of the aggregates of lower, junior and upper secondary graduates without vocational trainings have negative impacts on regional growth. Nevertheless, the level of the impact is not considerable. Indeed, in Germany a graduate with neither a vocational training nor a university qualification will have a hard time in getting a job. Still worse even if a graduate without a vocational training gets employed it would be so in a low paid job on a temporary basis. It would not, therefore, be a surprise if the impact of human capital with low education or qualification without vocational certificate brought negative impact on GDP growth.

On the contrary, the role of human capital 2 (HC2), that is, the share of lower, intermediate and upper secondary school graduates and who has vocational training have had not only positive but also substantial impacts on regional GDP growth, hence, confirming the importance of vocational training in Germany. A unit percent increase in the share of HC2 is followed by a 0.18 % growth in regional GDP over the years 1998-2008. In the same pattern, the impact of HC3 (the share of University of applied science and University graduates) has affected the economic growth of regions positively at 1% level. This is consistent with the studies of Mincer (1958), Fabricant (1959), Becker (1960; 1993) and Shultz (1963) who identified that tertiary education does contribute to economic growth substantially. The elasticity of regional GDP growth with respect to HC 3 is found to be large enough in that a 1% increase in the share of university graduates increases performance of GDP growth of a

[7] In standard economic literature, economic growth or just growth is expressed in terms of GDP. In this paper we may interchangeably use GDP growth, economic growth as growth

region by a 1.28%. This effect is more than what the creative core or creative professional impacted GDP.

We also learn that employment and firm size have considerable impacts on GDP growth. However, the theory that creative class is superior to human capital in explaining regional economic growth appears to be not supported by our empirical study. This is because we find in the creative class and human capital driven GDP growth estimations almost equivalent in which while the creative core and creative professional have positive and robust impacts on regional GDP growth we also obtain that the impact of the share of university graduates on GDP growth to be positive and substantial at 1% level. In fact, elasticity of GDP growth with respect to HC3 is more than with respect to creative core or creative professional (Table 4).

Table 4: Two-step system GMM estimates for regional GDP growth[8]

Creative class		Human capital	
LGDP	*β(Stan. Err)*	LGDP	*β(Stan. Err)*
L1.GDP	.814 (.040)***	L1.GDP	.863 (.029)***
L2.GDP	.119 (.033)***	L2.GDP	.124 (.031)***
L3.GDP	-.048 .028)*	L3.GDP	-.055 (.022)**
CCO	.578 (.158)***	HC1	-.012 (.017)
CPR	.230 (.066)***	HC2	.185 (.054)***
BOH	-.942(.232)***	HC3	1.282 (.137)***
LEMP	.116 (.030)***	LEMP	.018 (.004)***
LIND	.082 (.041)**	IND	.114 (.019)***
LDEN	-.150(.039)***	DEN	-.193 (.049)**
Year dummies	included	Year dummies	included
AR(1)	t= -9.08 Pr>t=0.000	AR(1)	t= -9.71 Pr>t=0.000
AR(2)	t= -1.06 Pr>t=0.289	AR(2)	t= -0.07 Pr>t=0.943
Hansen over-id.	χ^2 (24) = 26.12 Pr > χ^2 = .347	Hansen over-id.	χ^2 (16) = 20.65 Pr > χ^2 = 0.193
Observations	3152	Observations	3152
Regions	394	Regions	394

*p<0.1, **p<0.05, ***p<0.01;Standard errors in parentheses

An important aspect here is whether the above interpretations are based on a properly specified model. We have already shown that the two-step system GMM model is consistent and unbiased as it's the sum of the coefficients of the lags are in between pooled OLS and

[8] Note that all variables are in growth forms

within estimator. Further, a test of the specification of the regional GDP growth model using the Arellano-Bond test of first order AR (1) and second order AR (2) that error terms are not serially correlated and that there is no is endogeneity problem. This is proved by the results were in the first order AR (1) we obtain p=0.000 which is far less than the threshold of p<0.05 and in the second order of the Arellano-Bond AR (2) we obtain p=0.289 when creative class is used as explanatory variable and p=0.943 when human capital is used as independent variable in which case both figures well above the required value of p>0.05. Besides, the Hansen over-identification test p=0.347 when creative class is used as explanatory variable and p=0.193 when human capital is used as regressor show that the GDP growth model is not over-identified. Therefore, we conclude that the estimated GDP growth model properly specified.

Creative class, human capital and regional employment: We know that GDP[9] as indicator of economic performance has long been criticized by scholars since it measures only monetary transactions related to the production of goods and services making the precision of measurement incomplete picture of the system within which the human economy operates (Costanza et al., 2009). We, therefore, in addition to analyzing regional economic performance through GDP growth estimate the regional employment growth effects of creative class and human capital. This is not to substitute GDP growth based evaluation of economic performance but to examine regional economic performance analysis through other indicator as a complement. It also aims in estimating and comparing whether creative class is superior to human capital in explaining employment growth in Germany over years 1998-2008. To this end we determine-as a first step- the lag length of the dependent variable employment growth using autoregressive estimation. The autoregressive estimation shows that only the first two lags of employment have robust impacts on employment growth and, therefore, we take the first two lags length of employment for our analysis.

While the first-step system GMM is found to be appropriate for the creative class driven employment growth model, for the human capital driven employment growth model two-step GMM is identified to be suitable. In the creative class driven employment growth model a test of the bias-free and consistency of the one-step system GMM shows that the sum of the coefficients of the lag of employment is 0.900 in one-step GMM, it is 0.945 in pooled OLS and 0.385. In this case 0.900 is in between the pooled OLS and fixed effects. Similarly, in the human capital driven employment growth model the sum of the coefficients of the lag dependent variable employment has 0.930 which is in between the coefficients in the pooled OLS with 0.950 and that of the fixed effects (within) estimator with 0.407 (Table 3, Appendix). Therefore, we take the one-step (when creative class is used) and two step-system

[9] GDP is an estimate of market throughput, adding together the value of all final goods and services that are produced and traded for money within a given period of time. Costanza et al. (2009) - like other scholars- argue that GDP is typically measured by adding together a nation's personal consumption expenditures (payments by households for goods and services), government expenditures (public spending on the provision of goods and services, infrastructure, debt payments, etc.), net exports (the value of a country's exports minus the value of imports), and net capital formation (the increase in value of a nation's total stock of monetized capital goods).

(when human capital is used) GMM model in order to examine the extent to which creative class and human capital may affect the performance (growth) employment in regions.

The results of the estimation are presented in Table 5. As anticipated, the first lag of employment appeared to have positive and strong feedback on current employment in both the creative class and human capital driven employment growth models. This does not, however, has the same effect in both models because while a 1% increase in the first lag of employment has contributed to a 1.14% growth of contemporary employment when the creative class is used as regressor, same amount of increase (1% increase in the first lag of) employment is followed by a 0.88% current employment growth when human capital is included as explanatory variable. Moreover, it is interesting to observe a difference in the directions and magnitudes of the employment growth impact of the second lag of employment while creative class and human capital are used as explanatory variables. To be more specific, we observe that while the second lag of employment has a negative and significant effect on the increase of current employment in when creative class is included as explanatory variable the effect of the second lag of employment on contemporary employment growth is positive but not robust where human capital is taken as regressor. The difference could indicate that the share of the creative class may contribute to positive employment growth only at a time when the creative class are employed or just in the next immediate year. After that the creative class may rather be not as productive as their first time employment or just in the following years to have positive impact and consequently may discourage the growth of employment in two years. Or it may be possible that the persistence of previous year employment in affecting present year employment could be weak or even rather negative when creative classes are included.

The share of creative core and creative professionals has boosted regional employment at $p<1\%$ level. One would argue that since the creative core are engaged in scientific, engineering, research and teaching activities which all of such works tend to provide new ideas, innovations and technology such will have a reinforcing effect in increasing output and productivity of a region. The increase in output of a region tends to scale up the likelihood of demand for and supply of labor. When the labor market is able to take up a significant share of applicants there is a natural tendency to increase employment. The same applies to the case of creative professionals where the presence of innovative labor force- whom Florida consider as problem solvers and generators of new ideas- tends to increase the competency of knowledge economy as well as competitiveness of a region. A region with well-functioning knowledge economy provides tick labor market- a market resilient to even shocks where the employment conditions tend to increase on a sustainable manner. Therefore, the argument that the creative class (creative core and creative professional) play immense in regional economy performance through employment growth is supported by our empirical evidence. However, if one would compare the magnitude of the impact by the creative core and creative professional still creative core has a greater effect. Moreover, the view that Bohemians- like the creative class- affect regional labor market is not supported in this study. On the contrary Bohemians contribute negatively to employment growth where the effect is found to be robust at 1% level.

Regarding the effect of conventional human capital on employment growth our result does support the human capital theory underpinning that a tertiary level qualification promotes employment growth by making the labor market so strong. As expected the share of lower, intermediate and upper secondary school graduates without vocational training (HC1) have negatively affected employment growth at 1% level. The presence of a large share of these groups of people in a particular region would retard the economic performance of the region because these people do not have the knowledge and capability to generate new ideas, to innovate and to provide mechanisms that will solve socioeconomic problems. These conditions constrain labor market-the demand for and supply of labor and of employment. However, if lower, junior or secondary school qualification is complemented with vocational training then the impact of human capital on employment growth is positive although the level of impact is not significant. The share of university of applied sciences holders and university graduates-like in the case of the GDP growth model we have seen before- has contributed to employment growth of regions significantly at 1% level. It appears that the share of university graduates; creative core and creative professionals have all significant impacts on enhancing employment growth of regions. However, the elasticity of employment growth with respect to the share of tertiary level graduates, creative core and creative professionals is not the same. The creative core is superior to the creative professional and university graduates in increasing employment growth for the reason that the beta of creative core is more than that of beta of creative professionals and university graduates.

In addition to the creative class and human capital we include wage (WAGE), years of work experience (EXPM), firm size (IND) and population density (DEN) as control variables in the estimation of regional employment growth. There are, indeed, huge wage variations among regions with the highest being in Stuttgart and Munich and the lowest in some eastern parts of the country. The reason for the inclusion of wage as control variable emanates from the observation that some regions with good wage have good labor market and employment because these regions are rich and are able to hire a good number of employees. On the contrary poor regions with low wage will have a discouraging effect on employment growth because naturally people would like to be employed in regions where wage is better. We also include experience as a relevant control variable with the expectation that having had proven work experience tends to have an encouraging effect on employment growth since the more people have good experience the high is the likelihood that these people will have a greater productivity effect as they could work with efficient and with minimal supervision the eventual phenomena could result in increasing the employability condition of a region.

Against our expectation, the regional employment growth impact of wage is found to be negative when creative class is used as explanatory variable. This result, although not significant, is consistent with economic theory that an increase in the wage level should be reflected in a decrease in the employment condition (Flinn, 2011 and 2006; Even and Macpherson, 2003). The theory argues that if more are employed, wage should go down in order to accommodate as many employees as possible. However, the impact of wage on employment growth-when human capital is used as explanatory variable- appears to be

positive and significant at 1% level. This does not only reject the classical view that wage and employment go in opposite directions but also indicate that the inclusion of human capital instead of creative class could change the direction of the effect from the conventional into the unconventional one. Moreover, as expected, mean years of experience of an employee has positive influence on employment growth when creative class and human capital are used as covariates. However, while the influence is significant at 1% level when human capital is used as covariate the effect is not robust when creative class is employed as explanatory variable. Firm size has negative and robust impact on employment growth when creative class is used and positive and insignificant effect when human capital is used. Population density, as anticipated, has a discouraging and significant effect on employment growth in the human capital driven employment growth model but has a positive and robust impact in the creative class based regional employment growth model (Table 5).

Table 5: One-step and two-step system GMM estimates for regional employment growth[10]

Creative class (one-step SGMM)		Human capital (two-step SGMM)	
LEMP	*β (Stan. Err)*	LEMP	*β (Stan. Err)*
L1.EMP	1.142(.036)***	L1.EMP	.881(.036)***
L2.EMP	-.101(.029)***	L2.EMP	.055(.037)
CCO	2.109(.547)***	HC 1	-.379(.070)***
CPR	.198(.064)***	HC 2	.254(.168)
BOH	-3.183(.685)***	HC 3	.343(.155)**
WAGE	-.045(.088)	LWAGE	.435(.101)***
EXPM	.123(.042)***	EXPM	.073(.046)
IND	-.065(.021)***	IND	.037(.018)**
DEN	.0786(.044)*	DEN	-.791(.150)***
Year dummies	included	Year dummies	included
AR(1)	t= -5.74 Pr>t= 0.000	AR (1)	t= -4.88 Pr>t=0.000
AR(2)	t= -0.54 Pr>t= 0.587	AR (2)	t=-1.85 Pr>t= 0.062
Hansen over-id.	χ^2 (8) =7.87 Pr> χ^2 = 0.447	Hansen over-id.	χ^2 (45) = 27.04 Pr > χ^2= 0.984
Observations	3152	Observations	3546
Regions (groups)	394	Regions (groups)	394

*p<0.1, **p<0.05, ***p<0.01;Standard errors in parentheses

A final point for the creative class and human capital driven regional employment growth model is to make sure that the discussions made above are on the basis of a properly specified

[10] Note that all variables are in growth values

model. We know that $\text{cov}(\Delta\varepsilon_{it,}\Delta\varepsilon_{i,t-k}) = 0$ for K=1, 2, 3 is rejected at a level of 0.05 if p<0.05. If $\Delta\varepsilon_{i,t}$ are serially uncorrelated we expect to reject at order 1 but not at higher orders Cameron and Trivedi, 2009). This is, indeed, the case in our estimation of employment growth using creative class and human capital where we reject absence of serial correlation at AR (1) or order 1 because p=0.000. At order two AR (2) $\Delta\varepsilon_{it}$ *and* $\Delta\varepsilon_{i,t-2}$ are serially uncorrelated because we find p=0.587 when creative class is used as covariates and p=0.062 when human capital is used as driver of employment to which in both cases p>0.05. Moreover, the Hansen over-identification test of p=0.447 when employment growth is estimated using creative class and is p=0.984 when human capital is used shows that the number of variables used as instruments are not over-identified because all the values are more p>0.05 which is a threshold that shows absence of over-identification. Overall, the one-step system GMM creative class driven employment growth model and two-step system GMM human capital driven employment growth model show that the estimation is consistent, has no serial correlation of error terms, no over-identification of instruments and, hence, the model is properly specified.

Creative class, human capital and regional wage: In addition to analyzing regional economic performance through regional GDP growth and regional employment growth, in this section we include regional wage growth as indicator of regional economic growth with a view to meet objective three of the paper stated in the introduction part. More specifically, we estimate and compare the regional wage growth implications of creative class and human capital. Our estimation to determine the lag lengths of the dependent variable using the autoregressive estimation show that only the first two lags of the dependent variable have significant impacts on current regional wage and, therefore, we take the two lags of the dependent variable for further analysis (Table 4, Appendix). Following identification of lag lengths, we take the two-step system GMM estimator because we find that the sum of the coefficients of the lagged dependent variable in the two-step system GMM estimator which is 0.918 is in between the aggregate of the coefficients of the lagged dependent variable of the pooled OLS with 0.949 and of the fixed effects estimator with 0.508 when creative class is used as explanatory variable. Similar patterns are observed in the wage growth model when human capital is employed as covariate in which the sum of the coefficients of the lagged dependent variable in the two-step system GMM which is 0.927 is between 0.954 of the pooled OLS and 0.517 of the fixed effects model. In fact we find that estimates of difference GMM is much lower than that of the within estimator.

The results as indicated in Table 6 reveals that the first and second lags of wage have positive and significant effects on wage growth in both the creative class and human capital based regional wage growth model. Indeed, past years wage status of a region has a considerable impact on the contemporaneous wage level of the region making the extent of the impact robust at less than 1% when creative class as well as human capital variables is used as factors of wage. An important observation from the result is that the elasticity of wage with respect to

its first and second lags is almost the same when creative and human capitals are covariates. That is when the creative class is used as explanatory variable the responsiveness of wage growth with respect to its first and second lag are 0.673 and 0.245. When human capital- instead of creative class- is used as regressor the elasticity of wage growth in response to its first and second lag are 0.685 and 0.242. This may indicate that creative class and human capital might have similar influences on wage growth when its previous years are employed.

With regard to the implications of creative class on the growth effects of wages indicates that the regional wage growth impact of the share of the creative core and creative professional, as expected, is found to be positive. Nevertheless, while the level of impact by creative core is significant at $p<1\%$ the influence in which the share of creative professional has had on wage growth is not robust. Like in the GDP growth and employment growth models discussed before Bohemians have negative impacts on wage growth. With respect to the human capital whereas the shares of primary, intermediate and upper secondary school graduates without and with vocational training have negative effects on wage growth that of the influence of the share of university of applied science and university graduates on wage growth appeared to be positive and significant at 5% level corroborating the theory that tertiary level qualification increase wage. It is observed that a 1% rise in the share of tertiary level graduates leads to wage to grow by 0.05%. Compared to the GDP and employment growth models elasticity of wage growth with respect to tertiary school graduates is, however, found to be low (beta for wage growth is 0.054, GDP is 1.282 and for employment growth it is 0.342).

Regional wage growth is not only explained by creative class or human capital- it certainly can be influenced by work experience, employment conditions, industry size, population density and regional specialization (Krugman specialization index) among others. We include these variables as controls and estimate their impacts on regional wage growth. Of the these control variables mean years of work experience (LEXPM), employment (LEMP) and population density (LDEN) have positive effects on wage growth in both the creative class and human capital driven wage growth model. Indeed, mean years of experience and employment have considerable impacts on wage growth at $p< 1\%$ and $p<5\%$ levels respectively when creative class is included as regressor (Blachflower and Oswald, 1996). Nevertheless, we do not find a substantial impact of experience and employment on wage growth over the years 1998-2008 when human capital is employed as explanatory variable. Population density has a positive and great impact on wage growth which seems to be contrary to what one may expect by intuition. One would normally anticipate that increase in the population density of a region would put a pressure on employment and, therefore, on wage which eventually could affect wage in a negative manner. However, this does not appear to be the case may be for at least two reasons. A first possibility is that if an increase in the population density is attributed to a rise in the number of high skilled people the impacts of population density on wage growth would still be positive. A second possibility is that when a region is already rich and is capable of employing more and more people with good payment and remuneration there can be the tendency that population density would still tend to increase wage growth instead of becoming a constraint of wage.

The influence of regional specialization on wage growth is different in the creative class and human capital driven wage growth model (column 1 and column 2). Regional specialization-also called Krugman specialization index (KSI)-measures the level of industry specialization at regional level with respect to the level of industry specialization at national level ranging from a minimum of 0 where there is no difference between regional and national level specializations of industries to 2 when there is extreme specialization at regional level. The estimation shows that the more the region is specialized the negative impact it has on growth of regional wage in both the creative class and human capital driven model of wage growth. In particular, in the creative class based wage growth model the effect of regional specialization appeared to be not only negative but substantial at 5% level. This has important implications in regional economic policy analysis because industry specialization which is a function of the share of the number of employees in an industry in a region from total number of employees of industries at national level can have long-run effects on the competitiveness of regions.

Table 6: Two-step system GMM estimates for regional wage growth[11]

Creative class		Human capital	
WAGE	*β(Stan. Err)*	WAGE	*β (Stan. Err)*
L1.WAGE	.673(.030)***	L1.WAGE	.685(.031)***
L2.WAGE	.245(.025)***	L2.WAGE	.242(.027)***
CCO	.140(.032)***	HC 1	-.015(.007)**
CPRO	.002(.009)	HC 2	-.025(.022)
BOH	-.161(.041)***	HC 3	.054(.023)**
LEXPM	.026(.007)***	EXPM	.038(.008)***
LEMP	. 008(.003)**	EMP	.001(.002)
LIND	-.004(.003)	IND	.001(.003)
LDEN	.018(.005)***	DEN	.011(.005)**
KSI	-.025(.005)**	KSI	-.011(.009)
Year dummies	included	Year dummies	included
AR(1)	t= -8.61 Pr>t=0.000	AR(1)	t= -8.48 Pr>t=0.000
AR(2)	t=-1.88 Pr>t=0.060	AR(2)	t= -1.74 Pr>t=0.082
Hansen over-id.	χ^2 (45) = 37.74 Pr > χ^2 = 0.770	Hansen over-id.	χ^2 (45)= 49.41 Pr > χ^2 = 0.301
Observations	3546	Observations	3546
Regions (groups)	394	Regions (groups)	394

**p<0.05, ***p<0.01;Standard errors in parentheses

[11] All variables are in growth values

Bohemians and other creative class: Florida (2002) argues that other creative class (creative core and creative professionals) flock to places where Bohemians live. His argument is that Bohemians have a natural gifted talent that makes them especial and adorable by many and that these people have the potential to attract other creative class. In order to test his argument we estimate the impact of the share of Bohemians on other creative class (aggregates of creative core and creative professional). Further, since the share of creative class in a region can certainly be explained by a number of factors other than just Bohemians we include employment, economic growth, industry size, and population density as controls.

The determination of lag lengths using the autoregressive estimation reveals that the first two lags of the share of the creative class have robust impacts on the share of the creative class. Beyond the second lag the effect is found to be insignificant and, therefore, we take only the first two lags for analysis. This leads us to identify the kind of the dynamic panel model that fits to the data where we find one-step forward orthogonal or system GMM estimator to be appropriate. The system GMM is suitable because, the sum of the coefficients of the lagged dependent variables of the creative class in the one-step system GMM estimator which is 0.654 is in between the coefficients of the pooled OLS with 0.903 and fixed effects with 0.409, a requirement for consistent and efficient estimation in dynamic panel (Table 5, Appendix). The first lag of the share of creative class has, indeed, positive and commendable impact on the share of current creative class (Table 7). In particular, we find that a 1% raise in the share of first lag of creative class (creative core and creative professional) appears to increase current share of creative class (CCL) by about 0.64 %. Contrary to this the second lag has a negative effect on creative class with the level of impact being robust at 10% level.

It is interesting to observe from the estimation result that Florida's (2002) creative class theory that Bohemians attract other creative class (creative core and creative professionals) is supported because the effect of the share of Bohemians on the distribution of the share of the creative class is found to be positive and robust at 1% level. This is consistent with the results of Boschma and Fritsch (2009) who find strong relationships between Bbohemians and the creative class at regional level in a study that covered six European countries. They also indicate that Bohemians have positive influence on the geography of creative people. A high proportion of bohemians tend to indicate dense local culture, lifestyle, and set of values that are different from those of mainstream. Bohemians, being artistically creative, could add a sense of liveliness to a location as well as openness to different lifestyles and values which would then make the region attractive to creative class. Nevertheless, our result is at odds with the contributions of Moller and Tubadji (2009) who find that the influence of Bohemians on creative class is not significant. However, their estimation is limited to West Germany for 323 regions with periods spanning from 1975 to 2004 by collapsing the thirty years into six panels.

All control variables-employment, of GDP, of firm size and population density have positive impacts on the share of the creative class. Existence of good labor market (employment with good pay) in a region has a natural tendency to attract a significant share of the creative class because employment is after all life and life without employment is hard. For a 1% increase in

employment in a region tends to, keeping all other things constant, increase the share of creative class by 0.50% in a corresponding region. Similarly, we observe that regions with commendable GDP records attract considerable number of creative class because such rich regions have the capacity to employee as many innovative people as possible to further continue as being competent. The elasticity of the share of creative class with respect to GDP growth is 0.08 a figure less than the elasticity of creative class when employment is used. Overall, the conditions of employment of a region as well as the GDP level of a region do impact the distribution of creative class at 1% level.

Regarding the specification of the creative class model we find that the Arellano-Bond test of the first order AR (1) proves that there is no autocorrelations of the idiosyncratic error terms as the p=0.000 is well less than the required threshold of 0.05. The second order AR (2) value which is p=0.593 well above the required p>0.05 also confirms that the estimated model does not have any serial correlation problem which further indicates that there is no problem of endogeneity. Besides, the Hansen (robust) test of over-identifications with p= 0.204>0.05 rejects the null hypothesis that the model is over-identified. Therefore, we conclude that the bohemian driven creative class model maintains the requirements of the dynamic panel and that it is correctly specified.

Table 7: One-step system GMM estimates for regional creative class growth[12]

Independent	β (Stan. Err)
L1.CCL	.644 (.085)***
L2.CCL	-.010(.017)
BOH	.981 (.281)***
EMP	.494 (.097)***
GDP	.084 (.041)**
IND	.019 (.078)
DEN	.143 (.221)
Year dummy	included
AR(1)	t=-3.53 Pr>t=0.000
AR(2)	t= -0.53 Pr>t=0.593
Hansen over-id.	χ^2 (36) = 42.76 Pr > χ^2 = 0.204
Observations	3546
Regions (groups)	394

**p<0.05, ***p<0.01;Standard errors in parentheses

[12] All variables in growth values

7. Conclusion

Empirical analysis of the economic performance implications of human capital has long been established since 1960s when the theory of human capital was formally acknowledged. Since then human capital, at least in mainstream economics, has known to be exclusively measured by education. However, recently Florida observes that human capital measured by education is not robust in explicating economic performance and, accordingly, he provides an alternative measurement of human capital using occupation. He calls the name for the occupation based human capital as creative class and argues that creative class is not only an engine but superior to human capital in explaining regional economic performance. Our study is motivated to test this assertion and is, probably, the first of its kind to estimate and compare the impact of creative class and human capital on economic performance of 394 regions in Germany using dynamic panel model. We use rich administrative data for the years 1998-2008 and measure regional economic performance through growth of GDP, employment and wage and have identified four objectives. The first has estimated and compared regional GDP growth impacts of human capital and creative class. The second aim has evaluated and compared the impacts of creative class and human capital on regional employment growth. The third purpose has been analyzing the effects of creative class and human capital on regional wage growth and the fourth estimates the influence of the share of Bohemians on the share of creative class. While the three objectives, broadly speaking, were meant to test creative class theory that creative class outperforms human capital in explaining economic performance of regions; the fourth objective was meant for testing creative class theory that Bohemians has a positive impact on the distribution of creative class (creative core and creative professionals).

The impact of the share of creative core and creative professionals on regional GDP growth is positive and significant at 1% level confirming creative class theory that creative capital plays a significant role in enhancing economic performance of regions through GDP growth. By the same token, regional GDP growth effects of the share of university graduates is also found to be positive and robust at 1% level supporting the conventional human capital theory that higher level education does have a positive role in economic growth. It is, therefore, vivid that the contemporary creative class and the conventional human capital approaches have both relevant explanatory potential in the betterment of regional economic growth. Nevertheless, Florida's theory that creative class is superior to human capital (share of university graduates) in explaining regional GDP growth is not supported because the elasticity of regional GDP growth with respect to human capital (share of university graduates) is greater than that of the elasticity of GDP growth with respect to creative core or creative professionals.

On the other hand, while employment growth effects of creative core and creative professional are robust at $p<0.01$ the impact human capital (share of tertiary school graduates) has on employment growth is robust at $p<0.05$. This corroborates Florida's thesis that creative class outperforms human capital in explicating regional employment growth which is one of the indicators of regional economic performance. This is contrary to what we get in the GDP growth model where the role of human capital is identified to have a greater influence on GDP

growth than the creative class has. Moreover, in the regional growth model the share of the creative core and university graduates have substantial roles in enhancing growth of regional wage. That the presence of scientists, engineers, researchers and faculty members in a region has positive impact in increasing wage level because these people have the tendency to boost the economy of the specific territory and eventually of wage conditions of a region.

We also learn that although the implications of the share of creative cores and of the share of university graduates have great influences on growth of wage it is the creative core that has impressive impact subscribing the views of Florida. However, unlike the previous two models, the effect that creative professionals have on growth of wage is not robust. Moreover, albeit the effects of bohemians on GDP growth, employment growth and wage growth are found to be negative we confirm one of the creative class theories that Bohemians have robust impact on the distribution of creative class. Overall, our empirical evidence reveals that analysis of regional economy through creative class in place of conventional human capital could serve as an innovative approach yet creative class, as argued by Florida, is not all the time superior to human capital in explaining regional economy. Indeed, even if the share of creative core, creative professionals and tertiary level graduates have robust impacts on GDP growth it is by no means the share of tertiary level graduates that have a far greater impact on economic growth. The reverse holds for employment growth and is inconclusive for wage growth.

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Appendix

Table A1: Creative class and Bohemia identification using IAB database, Germany

Occupational category	**IAB occupation code**
Creative core	
Engineers	601: Engineers of machine, vehicle & construction 602: Electrical engineers 603 Architects 604: Surveyors 605: Mining, metallurgical and foundry engineers 606: Other Manufacturing Engineers 607: Other engineers 611: Chemists, chemical engineers 612: Physicists, physics engineers, mathematicians 52: Gardening Architects
Scientists, think-thank researchers	881: Social scientists and statisticians 883:Other scientists
Professors and faculty members	871: University professors, faculty members and lecturers at higher vocational schools and academies
Analysts, entrepreneurs, leading administrators	751: Entrepreneurs, CEO
Head of business unit	752: Management Consultant, organizers 762: Senior administrative and decisive
Opinion makers: dispersed in other categories	774: Software programmers / engineers, data processing professionals
Creative professionals	

High-tech services sectors and technicians	621: Mechanical Engineers 622:Electric technicians 623: General technicians 624: Surveyors 625: Mining, metallurgical, foundry technicians 626: Chemical engineers, physical science 627: Other manufacturing technicians 628 :Other technicians 629: Foreman, foreman 631: Biological and special technical professionals 632: Physical and mathematical and technical 633: Chemical laboratory 634: Photo lab technicians 635 :Draftsmen
Financial services	691: Bankers 753: Auditors and tax advisers
Legal services	813: legal services and legal consultants
Business services	703: Business consultancy experts 822: Business analysts
Humanities	882: Humanity experts
Bohemians	
Creative writers and performing artists	821: Publicity workers, promoters and advertisers 823: Librarians, archivists, museum professionals 831: Musicians 832: Performing Artists 833: Artistic graphic makers
Photographers, image and sound recording equipment operators, and other fashion models	837: Photographers 835: Artistic and associated professions of stage, screen and sound
Artistic, entertainment and sports associate professionals	838: artists, professional athletes, artistic paramedics

Table A2: AR (3) process of regional GDP growth

Variable	Creative class				Human capital			
LGDP	AR	OLS	FE	SGMM	AR	OLS	FE	SGMM
L1.LGDP	.563	.925	.333	.814	.563	.914	.334	.863
	(32.65)***	(53.05)***	(22.07)***	(20.05)***	(32.65)***	(52.35)***	(22.03)***	(28.99)***
L2.LGDP	.113	.100	.029	.119	.113	.098	.028	.124
	(6.14)***	(4.31)***	(1.83)*	(3.59)***	(6.14)***	(4.22)***	(1.75)*	(3.90)***
L3. LGDP	.320	-.044	-.027	-.048	.320	-.036	-.027	-.050
	(18.92)***	(-2.70)***	(-2.18)**	(-1.73)*	(18.92)***	(-2.23)**	(-2.17)**	(2.50)**
Sum β	0.996	0.981	0.335	0.885	0.996	0.976	0.335	0.937
Obs.	3152	3152	3152	3152	3152	3152	3152	3152
Regions	394	394	394	394	394	394	394	394

*p<0.1, **p<0.05, ***p<0.01;t-statistic in brackets

Table A3: AR (2) process of regional employment growth

Variable	Creative class				Human capital			
LGDP	AR	OLS	FE	SGMM	AR	OLS	FE	SGMM
L1. LEMP	1.028	.923	.361	1.102	1.028	.924	.382	.881
	(66.27)***	(59.38)***	(27.82)***	(31.36)***	(66.27)***	(59.57)***	(29.07)***	(24.08)***
L2. LEMP	-.031	.022	.024	-.191	-.031	.025	.025	.055
	(-2.05)**	(1.47)	(2.19)**	(-3.42)***	(-2.05)**	(1.71)*	(2.25)**	(1.49)
Sum β	0.997	0.945	0.385	0.911	0.997	0.949	0.407	0.936
Obs.	3546	3546	3546	3152	3546	3546	3546	3546
Regions	394	394	394	394	394	394	394	394

*p<0.1, **p<0.05, ***p<0.01;t-statistic in brackets

Table A4: AR (2) process of regional wage growth

Variable	Creative class				Human capital			
LWAGE	AR	OLS	FE	SGMM	AR	OLS	FE	SGMM
L1.WAGE	.754	.689	.423	.673	.754	.692	.426	.685
	(46.50)***	(42.67)***	(24.32)***	(22.32)***	(46.50)***	(42.89)***	(24.56)***	(21.91)***
L2.WAGE	.238	.260	.085	.245	.238	.262	.091	.242
	(14.63)*	(16.06)***	(4.83)**	(-9.66)***	(4.63)***	(16.17)***	(5.15)**	(8.81)***
Sum β	0.992	0.949	0.508	0.918	0.992	0.954	0.517	0.927
Obs.	3546	3546	3546	3152	3546	3546	3546	3546
Regions	394	394	394	394	394	394	394	394

*p<0.1, **p<0.05, ***p<0.01;t-statistic in brackets

Table A5: AR (2) process of regional creative class growth

Variable	Share of creative class			
SCP	AR	OLS	FE	One-step SGMM
L1.SCP	1.036 (66.15)***	.916(78.87)***	.422(32.21)***	.644(7.51)***
L2.SCP	-.047(-3.00)***	-.013(-1.24)	-.015(-1.83)*	-.010(-0.60)
Sum β	0.989	0.903	0.409	0.654
Obs.	3546	3546	3546	3546
Regions	394	394	394	394

*p<0.1, **p<0.05, ***p<0.01;t-statistic in brackets