DOI: 10.15201/hungeobull.67.3.1 Hungarian Geographical Bulletin **67** 2018 (3) 201–222.

Creative capacity of European countries

Martin ALEXY[1], Marek KÁČER[2] and Štefan REHÁK[3]

Abstract

In the paper[4] we study creative capacity of 28 European countries in the period 2005–2014. We construct a creativity index based on the 3Ts concept of talent, technology and tolerance as the key components of the creativity. Our index is measured and calculated with both the cross-section and the time series dimensions, which is an important contribution compared to other studies. We have demonstrated relatively stable rankings of the countries in time, even though the creative capacity measured by our creativity index was gradually growing in time with varying rate of growth for individual countries. We have also shown evidence that the creative capacity is clustered geographically. The creativity index was compared to World happiness index, GDP per capita and Human development index. We have replicated earlier cross-sectional analyses and shown the relatively strong correlation. However, we show that the picture is different for changes within individual countries. Here we demonstrated lack of correlation between creativity and GDP per capita or World happiness index. JEL: O10, O30, O34, C10

Keywords: creativity index, 3Ts concept, European comparison

Introduction

Creativity is a complex phenomenon and a subject of study in psychology, sociology and economy. Creativity in economic view can be generally defined as human activity focused on the creation of an intangible asset. Such asset has the characteristics of novelty, innovativeness or rareness. Analysing the process of creativity and measuring it by economic indicators has developed through several concepts and approaches. Some of the concepts are derived from complex theoretical analysis and their use is limited by data availability. Other concepts are based on the combination of indicators accessible from the statistic resources and from the expertise.

Empirical studies provide several creativity indices as proxy variables for the creative capacity of the respective economies. This paper focuses on these creativity indices. In the existing literature they are constructed in the form of cross-section data. We construct the creativity index in the form of panel data, i.e. with the cross-section and time series dimensions.

The contribution of our paper to the existing literature can be seen in the three areas. Firstly, we construct creativity index with both the cross-section and the time series dimensions. Secondly, we provide an open source creativity index, describing variables with their source and their weights. Thirdly, we analyse creative capacity of 28 European

[1] Department of Finance, Faculty of National Economy, University of Economics in Bratislava. Corresponding author. E-mail: martin.alexy@euba.sk

[2] Credit Management Research Centre, Leeds University Business School, Department of Finance, Faculty of National Economy, University of Economics in Bratislava. E-mail: marek.kacer@gmail.com

[3] Department of Public Administration and Regional Development, Faculty of National Economy, University of Economics in Bratislava. E-mail: stefan.rehak@euba.sk

[4] The paper is an outcome of the research project Competitiveness, economic growth and firm survival (APVV-15-0322) supported by Slovak Research and Development Agency. The research is co-financed by the European Union.

countries[5] and analyse geographical dimension of creativity.

The paper is structured as follows. The first part presents an overview of the existing literature related to creativity in economics and of creativity indices. The second part describes a methodology including the selection of the variables and the construction of our European 3T creativity index (3TCI). The third part provides empirical results of measuring the creative capacity of 28 European economies; we examine also the associations between the European 3TCI and measures of happiness, economic performance and human development here. The last part of the paper gives conclusions.

Economic dimension of creativity and literature review

Adam Smith (1776) recognized to the role of human capital ("acquired and useful abilities of all the inhabitants") as a "fourth factor of production" in addition to land, labour, and capital. Unlike traditional, tangible factors of production, the creativity is essentially different; it is limitlessly renewable resource which can be continuously recharged and re-energized. Creativity is a complex phenomenon and could be defined in several dimensions and disciplines of psychology, sociology and economy. Schumpeter, J.A. (1911) defines the creativity as "dynamic process of innovations, which is endogenous in relation to the economy." He is one of the first researchers who acknowledged the economic dimension of the creativity. Creativity in connection to economics can be generally defined as human activity focused on the creation of an intangible asset. Such asset has the characteristics of novelty, innovativeness or rareness. Amabile, T.M. (1983) and Weisnberg, R.W. (1988) broadened the economic understanding of the creativity as the part of production of ideas and inventions, which are new and useful for solving the economic issues. Martin, L. and Wilson, N. (2016) connect the philosophy of critical realism to entrepreneurial opportunity theory and suggest that ontological examination of entrepreneurship is required for identifying new types of empirical research, leading both to theoretical development and to practical entrepreneurship.

Lundvall, B.A. and Johnson, B. (1994) attempted to define the relation between the formation of creative ideas of individuals and the way of their absorption in (or their support to) the private and the public sectors. Not only the creation of ideas, but also the speed and the ability of their absorption play an important role. Florida, R. (2002, 2005) defined the "creative class" as a key driving force for economic development of post-industrial cities. He distinguished 3 groups of creative occupations: creative core, creative professionals and bohemians and presented "The 3Ts theory" for economic growth: technology, talent and tolerance. Florida emphasized the role of the creative individuals who ensure knowledge and innovation spill-overs within a city or a region as opposed to the concept of spill-overs between companies and sectors. Knudsen, B. *et al.* (2007) connected this influence of the creative class with the endogenous growth theory. According to Glaeser, E.L. (2004) the creative capital is strongly connected with human capital, which is traditionally measured by level of education; the majority of creative class has achieved high level of education. Empirical studies of Marlet, G. and van Woerkens, C. (2004), McGranahan, D. and Wojan, T. (2007), Florida, R. *et al.* (2008) confirmed that the indicators for the creative class and education are both good predictors of urban and regional growth and that the indicators for the creative class perform better than the indicators for education. We can conclude that both the creative class and traditional educational attainment are good proxies to measure human capital.

[5] Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Human creativity is considered a key driving force of the economy of cities. Florida's concept of creative class and creative cities has been discussed both by the academics and by the policy makers of city development. Agglomeration theories view the concentration of firms in the cities due to business networks and labour market proximity and due to knowledge spill-overs. Florida suggests that the main reason is creative people who invent and run innovative enterprises and who become facilitators of economic growth and urban restructuring. Bohemians and artists co-create liberal and tolerant cultural environment to which creative class is attracted. Critique of Florida argues about the novelty of his idea. Glaeser, E.L. (2004) claims that agglomeration theory already explained the role of cities and clusters for economic growth based on creativity. Pratt, A.C. (2008) claims that the idea of creative cities is another label for a quality of the urban life, which is not any novelty.

Florida's definition of creative class has been significantly questioned. His classification is rather broad using aggregate groups of occupations including non-creative jobs, too (Markussen, A. 2006). Based on empirical analysis of German regions Krätke, S. (2010) argues that even though the concentration of scientifically and technologically creative occupations positively impacts regional economy, such concentration of business, finance and trade professionals has no significant influence. Markussen, A. (2006) finds that scientists, engineers and managers frequently live in suburban areas and they may not want to live and spend their time with bohemians and artists. Glaeser, E.L. (2004) explains such location preferences of creative people by 3S's (skills, sun, sprawl) as opposed to Florida's 3Ts. McLean, H. (2014) suggests that the racial and gender aspects are often neglected in the creative city policies; she demonstrates that feminist arts activism uncovers the multiple exclusions of creative city policies and practices in Toronto; thus, tolerance is not truly practiced.

Peck, J. (2005) is very critical of creative-city strategies based on Florida's concepts viewing them as policies creating neo-liberalized urban policy environment, which "focus on short-term projects such as funding competitions or development schemes rather than progressive and programmatic goals such as poverty alleviation or environmental sustainability" (Peck, J. 2005, 764). Inequalities can increase during creativity-led urban development, because policymakers seem to prefer certain social groups and funds for urban development support only selected locations in the cities (Mcdowell, L. 2017; Wilson, D. 2017). Florida, R. (2017) explains inequalities in the cities as the result of the in-built structure of our economy and expects policymakers and politicians to deal with social inequality. He suggests that the densest and most innovative cities are the places with the highest level of inequality, while cities that are economically stagnant maintain their middle class.

Academic studies in European context suggest that Florida's concept of creative cities is valid to certain degree but there are differences between Europe and North America which need to be taken into consideration. Empirical research of Boschma, R. and Fritsch, M. (2009) in regions of 7 European cities confirmed that tolerance and openness are strongly linked with concentration of the creative class. However, the impact of city infrastructure with culture and leisure facilities was insignificant. Job opportunities were closely connected with concentration of the creative people, too. Asheim, B. (2009) points out the differences in migration in Europe and USA – number of cities in Europe for work force to migrate is significantly smaller. Barriers of mobility in Europe include language, institutional differences and labour markets' structures. European economies are more closely connected to local labour markets, the social ties are stronger and the real estate market works differently than in USA (Fidrmuc, J. 2004). Big cities seem to attract creative class and grow as centres of creative industries (Egedy, T. and Kovács, Z. 2009); however, the concept of creative cities does not work in smaller city regions (Asheim, B. 2009). Small economies are even more specific – their capital plays much more important role compared to large economies (Rehák, Š. 2014).

Creative industries are perceived as the special assets in global competitiveness by governments and legislators. On the European level the development of creative and cultural industries has been supported for past 15 years. European cultural and creative sectors have been recognized as sources of economic growth and job opportunities (see further European Parliament resolution P7_TA-2013-0368). As reported in the Opinion of the European Economic and Social Committee CCMI/137 the contribution from creative and cultural industries to European GDP in the period 2008–2011 amounts to between 4.4 per cent (for the purely creative, core industries alone) and 6.8 per cent (including associated non-core industries). Their contributions to employment stand respectively at 8.3 million jobs, or 3.8 per cent of the total active population of the EU for the purely creative core industries, and 14 million including the strongly dependent (non-core industries), or 6.5 per cent of the EU's total active population. This makes them the EU's third largest employer following construction and the beverages sector.

Policies adopted recently in EU include support for networking of creative people (European Creative Hubs Network Project Evaluation Summary Report 2018), support for cultural and creative industries to use advanced digital technologies (Mid-term evaluation of the Creative Europe programme 2018), access to finance for cultural organisations and creative SMEs (Good Practice Report: Towards More Efficient Financial Ecosystems 2016). These and other efforts are a part of Europe 2020 Strategy and they combine different mechanisms to support economic growth and creation of new job opportunities based on creativity.

We suggest that each economy has its creative capacity or creative potential. It is determined by diverse components. The vital ingredients and key determinants are creative talented and educated people, access of individuals and organisations to modern technologies on the one hand; country's investments into innovations, accumulated tacit and explicit knowledge through patents and research on the hand. Finally, an essential component is the open atmosphere allowing individuals to pursue new ideas and the environment tolerant to differences and novelties. We are interested in measuring such creative capacity and propose to capture it with a composite index, which allows for comparison among economies.

Measuring creativity through the set of indices developed in the last decade. There is a strong inspiration from the Florida's 3Ts theory; he is also one of the pioneers of the creativity index as a quantitative measure suitable for comparison between countries. Other authors introduced different creativity indices; some of them incorporated also factors of the social and cultural environment, others added additional emphasis on arts and culture. *Table 1* provides a basic overview of creativity indices.[6]

Euro-Creativity Index was introduced by Florida, R. and Tinagli, I. (2004). It is constructed from Technology Index, Talent Index and Tolerance Index. The Euro-Creativity Index has extended and adapted the Florida' s concepts of the creative class and its indicators to the European context. This index was calculated for 14 European countries. Florida, R. *et al.* (2011) broadened the previous work and created the Global Creativity Index (GCI) in similar 3Ts design. It was calculated as cross-section for 82 nations in 2011 and for 139 nations in 2015. The data used for its composition are from the longer periods (5 to 10 years) although different years are used for the different variables.

Hui, D. *et al.* (2004) introduced Hong Kong Creativity Index (HKCI). In this index the four forms of the capital (structural/institutional, human, social and cultural) are the determinants of the creativity growth. Accumulated effects of the interplay between these determinants are the manifestations of the creativity in terms of the outcomes or the outputs. Manifestation of the creativity is measured

[6] These are the main creativity indices developed for countries which differ from each other to certain degree. There are other indices which are slight modifications or which are designed for specific cities.

Table 1. Overview of creativity indices

Index	Key concept	Specifics
Euro-Creativity Index	Defines 3 areas to measure creativity based on 3Ts' theory: Talent, Technology and Tolerance. Each area defined by 3 indicators totalling in 9 creativity indicators.	Contains 2 additional measures of short-term trend: Euro-Creative Trend Index and the Euro-Creativity Matrix
Hong Kong Creativity Index	It is built on 5Cs with over 100 indicators: 1. Structural/institutional Capital, 2. Human Capital, 3. Social Capital, 4. Cultural Capital, 5. Manifestations of Creativity.	It captures the characteristics of the socio-cultural parameters and illustrates the interactions of various creativity factors.
Composite Index of the Creative Economy	Creative capacity is defined in 3 dimensions: Innovation, Entrepreneurship and Openness. Each dimension offers 3 indicators thus 9 in total.	It introduces a novel method – endogenous weighting. Each entity has its own unique set of the most appropriate weights.
European Creativity Index (only theoretical design)	It is composed of 32 indicators divided among 6 sub-indices: 1. Human capital, 2. Openness and diversity, 3. Cultural environment, 4. Technology, 5. Regulatory incentives to create, 6. Outcomes of creativity.	Index aims to combine culture-based indicators in existing frameworks related to creativity, innovation and socioeconomic development.
Global Creativity Index (GCI)	Technology, Talent and Tolerance indices form overall index. Technology is constructed from 3 variables, Talent and Tolerance from 2 each. GCI is thus created from 7 variables.	The research uses comparison of GCI with 6 measures of economic and social progress (GDP per capita, Income Inequality, Global Competitiveness Index, Global Entrepreneurship Index, Human Development Index, Happiness/life satisfaction)
Creative Space Index (CSI)	9 groups of indicators: 1. Talent, 2. Openness, 3. Cultural Environment and Tourism, 4. Technology and Innovation, 5. Industry, 6. Regulation and Incentives, 7. Entrepreneurship, 8. Accessibility, 9. Liveability	Authors used endogenous weighting method and 37 variables in 9 groups.

through the economic contribution of the creativity and the inventive activity of the economic sector in more than 20 indicators. Each of the four forms of the capital is defined by 20–30 indicators. The four forms of the capital and the manifestation of the creativity together compose the creativity index for Hong Kong.

Composite Index of the Creative Economy (CICE) has been developed by Bowen, H.P. *et al.* (2006) to benchmark and evaluate the creative capacity of the given regions. The endogenous weighting method has been introduced to determine the weight each sub-dimension should contribute to the total value of the CICE. This method isolates achievement on the underlying dimensions as the source of a higher or lower CICE score value. CICE measures the creative capacity of nine regions of Europe and North America from among a network of creative regions named Districts of Creativity.

Kern, P. and Runge, J. (2009) proposed the design of the European Creativity Index as a part of study made for the European Commission to evaluate an impact of the culture on the creativity. The concept was built upon the indicators related to the culture-based creativity and their inclusion into the existing socioeconomic indicator schemes (i.e. European Innovation Scoreboard). This index remained only as a theoretical concept.

Correia, C.M. and Costa, J.S. (2014) designed Creative Space Index (CSI) as cross-section index for 26 European countries using data from the period 2005–2012 and made comparison of their index with GCI. They used endogenous weighting technique in the fashion of Bowen, H.P. *et al.* (2006) and used 9 groups of indicators.

There are several approaches to creativity. One is to compare cities or regions another is to compare higher units such as countries. Since the countries are well-defined political units with specific histories ethnical background, they represent interesting units of analysis. Individual countries decide their own policies and how to implement them in economy, educational system, R&D and other areas. These decisions have significant impact on the creativity. Country comparison can help in understanding the effectiveness of policies and of approaches to harness the creativity.

All creativity indices have been calculated as cross-section data most commonly using indicators' average of periods of several years. We construct European 3TCI including a time dimension covering period 2005–2014 measuring creativity of 28 European countries. We follow the idea of 3Ts developed by Florida which we consider the most suitable for the comparison of the creative dimension of the different countries.

Aim of our study is to compose the creativity index which enables the cross-country comparison and also captures the dynamic changes in time. Our focus is on 28 European countries and our objective is geographic comparison of the creativity. Next we aim to find whether higher levels of creativity are associated with happiness, economic prosperity and human development.

Methodology

A composite indicator is a measure that combines several observed variables into a single number. If it comprises a temporal dimension in that it is measured over time in equal intervals, it can reveal trends and changes in time. The creativity is a multidimensional and complex issue. The composite indicators combining several observed variables or dimensions into one measure are a possible tool for measuring complex multidimensional concepts such as creativity.

The main advantage and strength of the composite indicators is the ease of interpretation when compared to the multiple dimensions of a complex phenomenon they represent. At the same time, since composite indicators are unidimensional figures, they facilitate a simple comparison while retaining all the information value of the underlying variables or dimensions. It is easier to compare a single number than battery of several variables. The potential limitation of the composite indicators is the fact that they may disguise important variations in their subdimensions, especially if the construction is not transparent enough. Another possible weakness lies in a simplistic interpretation. Finally, if an important dimension is omitted or ignored, it may lead to biased conclusion or policy. The alternative to a composite index would be a set or battery of several indicators. The advantages of the composite indicators are the disadvantages of a set of indicators and vice versa. The choice of one or the other should be made based on the objective of the analysis. Since the goal of our paper is to compare the creative capacity of European countries, the set of individual indices would not serve this purpose and that is why we opt for the composite index.

Florida's first creativity index (Florida, R. 2002) was constructed for metropolitan areas and its original calculation is very

simplistic.[7] Nathan, G. (2007) points out inadequacy of using the *Gay index* to measure tolerance; the index basically measures the number of households where the members of the household are of the same gender. Cities with many college or university students who share rented apartment may display biased results. Marlet, G. and van Woerkens, C. (2007) conclude that Florida's creative class is theoretically the same as human capital, even though they acknowledge that Florida's creative class measure is a better measure of human capital then levels of education. Glaeser, E.L. (2004) found that human capital was a better predictor of population growth in the set of US metropolitan areas analysed by in Florida; he also demonstrates that presence of skills in the metropolitan area may have a greater impact on new idea production rather than bohemians as suggested by Florida.

Creativity indices measured on a country level are described in the previous section. Hoelscher, M. and Schubert, J. (2015) in their comprehensive review and comparison of creative indices indicate that one of the shortcomings is that most indices are too narrowly focused on the economy and science. They hold that the creativity and innovation are also heavily based in cultural contexts, therefore the supportive cultural background has a positive impact on them, too. Runco, M.A. (2004) encouraged interdisciplinary and multi-perspective approach in constructing creative indices to avoid capturing creativity only in limited way.

Construction of European 3T creativity index

Selection of variables

Composite indices sometimes express inputs and other times outputs or processes. Our creativity index represents both inputs and outputs. Since our objective is to model creative capacity, we do not view this approaches as conflicting. If we take the number of scientific and technical journal articles as example (one of our indicators), it is a measure of the output. However, as far as the creative capacity of the economy is concerned, higher number of such publications reflects the creative environment and thus contributes to momentum. On the other hand, inputs such as public spending on education (if spent effectively) create a potential for future creative work. That is why we see output and input indicators as complementary rather than contradictory.

The creativity index design proposed by Florida, R. and Tinagli, I. (2004) is adopted in this study. Thus, our European 3T creativity index consists of three indices – Talent, Technology and Tolerance, each composed of 3 sub-indices. We consider it a balanced design. In *Table 2* the description of each sub-index with corresponding indicators (variables) is presented, along with the unit of measurement of the original underlying variable and exact source. We use 19 indicators compared to 9 indicators used by Florida and Tinagli. European 3TCI is calculated for 28 countries and 10-year period 2005–2014 due to data availability.

Talent index is comprised of the creative class, human capital and scientific talent. The creative class of our index consists of three groups of creative people following Florida, R. and Tinagli, I. (2004): creative core, creative professionals and bohemians. Overview of the creative class composition according to ISCO-88 code within the 3 groups is in *Table 3.*

The indicator is calculated as a proportion of labour force employed in the three groups of creative occupations. In addition to labour force with advanced education we are adding a new indicator to human capital sub-index: public spending on education. We propose this indicator because it is a measure of governmental investment into human capital which should bring results in the future. Our scientific talent index includes three variables: researchers in R&D (per one million people), human resources in science and technology and scientific and

[7] There are four factors of creativity index used for 268 metropolitan areas and the creativity index is calculated by subtracting the areas' rank order in each category from number 1076.

Table 2. European 3T creativity index – indices, sub-indices, variables, their weights and sources

W1	Index	W2	Sub-index	W3	Indicator (unit of measurement)	Source
1/3	Talent	1/3	Creative Class	1	Employed in creative occupations (share of labour force)	Eurostat (lfsa_egais)
		1/3	Human Capital	1/2	Labour force with advanced education (% of total labour force)	WDI (SL.TLF.ADVN.ZS)
				1/2	Public spending on education, total (% of GDP)	WDI (SE.XPD.TOTL.GD.ZS)
		1/3	Scientific Talent	1/3	Researchers in R&D (per one million people)	WDI (SP.POP.SCIE.RD.P6)
				1/3	Human resources in science and technology (per one million people)	Eurostat (tsc00025)
				1/3	Scientific and technical journal articles (per 1,000 of labour force)	WDI (IP.JRN.ARTC.SC)
1/3	Technology	1/3	Innovation	1/2	Patent applications filed through the Patent Cooperation Treaty, residents (per 1,000 of labour force)	WDI (IP.PAT.RESD)
				1/2	Patent applications to the European Patent Office (per one million of inhabitants)	Eurostat (sdg_09_40)
		1/3	High Tech innovation	1/2	European high-technology patents (per one million of inhabitants)	Eurostat (tsc00010)
				1/2	Royalty and license fees, receipts (BoP, % of GDP)	WDI (BX.GSR.ROYL.CD, NY.GDP.MKTP.CD)
		1/3	R&D	1	Research and development expenditure (% of GDP)	WDI (GB.XPD.RSDV.GD.ZS)
1/3	Tolerance	1/3	Attitudes index	1/3	Tolerance of homosexuality (1 to 10, 10 is high degree of justification)	EVS (question f118)
				1/3	Tolerance of people of different race (percentage of intolerant respondents)	EVS (question f117)
				1/3	Tolerance of immigrants and foreign workers (percentage of intolerant respondents)	EVS (question f127)
		1/3	Values Index	1/3	Non-acceptance of bribing (1 to 10, 10 is high degree of justification)	EVS (question a124_02)
				1/3	Non-acceptance of lying (1 to 10, 10 is high degree of justification)	EVS (question a124_06)
				1/3	Control of corruption (score ranging from -2.5 to 2.5)	WGI (CC_EST)
		1/3	Self Expression Index	1/2	Voice and accountability (score ranging from -2.5 to 2.5)	WGI (VA_EST)
				1/2	Control over life and freedom of choice (1 to 10, 10 is a great control)	EVS (question a173)

Notes: Abbreviations W1, W2 and W3 stand for weights corresponding to index level (W1), sub-index level (W2) and indicator level (W3). Sources of data: Eurostat, WDI (World Development Indicators, World Bank), EVS (European Values Study), WGI (Worldwide Governance Indicators, World Bank). In the last column, after the source of each variable, the information in parentheses gives closer identification of corresponding table (Eurostat), indicator (WDI, WGI) or survey question (EVS) where the variable originates from.

Table 3. Creative class composition according to ISCO-88 code

Group of creative people	Occupations ISCO-88 code
Creative core	211. Physicists, chemists and related professionals 212. Mathematicians, statisticians and related professionals 213. Computing professionals 214. Architects, engineers and related professionals 221. Life science professionals 222. Health professionals (except nursing) 231. College, university and higher education teaching professionals 232. Secondary education teaching professionals 233. Primary and pre-primary education teaching professionals 234. Special education teaching professionals 235. Other teaching professionals 243. Archivists, librarians and related information professionals 244. Social science and related professionals
Creative professionals	111. Legislators 112. Senior government officials 113. Traditional chiefs and heads of villages 114. Senior officials of special-interest organisations 121. Directors and chief executives 122. Production and operations department managers 123. Other department managers 131. General managers 223. Nursing and midwifery professionals 241. Business professionals 242. Legal professionals 246. Religious professionals 311. Physical and engineering science technicians 312. Computer associate professionals 313. Optical and electronic equipment operators 314. Ship and aircraft controllers and technicians 315. Safety and quality inspectors 321. Life science technicians and related associate professionals 322. Modern health associate professionals (except nursing) 323. Nursing and midwifery associate professionals 324. Traditional medicine practitioners and faith healers 331. Primary education teaching associate professionals 332. Pre-primary education teaching associate professionals 333. Special education teaching associate professionals 334. Other teaching associate professionals 341. Finance and sales associate professionals 342. Business services agents and trade brokers 343. Administrative associate professionals 344. Customs, tax and related government associate professionals 345. Police inspectors and detectives 346. Social work associate professionals 348. Religious associate professionals
Bohemians	245. Writers and creative or performing artists 347. Artistic, entertainment and sports associate professionals

technical journal articles. The last indicator is a new addition compared to Florida, R. and Tinagli, T. (2004). We include it because it measures the results of research work and of scientific talent and is the foundation of the future development of research work.

Technology index contains innovation, high tech innovation and research and devel-

opment sub-indices. Compared to Florida, R. and Tinagli, T. (2004) we add just one new indicator which is royalty and license fees. It captures the economic benefits from patents and other proprietary rights and it can further stimulate (high tech) innovation.

Tolerance index is the one we modified the most when compared to Florida, R. and Tinagli, T. (2004). It is composed of attitudes index, value index and self-expression index. Attitudes index is measured with three indicators very similar to the original design. Value index comprises of non-acceptance of bribing, non-acceptance of lying (from EVS) and control of corruption (from Worldwide Governance Indicators – WGI). It is very different to Florida and Tinagli who based the sub-index on comparing the degree to which a country is based on traditional versus secular values. We selected the indicators which we believe are better expression of the value system of a society. Self-expression index uses two new indicators. One of them is "Voice and accountability score" from the WGI. It captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. The second one is "Control over life and freedom of choice" coming from the EVS. It measures the degree how much people perceive they have completely free choice and control over their lives. The Florida, R. and Tinagli, T. (2004) self-expression index is based on similar set of questions from the World Values Survey covering attitudes toward self-expression, quality of life, democracy, leisure, the environment, trust and more.[8]

Coping with the missing data issue

Since our intention was to construct the creativity index in the form of panel data, there was a necessity to deal with the fact that not all data for the desired variables were available. Two specific issues regarding this point had to addressed: firstly, regarding the data from the European Values Study and secondly, the missing data from the other sources.

The missing data problem for variables originating from the European Values Study[9] was specific in that there were only four waves of the study conducted within the span of nearly 30 years – the first study was undertaken in 1981 and the last in 2009, with three rather isolated observations per country in case of the countries under research. Moreover, the data were collected via extended surveys and thus there is possibility of biases. However, they gave a good measure regarding the trends in the shifts of preferences and ideas of the citizens of the individual countries. That is why to compensate for the years when no survey was conducted and at the same time to compensate for the possible selection bias the fitted values from simple logarithmic trend models were used instead[10].

The qualitatively different was the missing data issue for the remaining 13 variables from other sources. We had 104 missing values in the dataset which represents less than 3 per cent of data. The biggest proportion of missing values for a single variable was slightly less than 15 per cent. In general, this was one of the criteria we considered for variables selection – the proportion of missing values had to be below 20 per cent. We have dealt with these in the following three ways. Firstly, where possible, we replace the missing data with values from the same or nearly same variables from other sources (17 missing values). Secondly, we replaced

[8] Study on values realized in the countries of Europe by EVS research network is not included in each of the data-sets of World Values Survey.

[9] This relates to six variables used in tolerance index, see *Table 2* for details.

[10] Using imputation by logarithmic time trend makes sense also from the perspective of the gradual change in time. The underlying concepts of attitude and values regarding the whole country is not expected to change in abrupt or erratic way – that is why smoothing the values using the trend function may well correspond to reality. As far as a functional form is concerned, we utilize the logarithmic function which decreases the rate of growth or decline in time. To the best of our knowledge the damped trend functions are one of the most reliable forecasting tools. The attitudes or values may change because of a random shock in the future (such as the recent migrant waves) but no forecasting method is immune to this.

the missing values by the directly preceding known value from the same variable and the same country (77 missing values). Thirdly, we replaced missing values in the beginning of the time series with the following value – this was the case for the missing values on the beginning of the time-series (10 missing values).

Normalization of variables

Each variable is measured in different units of measurement and even though the "size" effect of the economy is eliminated (each variable is expressed either as a score or as a ratio) in order to construct the overall indicator as a linear combination of the variables each value needs to be transformed to the score between 0 and 10, 10 being the highest value, meaning the best impact on the creative capacity of the economy. Two points are necessary for the linear transformation to be performed. Instead of minimum corresponding to 0 and maximum corresponding to 10 (for certain variables where the high value suggests the low creative capacity it is reversed – these variables are percentage of intolerant respondents to people of different race and immigrants, and also justification of bribing and lying) we decided to take the 5th percentile to be transformed to 0 and the 95th percentile to 10 in order to eliminate the potential influence of outliers[11]. Technically the linear transformation is performed according to the following equation:

$$y = a + bx,$$

where y is the value of the score, x is the value of the variable, a and b are the constants calculated for each indicator separately based on the following terms:

$$a = \frac{10 * 5^{th}\ percentile}{5^{th} - 95^{th}\ percentile}$$

$$a = \frac{10}{95^{th} - 5^{th}\ percentile}$$

The above normalization in reality corresponds to two consequent transformations – the first one is winsorization, and the second one is min-max normalization. The winsorization helps to deal with extreme values. And the min-max transformation is one of the frequently used methods of normalization when creating the composite indices (see OECD, 2008).

Determination of weights

When forming any composite index, the determination of weights is of the great importance. We use the three levels of weights (see *Table 2* for details) – the first level is the level of three indices, the second level refers to the nine sub-indices and the last one corresponds to individual indicators (or variables). In this stage of work, the decision was made to use the equal weights on all three levels. In this way, all indices and sub-indices have the same weights and so do the variables within sub-indices. We consider this method to be appropriate in our situation. We prefer to keep the theoretical concept of 3T creativity index rather than to employ empirical weighting and grouping based on statistical methods such as principal component analysis. Also, most composite indicators employ equal weights (OECD 2008, 31).

Comparison with other indices

Representative variables used for happiness, economic performance and human development

We decided to explore association between creativity index and two important dimension of human life – economic prosperity and happiness of population. We choose GDP per

[11] The values of the 5th and the 95th percentiles were selected as a compromise – if the minimum, resp. maximum are not extreme values and represent potentially useful benchmark, the 5th, resp. 95th percentile are reasonably close and the difference would be relatively small. If, on the other hand, the minimum, resp. maximum are extreme values, the values of the 5th, resp. 95th percentiles will eliminate their adverse influence on the index.

capita as a proxy of economic performance, World Happiness Index as a proxy of happiness and Human development index as a proxy of both. At this stage, the analysis is just exploratory. We are not inferring anything about the direction of causality, we primarily focus on statistical relationship. Also, the previous research used similar justification of the usefulness of the creativity index. Nevertheless, the examination of causality is a potentially fruitful topic for future research.

GDP per capita is the standard measure of economic output.[12] GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

The World Happiness Index published in World Happiness Report is used as a proxy of citizens' happiness. World Happiness Report[13] is compiled by a group of independent experts on the basis of the Gallup World Poll survey. The report provides World Happiness Index representing six key variables – income, healthy life expectancy, social support, freedom, trust and generosity. These variables explain major national-level differences in life evaluations. The respondents in the surveys the index is based on are asked to assess their life situation on a 0 to 10 scale, 0 being the worst possible life and 10 being the best they can imagine[14]. The important feature of the index is its time-series dimension enabling to explore not just cross-sectional differences among the countries but also changes within a single country.

Human development index (HDI) is yet another representative variable that measures the economic performance and citizens' happiness in a balanced fashion. It combines three important dimensions: long and healthy life (life expectancy index), knowledge (education index), a decent standard of living (GNI index). Even though there is some overlap with GDP per capita, the HDI is often used for assessment of countries' development and not only for economic growth.

Measure of association between the creativity and happiness, economic performance and human development

To study associations between creativity and economic performance and happiness we use Pearson's correlation coefficient.[15] It measures the degree of linear association between the two variables. The Pearson's correlation coefficient is the most commonly used measure of bivariate correlation. There are two forms of the centring of variables, which are usually used in the modelling, namely the grand mean centring and the group mean centring. Grand mean centring uses one and the same mean value for the whole sample. Group mean centring considers the different groups within the sample and thus calculates with one mean value for one group of the sample. Since we deal with panel data the group mean centring seems to be the preferred option. We compute correlations both by years thus capturing "between" dimension (measuring differences between countries) and by individual countries capturing "within" dimension (measuring differences in time).

Empirical results

Creativity of European countries

Construction of European 3TCI enables us to compare creativity of 28 European coun-

[12] We use GDP per capita in constant 2010 USD.

[13] For the up-to-date information see http://worldhappiness.report/ed/2018/

[14] The method of measurement used in the surveys is sometimes called Cantril Self-Anchoring Scale, or Cantril ladder. That is why the world happiness index is sometimes called life ladder.

[15] Based on Long's review of research methodologies in creativity studies, not limited only to creativity in entrepreneurship or in economics (Long, H. 2014), correlational techniques were utilized most widely to analyse quantitative data.

tries among themselves and since the index is computed in period of ten years we can explore the time dimension, too. *Table 4* presents average values of European 3T creativity index along with its three sub-indices for 28 European countries for three sub-periods within the time-period 2005–2014 along with the country rankings.

The top 4 creative countries based on European 3CTI are Sweden, Finland, Denmark and Iceland in all three sub-periods; on the other end of the spectrum the bottom four countries are always Croatia, Slovakia, Bulgaria, Romania. In general, the ranking of countries is fairly stable across the sub-periods. The greatest fall was experienced by Greece when in the first sub-period 2005–2008 its rank was 20 while in 2012–2014 the rank was 24. Interestingly, the average values of its creativity index were very similar in all three sub-periods.

Based on countries ranking we can observe the interesting clustering. The top 5 countries are those from Scandinavia plus Iceland. The following 8 are from Western Europe. 11 of these 13 countries are the old member states of EU and 2 of them are members of European Economic Area (EEA). Slovenia ranks 14 and marks the half of the sample. The following 3 countries are from Southern Europe. 10 post-socialist countries are at the end of the table, along with the sinking Greece. With certain level of simplification, we can say the ranking of creative capacity represented by European 3T creativity index is North, West, South and East. *Figure 1* presents European 3T creativity index map (average values for three sub-periods) and partially illustrate the above-mentioned clustering.

Next we analyse changes of creativity in time within each country, using period of ten years. *Figure 2* shows the evolution of the European 3T creativity index in time. In this figure, we created 4 groups (with 7 countries each) based on average value of the creativity index within the ten-year period (2005–2014). This way the groups are relatively homogenous in terms of level of the

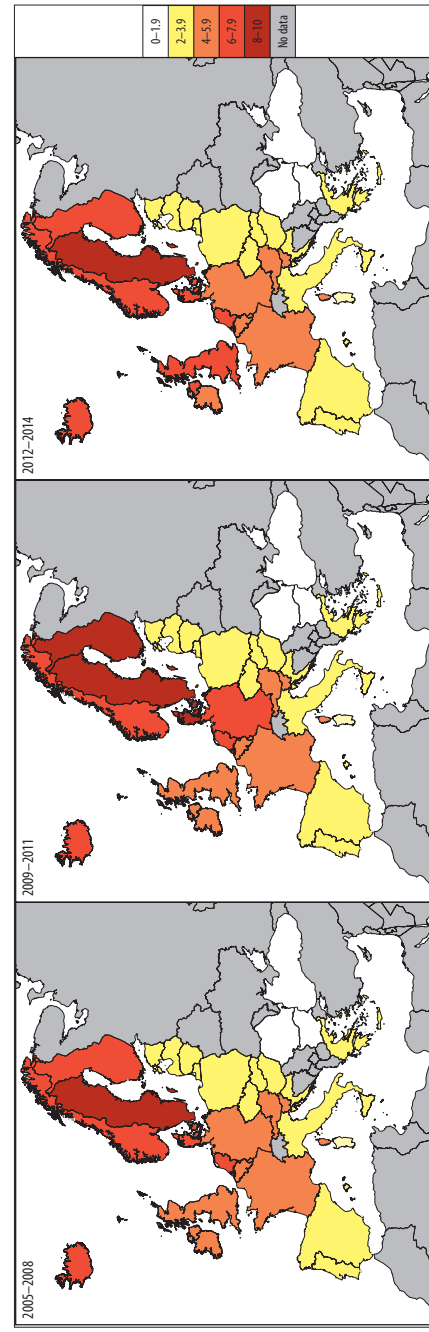

Fig. 1. Average values of European 3T creativity index for 28 European countries. The maps are coloured based on the average values of European 3T creativity index for a given country and sub-period.

Table 4. Average values of European 3T creativity index along with rankings for 28 European countries for three sub-periods

Period 2005–2008			Period 2009–2011			Period 2012–2014		
Country	Creativity Index		Country	Creativity Index		Country	Creativity Index	
	value	ranking		value	ranking		value	ranking
Sweden*	8.23	1	Sweden	8.37	1	Sweden	8.68	1
Finland*	7.98	2	Denmark	8.30	2	Denmark	8.35	2
Denmark*	7.86	3	Finland	8.09	3	Finland	8.28	3
Iceland*	7.40	4	Iceland	7.61	4	Iceland	7.41	4
Netherlands*	6.63	5	Norway	6.82	5	Norway	7.03	5
Norway*	6.47	6	Netherlands	6.77	6	Netherlands	6.94	6
Germany*	5.96	7	Germany	6.29	7	Germany	6.43	7
United Kingdom*	5.83	8	United Kingdom	5.89	8	United Kingdom	6.07	8
Austria*	5.31	9	France	5.56	9	Luxembourg	5.96	9
France*	5.23	10	Luxembourg	5.48	10	Belgium	5.77	10
Luxembourg*	5.09	11	Austria	5.42	11	Austria	5.75	11
Belgium*	5.07	12	Belgium	5.40	12	France	5.74	12
Ireland*	4.67	13	Ireland	5.38	13	Ireland	5.41	13
Slovenia	4.18	14	Slovenia	4.99	14	Slovenia	5.28	14
Spain*	3.72	15	Spain	4.16	15	Spain	4.04	15
Italy*	3.41	16	Estonia	3.65	16	Portugal	3.80	16
Portugal*	3.09	17	Portugal	3.51	17	Estonia	3.60	17
Estonia	2.90	18	Italy	3.26	18	Italy	3.20	18
Hungary	2.81	19	Hungary	3.08	19	Hungary	3.11	19
Greece*	2.74	20	Lithuania	2.92	20	Latvia	3.05	20
Czech Republic	2.52	21	Latvia	2.81	21	Lithuania	3.03	21
Latvia	2.45	22	Czech Republic	2.75	22	Czech Republic	2.94	22
Lithuania	2.33	23	Greece	2.75	23	Poland	2.88	23
Poland	2.23	24	Poland	2.57	24	Greece	2.72	24
Croatia	2.16	25	Croatia	2.39	25	Croatia	2.66	25
Slovakia	2.08	26	Slovakia	2.15	26	Slovakia	2.07	26
Bulgaria	1.41	27	Bulgaria	1.57	27	Bulgaria	1.77	27
Romania	1.35	28	Romania	1.51	28	Romania	1.47	28

Notes: The table shows ranking of 28 European countries based on the average values of European 3T creativity index for three sub-periods within time-period 2005–2014. *Countries were the EU and EEA member states before 2004.

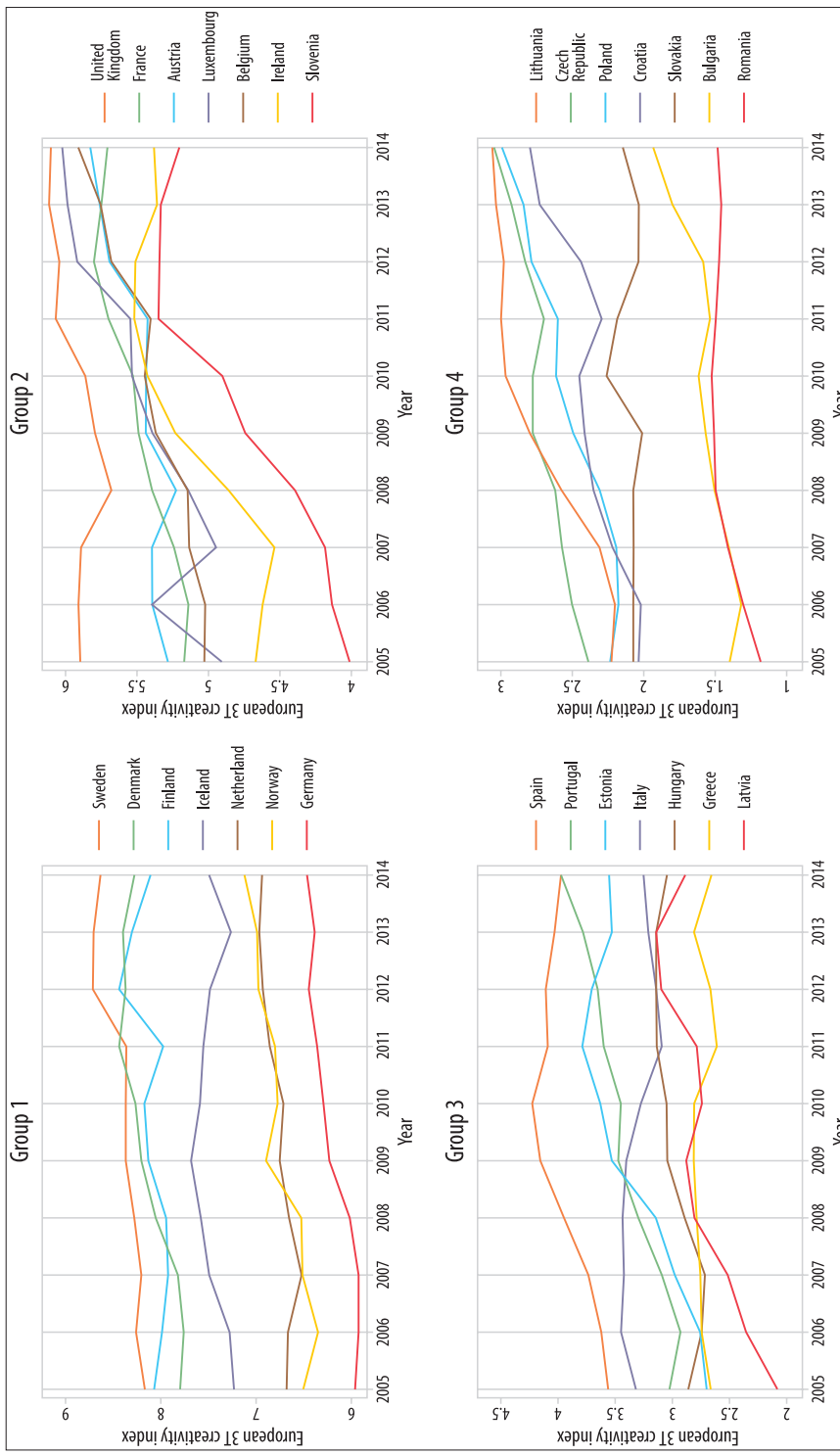

Fig. 2. Time-series plots for European 3T creativity index. The groupings of the countries are determined by the average value of the European 3T creativity index during the ten-year period – the group 1 comprises the first seven countries, group 2 the set of following seven countries, and so on.

creativity. The charts reveal that for majority of countries the creativity index increases in time. However, in each group where the level of creative capacity measured by our index is stagnating (e.g. Iceland in the group 1, Greece in the group 3, Slovakia and Romania in the group 4). Even though we have shown in the previous paragraphs that countries' ranking is relatively stable within the analysed periods, growing trends suggest that ranking may change in the longer term which is important observation for stagnating countries.

Association between European 3T creativity index, World happiness index, GDP per capita and Human developments index

In order to explore the relationship between European 3T creativity index and three indices representing happiness (World happiness index), economic situation (GDP per capita) and human development (Human development index) we use Pearson correlation coefficient. The structure of the data (time-series and cross-section dimension) enables us to look at this problem from two perspectives.

The first one is to explore the correlation between countries. This approach is suitable for data without time-series dimension (e.g. Florida, R. *et al.* 2015). The calculated Pearson's correlation coefficients for each year in the sample are shown in *Table 5*, Panel A.

The correlation coefficient of European 3T creativity index and World happiness index takes on values from 0.77 to 0.90 and it is statistically significant at the usual 5 per cent significance level for each year. The correlation coefficient between the European 3T creativity index and GDP per capita is also statistically significant for each year with somewhat smaller values ranging from 0.71 to 0.75. This suggests that countries with higher values of the European 3T creativity index have on average higher values of happiness and higher values of GDP per capita. The relationship is stable and seems to hold for each year within the sample. This finding is not new and has been documented in earlier literature (Hassan, I. and Tucci, C.L. 2010; Florida, R. *et al.* 2015). As far as the relationship between the European 3T creativity index and Human development index is concerned, the cross-sectional correlation coefficients are relatively high and stable with values ranging from 0.87 to 0.90. Again, this demonstrates strong relationship between the two variables.

The second approach is focused on the relationship between the variables of interest within the same country. The values of the within country correlation coefficients are displayed in *Table 5*, Panel B. The results are rather unstable in terms of direction of relationship, its strength and its statistical significance, especially for the first two indices. There are several potential reasons for this observation. Firstly, when compared to the cross-sectional correlations the number of time-series points is at most ten and often less because of the missing data for World happiness index. Secondly, the changes within countries are much smaller than those between countries. Thirdly, there may be time lags involved in that the changes of one variable may be associated with the changes in the other one with some lag. Even though the examination of causality is a potentially very interesting research topic, given the small number of time periods in the sample we refrain from inferences about the causality among the variables involved. On the other hand, the relationship between the European 3T creativity index and HDI is relatively strong for majority of countries. This may be caused by partial overlap between the two indices along the dimension of talent/education indices.

Clusters of countries based on European 3TCI, World happiness index, GDP per capita and Human developments index

One of the questions we try to answer in the paper is related to the geographic distribution of the creativity index. We have already dem-

Table 5. Correlation coefficients between European 3T creativity index and World happiness index (WHI), GDP per capita and Human development index (HDI)

Panel A: Cross-sectional correlations				Panel B: Time-series correlations			
Year	Correlation coefficient			Country	Correlation coefficient		
	WHI	GDP pc	HDI		WHI	GDP pc	HDI
2005	0.83*	0.73*	0.89*	Austria	0.01	0.49	0.66*
2006	0.90*	0.74*	0.88*	Belgium	-0.74*	0.31	0.90*
2007	0.77*	0.71*	0.88*	Bulgaria	0.74	0.77*	0.91*
2008	0.78*	0.72*	0.87*	Croatia	-0.07	-0.13	0.89*
2009	0.84*	0.72*	0.87*	Czech Republic	0.20	0.59	0.97*
2010	0.86*	0.73*	0.87*	Denmark	-0.72*	-0.64*	0.81*
2011	0.86*	0.73*	0.89*	Estonia	0.12	-0.04	0.80*
2012	0.87*	0.74*	0.89*	Finland	-0.46	-0.59	0.42
2013	0.85*	0.75*	0.89*	France	-0.26	0.24	0.90*
2014	0.83*	0.75*	0.90*	Germany	0.78*	0.77*	0.90*
Average	*0.84*	*0.73*	*0.88*	Greece	0.26	0.40	0.21
				Hungary	-0.42	-0.32	0.82*
				Iceland	-0.65	0.03	-0.18
				Ireland	-0.53	-0.53	0.18
				Italy	0.78*	0.64*	-0.68*
				Latvia	0.49	0.50	0.83*
				Lithuania	-0.30	0.65*	0.71*
				Luxembourg	-0.22	-0.26	0.69*
				Netherlands	-0.42	-0.15	0.83*
				Norway	0.17	-0.50	0.82*
				Poland	0.12	0,94*	0,91*
				Portugal	-0.60	-0.66*	0.98*
				Romania	0.14	0.87*	0.96*
				Slovakia	0.40	0.21	0.18
				Slovenia	0.39	-0.23	0.84*
				Spain	-0.78*	-0.52	0.71*
				Sweden	0.24	0.35	0.76*
				United Kingdom	-0.54	0.07	0.57
				Average	*-0.07*	*0.12*	*0.65*

Notes: The tables show the Pearson correlation coefficients between the European 3T creativity index and World happiness index (WHI), GDP per capita and Human development index (HDI). Panel A shows correlation between countries in each year and their average. Panel B shows correlation between the creativity index and World happiness index (resp. GDP per capita, or HDI) within each country and their averages. *Statistically significant coefficients with p-value lower than 5 per cent.

onstrated that the levels of creativity are clustered within certain regions. The highest levels are in the countries of Northern and Western Europe. The countries in another group belong to one of the two categories: they are either post-socialist countries that joined EU later (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Croatia, Bulgaria, Romania) or they are southern countries and older members of EU (Greece, Italy, Portugal and Spain). Slovenia is an interesting case in that it is between the two groups.

The charts in *Figure 3* show the association between the European 3T creativity index and happiness for three sub-periods. The clustering of the countries partially confirms the earlier assignment into the four groups. The earlier member countries of EU and EEA are located in the upper right corner of all charts with both the higher levels of happiness and value of creativity index. The Southern older EU members show an interesting pattern in time in that they moved closer to those from Eastern and Central Europe.

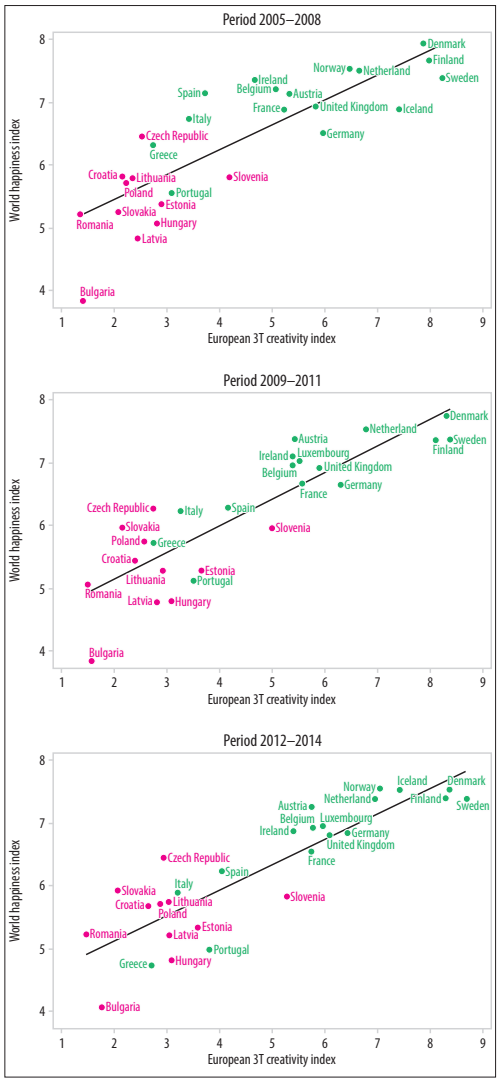

Fig. 3. Association between European 3T creativity index and World happiness index. The scatterplots show the association between average values of European 3T creativity index and average values of World happiness index for given period. The colouring is based on the EU/EEA membership before 2004 (green: earlier members, orange: entrants after 2004).

The charts in the *Figures 4* and *5* show the relationship between creativity index and the GDP per capita, resp. HDI. Here the separation between the older EU/EEA members from North-West and the rest of Europe is also visible. The countries from Northern and Western Europe are again in the upper right corner with high levels of GDP per capita, resp. HDI and the European 3TCI, too. The countries from the Southern Europe are located above those from the Central and Eastern Europe with exception of Slovenia, i.e. the southern countries have higher level of GDP per capita and HDI but in terms of creativity they are within the range of creativity of Central and Eastern European countries.

Discussion

The comparison of creativity index with other indices is not new and has been used before. The previous studies (e.g. Florida, R. *et al.* 2011) also related the level of creativity to GDP, life satisfaction and HDI and shown significant associations. This may have suggested that the increase in creativity or creative capacity causes the increase in the overall economic performance, life satisfaction and HDI.[16] However, the above results were obtained using the cross-sectional data and we have replicated this result in our study. Moreover, we have extended this analysis using time-series dimension and demonstrated, that this is not the case for changes within a single country – the GDP per capita and creativity index are not correlated. The same holds for World happiness index. Interestingly, as far as the Human development index is concerned, we have shown that there are some links between the creativity and human development within the most of the countries, even though this result needs to be confirmed or refuted using the longer time period and more elaborate methods such as regression or causal analysis.

The analysis of creative capacity using the European 3T creativity index revealed that

[16] Results of comparison of Global Creativity Index - GCI (see Florida, R. *et al.* 2011) using cross-section correlations: GCI and GDP per capita 0.84, GCI and Global Competitiveness Index 0.79, GCI and Global Entrepreneurship Index 0.81, GCI and Human Development Index 0.82, GCI and Life satisfaction 0.74.

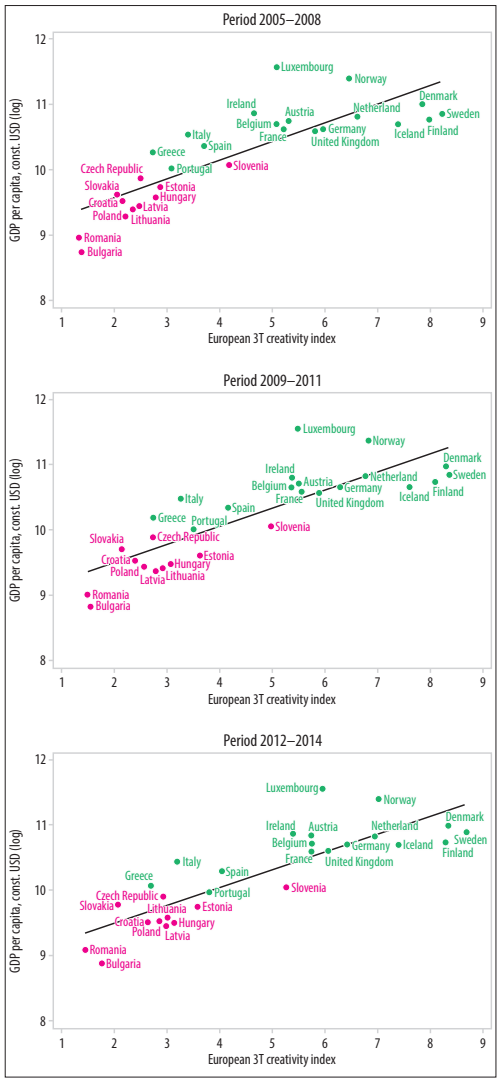

Fig. 4. Association between European 3T creativity index and GDP per capita. The scatterplots show the association between average values of European 3T creativity index and average values of GDP per capita for given period. The colouring is based on the EU/EEA membership before 2004 (green: earlier members, orange: entrants after 2004).

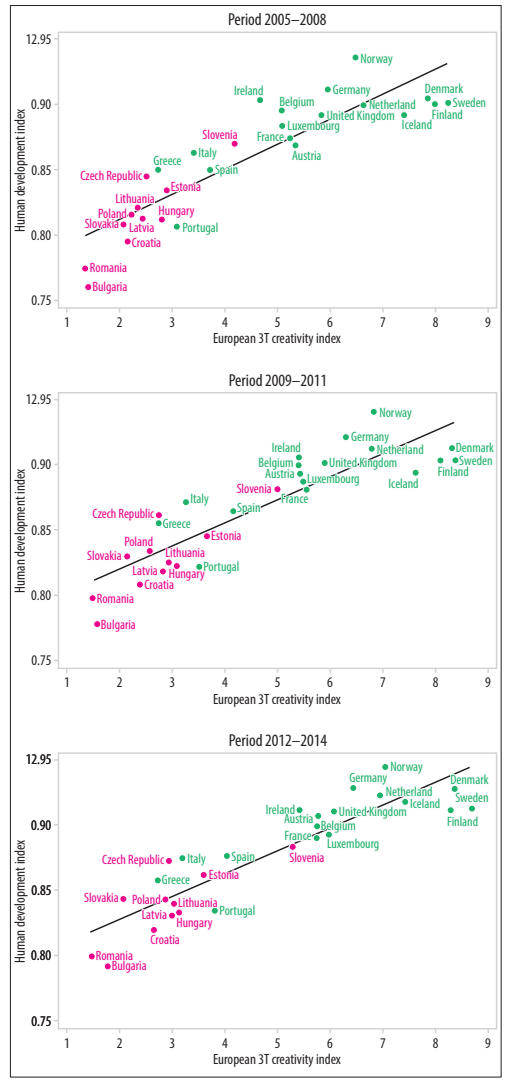

Fig. 5. Association between European 3T creativity index and Human development index. The scatterplots show the association between average values of European 3T creativity index and average values of Human development index for given period. The colouring is based on the EU/EEA membership before 2004 (green: earlier members, orange: entrants after 2004).

the country rankings are relatively stable in time. On the other hand, the creativity index grows gradually for most of the countries, albeit with a different rate of growth. Perhaps the ten-year period is relatively short for the changes in rate of growth to manifest in the rankings. Countries wishing to stay in the forefront or to advance compared to their peers need to take this into account.

Relatively stable rankings and general slow rate of growth suggest that the change occurs rather slowly. We suppose it is because of cultural background, political and economic history of a country. If the policy makers wish to influence the overall creative capacity of a country, perhaps the quickest way would be to work on smaller units, such as regions or cities.

Our analyses suggest that creativity is not distributed randomly over European countries. Possible explanations of this finding may be the common history and exchange of ideas and concepts, mutual trade, sharing economic and political practises resulting in spill-over effects. We assume that historically such spill-over effects occurred regionally and the question is to what degree will the cooperation within the EU help some countries to grow faster, learning and inheriting from the most advanced ones.

Conclusions

We study the creative capacity of 28 European countries in the period 2005–2014 in this paper. We constructed European 3T creativity index based on Florida's 3Ts concept and calculated the index in the format of panel data. Unlike other studies comparing the creativity of countries we add time dimension.[17] Talent, technology and tolerance indices were also calculated individually. The paper provides open source creativity index, describing variables with their source and the weights of individual variables and sub-indices.

We have demonstrated relatively stable rankings of the countries in time, even though the creative capacity measured by the European 3T creativity index was gradually growing in time with varying rate of growth for individual countries. We have also shown evidence that the creative capacity is clustered geographically, even after more than ten years of cooperation within EU. Whether this changes in the future is an open question.

[17] Studies measuring the creativity of countries constructed their indices only as cross-sectional. See Florida, R. and Tinagli, I. (2004), Florida, R. *et al.* (2011), Correia, C.M. and Costa, J.S. (2014).

The creativity index was compared to World happiness index, GDP per capita and Human development index. We have replicated earlier cross-sectional analyses and shown the relatively strong correlation. However, one of the important contributions of our study is the addition of time-series perspective where we show that the picture is different for changes within individual countries. Here we demonstrated lack of correlation between creativity and GDP per capita or World happiness index.

Even though the above findings are relatively new, our study is not without any limitations and our approach is not without any issues. The first limitation is the assumption that it is possible to represent creative capacity using a single number. This is the implicit assumption in each study that deals with construction of any composite index. However, without this assumption the country comparison would be much more complicated. The second limitation lies in the choice of the 3T concept as a reference design of a comprehensive creativity index. Possibly one can make arbitrary choices in selection of individual variables or composite index construction design. We tried to be transparent, allowing future amendments and modifications. Another limitation is a relatively short period of 10 years in the construction of the index. Consistent collection of data will help in forming longer time series thus future research could examine causality among creativity and other variables of economic performance, wealth or indicators of quality of life. Lastly, we have used relatively simple methods of analyses (correlations and graphical analysis).

REFERENCES

Amabile, T.M. 1983. *The social Psychology of Creativity.* New York, Springer Verlag.

Asheim, B. 2009. Guest Editorial: Introduction to the Creative Class in European City Regions. *Economic Geography* 85. (4): 355–362.

Boschma, R. and Fritsch, M. 2009. Creative Class and Regional Growth: Empirical Evidence from Seven European Countries. *Economic Geography* 85. (4): 391–423.

Bowen, H.P., Sleuwaegen, L. and Moesen, W. 2006. *A composite index of the creative economy with application to regional best practices.* Leuven, Vlerick Leuven Gent Management School Working Paper Series.

Correia, C.M. and Costa, J.S. 2014. Measuring creativity in the EU member states. *Investigaciones Regionales* 30. 7–26.

Egedy, T. and Kovács, Z. 2009. The capacity and potentials of Budapest to attract creative economy. *Hungarian Geographical Bulletin* 58. (4): 281–294.

European Creative Hubs Network Project Evaluation Summary Report, May 2018. Brussels, European Commission.

European Parliament resolution P7_TA-2013-0368 on promoting the European cultural and creative sectors as sources of economic growth and jobs. Strasbourg, European Parliament, 12 September 2013.

Firdmuc, J. 2004. Migration and Regional Adjustment to Asymmetric Shocks in Transition Economies. *Journal of Comparative Economics* 32. (2): 230–247.

Florida, R. 2002. *The Rise of the Creative Class: And How Its Transforming Work, Leisure, Community and Everyday Life*. New York, Basic Books.

Florida, R. 2005. *The Flight of the Creative Class: The New Global Competition for Talent.* New York, Harper Business.

Florida, R. 2017. *The new urban crisis: How our cities are increasing inequality, deepening segregation, and failing the middle class – and what we can do about it.* New York, Basic Books.

Florida, R. and Tinagli, I. 2004. Europe in the Creative Age. *Demos* February, 2004.

Florida, R., Mellander, C. and King, K. 2015. *The Global Creativity Index*. Toronto, Martin Prosperity Institute.

Florida, R., Mellander, C. and Stolarick, K. 2008. Inside the black box of regional development: Human capital, the creative class and tolerance. *Journal of Economic Geography* 8. 615–49.

Florida, R., Mellander, C., Stolarick, K., Silk, K., Matheson, Z. and Hopgood, M. 2011. *Creativity and Prosperity: The Global Creativity Index.* Toronto, Martin Prosperity Institute.

Glaeser, E.L. 2004. Review of Richard Florida's The rise of the creative class. *Regional Science and Urban Economics* 35. 593–96.

Good Practice Report: Towards More Efficient Financial Ecosystems. Luxembourg, Publications Office of the European Union, 2016.

Hassan, I. and Tucci, C.L. 2010. The innovation–economic growth nexus: Global evidence. *Research Policy* 39. (10): 1264–1276.

Hoelscher, M. and Schubert, J. 2015. Potential and Problems of Existing Creativity and Innovation Indices. *Creativity Research Journal* 27. (1): 1–15.

Hui, D., Chun Hung, N.G., Mok, P., Fong, N., Chin, W.K. and Yuen, Ch. 2004. *A study on Hong Kong Creativity Index.* Commissioned by the Home Affairs Bureau. Hong Kong, The Government of Hong Kong Special Administrative Region.

Kern, P. and Runge, J. 2009. *KEA briefing: towards a European creativity index. Part of the KEA's report 'The contribution of culture to creativity', conducted for the European Commission in 2008–2009*. Brussels, KEA European Affairs.

Knudsen, B., Florida, R., Gates, G. and Stolarick, K. 2007. *Urban density, creativity, and innovation.* Working paper. Toronto, The Martin Prosperity Institute, University of Toronto.

Krätke, S. 2010. 'Creative Cities' and the Rise of the Dealer Class: A Critique of Richard Florida's Approach to Urban Theory. *International Journal of Urban and Regional Research* 34. 835–853.

Long, H. 2014. An Empirical Review of Research Methodologies and Methods in Creativity Studies (2003–2012). *Creativity Research Journal* 26. (4): 427–438.

Lundvall, B.A. and Johnson, B. 1994. The learning economy. *Journal of Industry Studies* 1. (2): 23–42.

Markussen, A. 2006. Urban Development and the Politics of a Creative Class: Evidence from the Study of Artists. *Environment and Planning* 38. (10): 1921–1940.

Marlet, G. and van Woerkens, C. 2004. *Skills and creativity in a cross-section of Dutch cities.* Discussion Paper Series 04-29. Utrecht, Koopmans Research Institute.

Martin, L. and Wilson, N. 2016. Opportunity, discovery and creativity: A critical realist perspective. *International Small Business Journal* 34. (3): 261–275.

Mcdowell, L. 2017. The Ideal Worker: Inclusion and Exclusion in a Knowledge-based City: The Case of Oxford, UK. In *Inequalities in Creative Cities: Issues, Approaches, Comparisons.* Eds.: Gerhard, U., Hoelscher, M. and Wilson, D., New York, Palgrave Macmillan, 79–105.

McGranahan, D. and Wojan, T. 2007. Recasting the creative class to examine growth: Processes in rural and urban counties. *Regional Studies* 41. 197–216.

McLean, H. 2014. Digging into the creative city: A feminist critique. *Antipode* 46. (3): 669–690.

Nathan, G. 2007. *Opinion of the European Economic and Social Committee CCMI/137 on Creative and cultural industries – a European asset to be used in global competition.* Brussels, EESC, 16 September 2015.

OECD 2008. *Handbook on Constructing Composite Indicators: Methodology and User Guide*. Paris, OECD.

Peck, J. 2005. Struggling with the Creative Class. *International Journal of Urban and Regional Research* 29. 740–770.

Pratt, A.C. 2008. Creative cities: The Cultural Industries and the Creative Class. *Geografiska Annaler: Series B, Human Geography* 90. 107–117.

Rehák, Š. 2014. Creative class and creative cities: A theoretical concept and its limits. *Sociológia* 46. (5): 599–619).

Runco, M.A. 2004. Creativity. *Annual Review of Psychology* 55. 657–687.

Schumpeter, J.A. 1911. *Economic development*. Translated edition by Opies, R. and Elliot, J.E., Transaction publishers, 1983.

Smith, A. 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations*. Ed.: Soares, S.M., MetaLibri Digital Library, 2007.

Weisnberg, R.W. 1988. Problem solving and creativity. In *The nature of Creativity.* Ed.: Stemberg, R.J., Cambridge, Cambridge University Press, 148–176.

Wilson, D. 2017. Making Creative Cities in the Global West: The New Polarization and Ghettoization in Cleveland, USA, and Glasgow, UK. In *Inequalities in Creative Cities: Issues, Approaches, Comparisons,* Eds.: Gerhard, U., Hoelscher, M. and Wilson, D., New York, Palgrave Macmillan, 107–127.