ASYMMETRY IN THE OKUN COEFFICIENT IN ROMANIAN ECONOMY

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Introduction

Any recession is characterized by social costs. The loss of jobs, the specter of unemployment, and the decrease of earnings are all negative phenomena that produce during the recessions. During the ongoing financial crisis, unemployment rose quickly in Romanian economy. From a very low unemployment rate, at about 3.5 % before the trigger of the recession, in less than a year, the unemployment more than doubled. Coupled with the loss of budgetary revenues and the increasing public debt, this put further constraints on the optimal decisions of policy makers.

The dynamics on unemployment in the near future, as well as the future development of the unemployment as the economy starts to grow, led to reignite of the interest in the output-unemployment relationship, also known as the Okun coefficient. While there are a number of studies on the estimation of the Okun coefficient, see [1] and [3], less attention was paid to the possibility of asymmetries in the Okun relationship. The recent experience showed that while during the expansion between 2000 and 2008 the unemployment decreased constantly but slowly, the unemployment rose rapidly in less than one year. There is also a major interest on the possible dynamics of unemployment during the post-crisis recovery.

The main purpose of this study is to analyze whether the Okun's Law is asymmetric or not in Romanian economy. I also investigate whether the shifts in the Okun relationship are correlated with the business cycles. The econometric framework is a nonlinear one, supported by recent research, see [18], that points to the possibility of modeling the Romanian business cycles using nonlinear econometric models.

This paper is organized as follows. The first section reviews the main results in the literature on the Okun coefficient. The next section introduces the model and explains its approach. I estimate the Okun coefficient using the Markov Switching approach and compare the result of the estimations with previous results for Romania. I draw an assessment of the results and some possible policy implications in the last section.

1. Literature Review

The Okun's Law is a key relationship in macroeconomics and it was proposed by the American economist Okun, see [15]. In its original form, the relationship implies that a GDP growth by 3 % leads to a 1% decrease in unemployment. Following studies confirmed this finding, although they found slight variations from the proposed value of -0.3 in the original paper.

A series of researches were undertaken in order to test in various form the existence of this relation, mostly for United States, as well as other developed economies. We can include here the studies by [7], [8], [6], [17] or [21]. A few studies which compare this relationship for several developed or OECD countries were also realized by [14] and [12].

Interestingly, [14], and also [12], proposed an interpretation of the difference between the Okun coefficients in the studied economies by the difference in the institutions of the labor market in these economies. Thus, [14] found values for the Okun coefficients ranging from -0.08 for Japan to -0.41 for the United States. According to him, a bigger absolute value for a country implied that the labor market in that economy was more flexible. His findings did confirm the conventional wisdom that the labor

markets in the Anglo-Saxons economies were more flexible.

Recently, there is a growing interest in the possible asymmetry of the Okun coefficient. A theoretical background for the asymmetric Okun coefficient was provided by [10]. According to them, finding whether there are asymmetries or not in the output-unemployment relationship helps at:

- Discriminating between alternative labor and goods market theories;
- Establishing or not the existence of an asymmetric Phillips curve;
- Better designing stabilization policies;
- Improvement of the forecasts for unemployment.

They also suggested that the first contributions to the possible nonlinearities or shifts of the Okun relationship can be traced back to [4] or [16]. For example, [4] used a production function and suggested that the symmetric Okun coefficient would wrongly lead to an overestimation of the unemployment during booms as well as to an underestimation of unemployment during recessions.

Following studies deepened the initial findings. [20] estimated a model which relates the changes in unemployment with changes in the output. The model was estimated for positive and, respectively, negative values of the output. The model was estimated for 20 OECD countries. He found evidence for asymmetric effects. [13] also found also nonlinearities and asymmetries in the Okun coefficient, with the relation stronger during rapid downturns.

Using an approach derived from the paper in [20], [10] studied the existence of the asymmetry for seven OECD economies. They showed that failure to take into account the asymmetries would lead to a rejection of the hypothesis of a long-run relationship of unemployment and output in United States and New Zealand. Moreover, the symmetric approach (except for Canada) showed different magnitudes for the short-run relationship depending whether the economy was in a boom or a downturn.

[19] also studied the existence of asymmetries in the Okun coefficient for United States. They showed that short-run effects of the output gap have a stronger effect on the unemployment cycle during a downturn, confirming previous findings for US or other developed economies.

A different approach was proposed by [5]. He proposed the use of the Markov Switching approach in the analysis of Okun coefficient shifts. By applying this approach on data for the US economy he proved that there are changes in the Okun coefficient depending on the business cycle phases.

An extension of this approach was done by [11] who used the regime-dependent Markov Switching approach to estimate the Okun coefficient in US economy. They pointed that by using this approach, further evidence on the "jobless recovery" can be offered.

2. The Model and Its Estimation

As we have seen from the previous section, there is continuing great interest in the modeling of the Okun coefficient as well as the detection of possible asymmetries. While the initial approaches were based on classical approaches, with the estimation on positive and negative ranges for the value of the output gap, the last approaches suggested the use of the Markov Switching Approach (MS, hereafter), see [9] for a detailed presentation. Such of model allows for nonlinearities, by introducing the possibility of shifts in the time series process.

I combine the gap approach as proposed by [21], with the MS approach that allows for the detection of shifts in the Okun coefficient. The gap approach in the estimation of the Okun coefficient can be expressed though the following equations:

$$y_t^c = y_t - y_t^n \quad (1)$$

$$u_t^c = u_t - u_t^n \quad (2)$$

$$u_t^c = \beta * y_t^c \quad (3)$$

Where: β is the Okun coefficient with a negative value, as the theory predicts; y_t^c represents the production cycle, y_t represents the production, y_t^n represents the potential production, u_t^c is the unemployment cycle, u_t represents the unemployment rate and u_t^n stands for the natural rate of unemployment.

The MS model proposed in described below:

$$u_t = \alpha + \beta_{S_t} y_t + \sigma_{S_t} \varepsilon_t \quad (4)$$

Where: S_t stands for the state at time t – there are a finite number of states;

α is the constant which is constant over the states;

u_t is the dependent variable;

y_t is the explanative variable;

σ_{S_t} is the standard deviation, which differs along with the states;

β_{S_t} shows the regression coefficients for each state and corresponds to the regime switching Okun coefficients;

ε_t are the residuals characterized by a normal distribution with a zero mean and a variance equal to 1.

The independent variable y_t is given by the monthly industrial production, taken as a fixed base index series with the base in December 1990. The dependent variable u_t I use is given by the unemployment rate. Afterwards both series were seasonally adjusted, logged and filtered using the Hodrick-Prescott filter. For both series the sample used was between January 1991 and December 2009.

The model used was a two state MS model, as in equation (4). The model was estimated using the maximum likelihood approach. The estimation indicated that the convergence was achieved. In Table 1, I present the results of the estimation. The estimated values for the coefficients and standard deviations are all statistically significant.

Tab. 1: Maximum Likelihood Estimates for the Model

State parameters	Estimates
Constant	
α	-0.0024 (0.0008)
State 1	
β_1	-0.3182 (0.0670)
σ_1	0.0243 (0.0027)
State 2	
β_2	-0.0963 (0.0097)
σ_2	0.0091 (0.0006)

Note: Standard errors in brackets. Source: own computations

The estimated model features a non-switching constant which appears as statistically significant. The negative value of the constant may suggest that at zero economic growth, the unemployment tends to decrease.

The results indicate that the Okun coefficient differs along two states and that there is a strong Okun coefficient and a weak Okun coefficient. Practically, there is a state in which the unemployment reacts quite strong to output changes, and a state in which the reaction of the unemployment is rather a weak one. The results here can be compared with those from previous studies, see Table 2.

Tab. 2: A Comparison of the Estimations of the Okun Coefficient

Estimation	Posterior mean	Confidence interval		Data Sample
New Keynesian model**	-0.49	-0.44	-0.53	2000-2008 (quarterly)
Bayesian linear regression***	-0.55	-0.03	-0.99	2000-2008 (quarterly)
Classical linear regression*	-0.17	-	-	1991-2004 (monthly)

Source: own

Notes: * Classical linear regression applied on monthly data, see [1].

** Okun coefficient derived from an estimated New Keynesian model, see [3].

*** Bayesian linear regression, see [3].

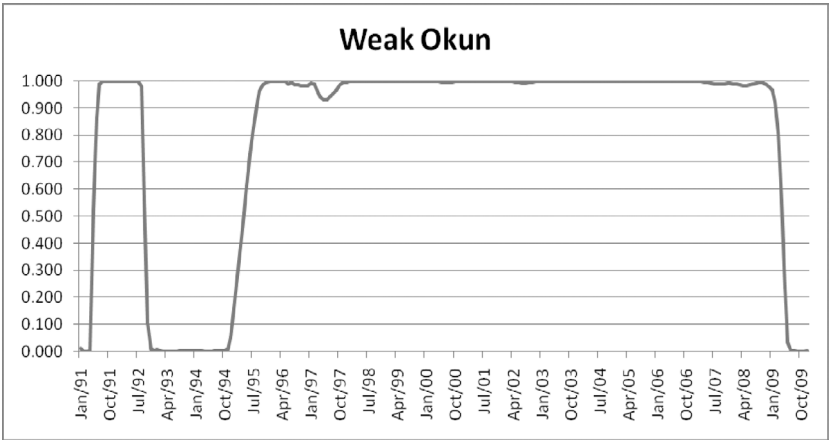
The results in this paper reconcile the findings up to now. According to the findings here, there is a phase characterized by a strong Okun coefficient, around -0.38, and phase with a weak Okun coefficient. Thus, the value in [1], who used a symmetric approach, appears as an average of the two values derived from an asymmetric approach. The higher values registered in [3] may have been biased upwards by sample and frequency used, as the quarterly GDP and unemployment rate were used.

A further problem is whether the phases of the two switching Okun relationships are correlated with the business cycles in Romanian economy. The usual findings were that the unemployment reacted stronger in a downturn compared to the upturns. Figure 1 and Figure 2 in the Annex show the two phases based on the smoothed probabilities derived from the estimated MS model. The graphs consist in two figures each with two axes, with probability of a certain state (strong or weak Okun) on the vertical, and the time period on the vertical. Each point on the figure is associated with a certain probability (namely that unemployment is either in the strong relationship with

Fig. 1: **Smoothed Probabilities for the Two States of the Markov Switching Model. State 1 (Strong Okun Coefficient)**

Source: own

Fig. 2: **Smoothed Probabilities for the Two States of the Markov Switching Model. State 2 (Weak Okun Coefficient)**



Source: own

output or in the weak relationship with the output) which shows us which kind of state predominates at a certain point. For each figure, each time the probability is higher than 50 %, we can say that the state pictured in that figure is predominating. Thus, the figures mirror each other, in other words, the probabilities at a certain point for both states add to one.

In Table 3 we can see the derived dating of business cycles in Romanian economy as derived from [2].

Tab. 3: Dating Business Cycles in Romania Using the MS Approach

Smoothed probabilities		Duration of recessions in months
Peak	Through	
January '91	September '92	21
February'97	January '99	24
August '08	-	-

Source: [2] – computations for 1991-2008 period.

Quite significantly, the results here confirm the other findings in the literature, at least for the last cycle, the growth from 1999 to 2008, and the recession that started from 2008. Thus, during the ongoing recession, the Okun relationship switched to the stronger behavior, and thus explaining the rapid expansion of unemployment that doubled in less than one year. At the same time, the long growth period started in 1999 showed a constant but slow decline in unemployment, which can be explained by a Okun coefficient of -0.09. We can also see that the first downturn, the so called "transformational recession" that was common to all transition economies, was characterized by a rapid expansion of unemployment. For this first recession, the Okun coefficient is shown to be in the stronger state, at least for the first part of this recession.

The two periods in which the Okun coefficient behaves, let's say, unexpectedly, are the expansion between October 1992 and January 1996, and the recession that followed between February 1997 and December 1998. I would explain this behavior through the fact that the state intervention continued to be high during those times. During the first expansion period, the state tried to keep the unemployment low and not only postponed the restructuring of the state owned firms, but also encouraged their activity through governmental credit. This is why the Okun coefficient switched to the stronger behavior. Once the economy entered again in recession, the policy makers tried to lower the social costs by different policies, one of which was the early retirement. This would explain the weak state of the Okun coefficient.

After 1999, we can talk about a normal behavior of the unemployment-output, in concordance with the main findings in the literature, which is another sign that the Romanian economy became a full market economy.

Conclusion

There is an acute interest in how much the unemployment will rise until the crisis will be finished. Once the crisis is over, and the recovery starts, clearly a question to be asked will be how rapid will the unemployment decrease. Recent experiences showed that even developed economies can pass through the so-called "jobless recovery" phenomenon.

In this paper I address both questions by using the asymmetric approach is the estimation of the unemployment-output relationship, also known as the Okun coefficient. While there are several studies in the estimation of the Okun coefficient for Romanian economy using different approach, from the classical regression to the Bayesian approach, they could not explain the asymmetry which is obvious from the behavior of real data.

The estimation based on a MS shows evidence for the existence of an asymmetric behavior of the Okun coefficient, with a state characterized by a weak Okun coefficient, and a strong Okun coefficient state. Moreover, the last long expansion is associated with a weak Okun relationship, while the ongoing crisis with a strong one.

The results here imply that there is a real danger for a jobless recovery once the economy starts to grow. A weak coefficient of -0.09 is general thought as an evidence of a rather rigid labor market. Such a characteristic of labor market in Romanian economy should be addressed by specific labor market policies and measure that would help the economy generate more jobs once it starts to grow.

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Abstract

ASYMMETRY IN THE OKUN COEFFICIENT IN ROMANIAN ECONOMY

Petre Caraiani

The current financial and economic crisis reignited the interest in the output-unemployment relationship. The unemployment rate in Romanian economy reacted strongly to the fall in economic activity, by more than doubling in less than a year raising, and thus raising questions on the validity of a symmetric relationship between unemployment and output. In this paper I investigate the existence of asymmetries in the Okun coefficient in Romanian economy. The asymmetric approach is justified based on both practical reasons, given the last results in the literature, as well as from a theoretic point of view. The econometric framework used is the Markov Switching approach. The data used is at monthly frequency and consists in the monthly industrial production index and in the unemployment rate between January 1991 and December 2009. The Regime switching approach allows for the testing whether the Okun relation switches between different phases. I find that there are asymmetries in the Okun coefficient. A state characterized by a weaker Okun coefficient of -0.09 was found, and a state with a stronger Okun coefficient of -0.32. After 1999, the switches are associated with the two phases of the business cycles, with a weaker Okun coefficient during the expansion and a stronger Okun relationship during the recession, as in the literature, underlining that the Romanian economy became a full market economy. The findings here reconcile the previous findings based on symmetric approaches. Some policy implications as well as the peril of a jobless recovery are discussed. This paper thus contributes to the ongoing refinement and understanding of the output - unemployment relationship.

Key Words: *business cycles, Markov Switching, nonlinear methods, Okun coefficient, mathematical methods.*

JEL Classification: *C22, C50, E32.*

TRANSFORMATION OF 3T MODEL TOWARDS THE COMPARISON OF CREATIVE CENTRES WITHIN THE EUROPEAN UNION

Jitka Kloudová, Ondřej Chwaszcz

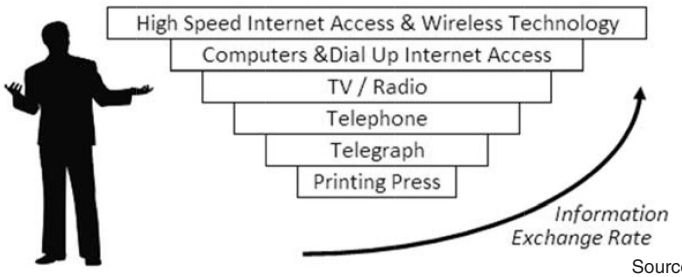
The Origin of the Creative Economics

The creative economics paradigm is just composing nowadays. Most authors dealing with this topic take their own view on the creativity, and that is why the results reached are hardly comparable. This works perceives the creativity as a new element, which should supplement the existing economic growth theory based mainly on Paul Romer [30], [31] and its endogenous growth theory. The endogenous growth theory points out the necessity of human resource and investments in research and development.

These aspects of endogenous theory form also the creative economics which considering the time period completes the theoretical framework by socio-cultural and urban aspect. Nowadays, The key role is represented by human creativity and ideas, which are by these creativity produced [14]. In connection with the level of development of an individual country there are new ideas incorporated to the common life, increasing the standard of living and then create the space for further development and human creativity application [20], [32].

The development of a creative economy has been supported by the enormous development of technology [22] which has opened up new paths in recent years via Internet and other multimedia (Fig. 1). This technological development contributes to the development of science, culture and entertainment and at the same time makes possible its commercialization. Increased investment into science increases the demand for scientific workers. Possibilities in the area of entertainment (film, computer games) have also expanded significantly, with an additional increased demand for specific professions [18] and at the same time the creation of space for the emergence of completely new professions. Last but not least, ICT technology has influenced the appearance of already existing professions [3] and requires the expansion of the knowledge base amongst employees.

Fig. 1: **Information Exchange Rate**



Source: made by author

Development of ICT caused the formation of new social and labour group (the step from mass production to services and knowledge economy is well noticed by Daniel Bell [2]), so-called creative class [6]. Members of this social group nowadays represent main engine of economic development which improves the economy by adding new ideas, technology and other creative products [19]. Among creative class jobs we count positions from field of science, education, culture and in wider concept also trade, law, finance and health service. Florida [8] has been working with the hypothesis that bohemian cities attract creative and talented individuals, which support the development of innovations and hi-tech areas.

Members of creative class tend to concentration and formation of creative centres. Selected cities and regions then achieve higher economic performance and competiveness. Richard Florida tries capturing these facts by using so-called 3T factors (technology, talent, tolerance). Florida`s 3T model contains great idea but on the other hand the practice content is quite limited (see also critiques by Peck [26] or Pratt [28]). The model itself consist of few selected indexes while some of them are hard to verify (more in Hartley [12])

Although Florida along with Tinagli [9] have innovated their creative index to the Euro-creativity index, its use is still extremely limited. Smaller regions are unable to work with this index at all. The technological index, for example, contains indexes concerned with patents which can only be placed in a specific location with difficulty in today's globalized world. The third, and at the same time final index in this category, is the relationship between costs and R&D which, of course, only speaks of inputs and fails to deal with the outputs of the invested items. Similarly limited indexes can also be found in the areas of tolerance and talent (for a detailed critique of Florida's thesis, see Malanga [23]; Peck [26]; Markusen [24]; Hansen et al. [11]; Hansen [10]).

1. Creativity as a Part of the Potential Economic Growth

The success of selected companies continues to be evaluated at present in terms of products and services which creates pressure on the transformation of the economic system into continually more effective forms. Adam Smith was the first to link the outputs of economic systems; all forms of division of labour are carried out due to the existence of lower transactional costs. As Ronald H. Coase [4] has argued, transaction costs are dependent on established institutions functioning in particular countries. The institutions consequently represent the legal, political, social and educational system along with the culture of the given country. In reality it is the same institutions which control the performance of the economy [5], [17].

Douglass North [25] provides a more detailed definition of institutions characterizing them as a person created with limits making up the structure of human interactions with the aim of decreasing risk when achieving goals in social, political and economic areas. Institutions are created by formal rules (the constitution, laws and legal regulations, directives) and informal restrictions (norms of behaviour, conventions, actual ideas regarding behaviour) and the ways in which they are enforced. These institutions consequently define the rules of the game and determine the direction of further development. A well-established institutional framework is thus the first presupposition for economic growth.

Creativity [29], which is capable of solving and making more effective existing social and trade processes in a creative manner, can be viewed as the main driving force for economic growth in advanced countries in relation to the establishment of rules in society.

A creative environment rests on three basic pillars (Fig. 2). The first pillar consists of people who make up the knowledge labour force. Creative employees contribute to the greatest extent to the development of a competitive company. Location is also an essential point in the area of creativity and this for two reasons in particular. Geographic location has an influence on the allocation of companies and the labour force. In addition, the actual cultural-social equipping of the locale also plays an essential role.

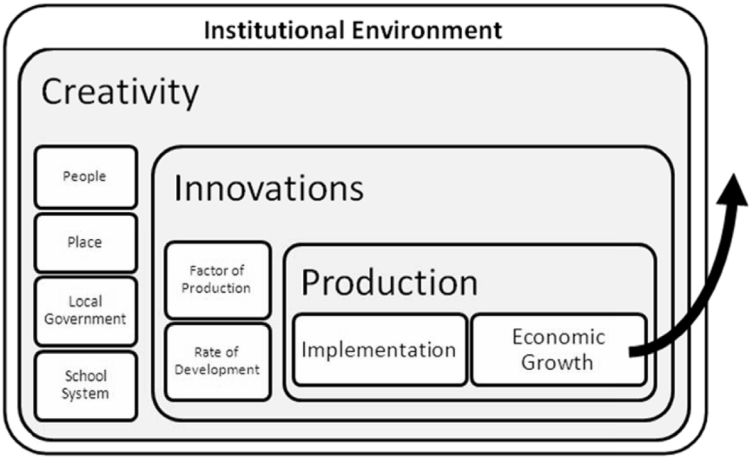
The support of local governments can serve to support the development of an institutional environment, create a suitable business environment and monitor the area of intellectual property which plays a key role within the framework of a creative economy. The final pillar consists of a quality educational system as creative centres cannot merely draw

from their own potential which is able to attract creative companies and employees but must also be able to create these companies and employees themselves.

If and when a selected country has a high creative potential, it has the finest bases for development and consequent implementation of innovation. Creativity must be focused on innovations and the acceleration of this development; the opposite direction is no longer possible. Purchasing of highly innovative products as well as technologies or licenses making possible their development is counterproductive without sufficient creative potential (suitable employees and companies) [15]. New innovations can be reasonably carried out in areas which are sufficiently supplied in terms of production factors and which contain a certain level of economic development. In the opposite case, newly produced ideas which emerged from the creative potential of selected countries would not be of use economically.

If and when the concerned locality has a corresponding level of production factors and creates a demand for new ideas for the purposes of further development, only the final step remains, that being the implementation of these new innovations into the production process. An effective production process brings with it lower costs and opens up new possibilities for business which consequently leads to economic growth and competitiveness.

Fig. 2: The system of economic growth in developed regions



Source: made by authors

The presented scheme also indicates that creativity contributes significantly to the development of competitiveness. In contrast, it should be pointed out that creativity cannot evoke economic growth on its own. The actual company cannot function without the basic establishment of the institutional framework. If the basic rights and the possibilities for their enforcement are not established, there is no reason to be occupied with economic science.

If and when a company functions on the basis of freely elected institutions, creativity and potential need to be developed which will be capable of transforming new ideas into innovation and consequently also into general production.

These realities are ignored by a number of economists with an interest in the creative economy since economic growth can never be directly linked with a creative environment; more influencing factors need to always be considered. Supporters of the creative industry often try to do so when attempting to argue that an increase in support of the creative industry will lead to the development of the region.

The creative industry is without a doubt a growing branch, but the growth stems from the growth to the living standard which is

caused by the increase in the creative and innovation potential of the area. Arguments voiced concerning marked support for the creative industry are thus in the interests of certain lobby groups as opposed to an interest in supporting the growth of economic maturity.

The creative economy cannot be defined by a border which would distinctly measure its field of activity. The creative economy is based on new ideas which make up the added value for inputs and contribute thus to the increase in effectiveness on the side of outputs. The creative economy unites the creative ideology or the cultural industry, creative cities and the creative class.

2. Choice of Methodology and New Creative Index

Social development along with the acceleration of development of new technologies has significantly influenced the appearance of the world. Creativity has begun to be a significant aspect contributing to economic growth with the creative class making up to the greatest extent a new working class; its representation percentage wise is growing continually for all workers. The basis for reaching an understanding of these phenomena is their mapping out. Several authors are presently working in the area of the creative environment [34], [16], [9], [6], [7], [1], [33]. Unfortunately, the majority of the work is limited to a certain extent: a low number of indexes, a small collection of data, limitations in terms of use for merely the territory of the country, etc.

The aim of this study is to map the creative potential within the selected European countries and their regional locations. The study itself works with 89 cities in Germany, Spain, the Netherland, Finland, Sweden, Estonia and Luxemburg. The sample of the cities was chosen in order to cover both economically developed countries with high quality of life and touristic centres. Basic database come from urban audit of Eurostat, which was had lastly done from the initiative of Directorate-General for Regional Policy at the European Commission in 2006–2007.

For the methodological instrument the New Creative Index was chosen [21], which was previously tested on sample of 32 German urban regions where it proved the close positive correlation on the level of 0.7 between this index and the level of GDP per capita. The construction of New Creative Index itself looks to be based on Florida 3T model for the first sight, but the content of 3T is composed from different indexes. The use of new indexes in greater representation (32) eliminates some shortcomings which unable to apply the Florida creative index to countries in EU or the smaller territorial units.

3. The Analysis of Creative Potential of Chosen Countries and their Urban Regions

The analysis itself works with selected 3T areas separately at the beginning and for each area there is the sub-index set which is subsequently formed into the New Creative Index itself. Within the analysis of individual areas there are used index presented and partial results graphically evaluated. At every single index there is proportion between average values among every region with high and low creative potential shown. The New Creative Index is presented from geographical point of view in order to enable to evaluate the distribution of creative potential from this view. It examines the results of the analysis in relation to external indicators (GDP, demography) for purpose of confirmation or refusal of suitably selected methodology.

3.1 Talent Index

Talent index is based on basic presumption that education is important input of production process. Thus the higher level of education and talent should accelerate the regional development. Within the indexes is examined not just the potential which is created by region through the educational system but also the representation of educated labour in production process. Among indexes of this field we find also unemployment rate, what responds to presumption that creative centres create bigger job offer than other regions.

Tab. 1: Talent Index

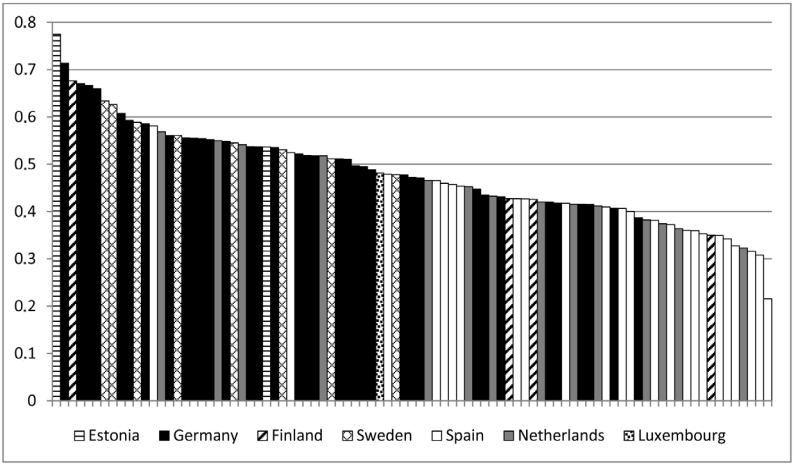
Talent Index	Top / bottom
Unemployment rate (1/X)	1.953
Proportion of unemployed who are under 25 years old (1/X)	1.518
Students in higher education (ISCED level 5-6) per 100 resident population aged 20-34	1.501
Students in upper and further education (ISCED level 3-4) per 100 resident population aged 15-24	2.82
Prop, of working age population qualified at level 3 or 4 ISCED	1.42
Prop, of working age population qualified at level 5 or 6 ISCED	1.063

Source: Urban Audit - Eurostat; own calculations.

The analysis has confirmed that unemployment in regions with high creative potential is by 51 % (1/1.953=51 %) lower than in regions with low creative potential. All selected indexes showed the positive correlation to the New Creative Index within the model. Positive correlation of indexes related to education confirms its importance. As exceptional output we find in fact that higher correlation coefficient was proved at ratio of labour force with secondary education (3 or 4 ISCED) of 0.45 to neutral correlation relation of labour force with tertiary education (5 or 6 ISCED).

The table of localities with a high creative index is led by the city of Tartu which is home to the national university of Estonia (graph Fig. 3). This is followed by the German city of Darmstadt and its well-known technical university. Consequent towns and cities are also high thanks to their universities which serve to confirm the significant contribution of these institutions to the development of the creative potential of an area.

Fig. 3: Talent Index



Source: Urban Audit - Eurostat; own calculations

The small town of Santiago de Compostela with its ancient university ranked first out of the Spanish towns and cities. On the opposite side of the talent index were three Spanish cities (Palma di Mallorca, Las Palmas, Hospitalet de Llobregat) preceding Heerlen in the Netherlands.

3.2 Technology Index

This work has emphasized the importance of ICT to development of society and constitution of creative class just at the beginning. Rapid development of ICT caused not just changes in social behaviour but with use of new communication options and share of information there was routine way of trade changed. At the same moment the significant demand for new specific work force was created. For this reason the relevant part of indexes of Technological index deals with ICT sector. Beside, the attention is paid to service sector and the Internet.

Tab. 2: Technology Index

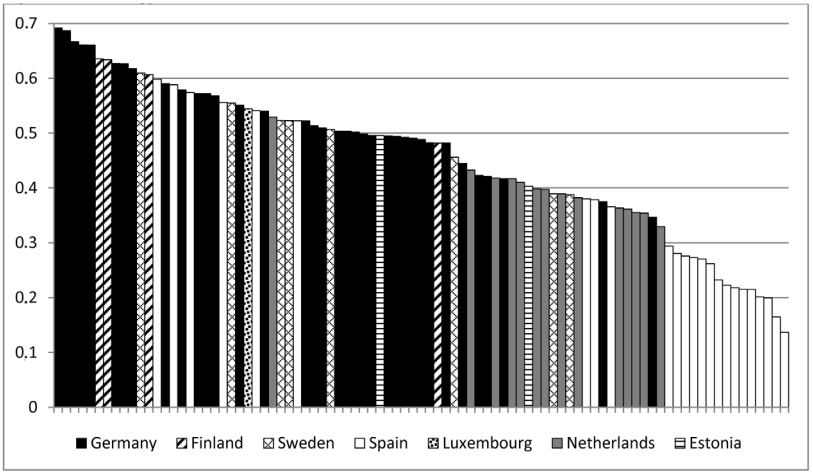
Technology Index	Top / bottom
Proportion of employment in industries G-P (NACE Rev, 1)	0.966
Proportion of employment in financial intermediation and business activities	1.257
Percentage of households with Internet access at home	1.665
Proportion of local companies that produce ICT products (max 1)	2.994
Percentage of those employed in manufacturing of ICT products	13.57
Percentage of those employed in the provision of ICT services	2.151
Percentage of those employed in the production of ICT content	2.637
Percent of population over 15 years who regularly use the Internet	1.476

Source: Urban Audit - Eurostat; own calculations

Indexes of individual regions, which come from ICT sector, show significant correlation with New creative Index in almost every cases. This corresponds also to comparison of regions with high and low creative potential. Here is the only one index which does not show the dependence and that is the index of ratio of employees in service sector. Supposing that the result is influenced by touristic regions where the creative potential was not proved.

In accordance with expectations, German towns and cities found their way on the leading positions (Karlsruhe, Darmstadt or Nuremberg). Helsinki and Oulu in Finland and Stockholm in Sweden were in leading positions from other countries (graph Fig. 4).

Fig. 4: Technology Index



Source: Urban Audit – Eurstat; own calculations.

Two groups can be distinguished at first glance within the framework of the Spanish towns and cities. The first is located in the upper half of the creative index with the majority being from the northern part of Spain (Hospitalet de Llobregat, Vitoria-Gasteiz, Zaragoza, Barcelona). The second group is located in positions with an extremely low technological index (Las Palmas, Sta. Cruz de Tenerife, Córdoba, Santiago de Compostela, Vigo).

3.3 Tolerance Index

Determination of tolerance index in formal Florida's 3T model was quite controversial. Therefore, this work tries showing just the indexes measurable, well defined and usable even for smaller region (Tab. 3). To complete the content of wide sense of tolerance index the bigger number of indexes was used and they were divided into two areas. That's how the sub-index, dealing with mobility and based on assumption that attractive location attract new creative workers which are more mobile than other people, was created. The other sub-index is connected to environment which should retain and attract members of creative working class with contribution of suitable urban amenities (culture, security, tourism and sport).

Tab. 3: Tolerance Index

Tolerance Index	Top / bottom
Tolerance Index – people	
EU nationals as a proportion of total population	7.536
Non-EU nationals as a proportion of total population	2.104
Nationals born abroad as a proportion of total population	3.619
Nationals that have moved to the city during the last two years as a proportion of the total population	1.702
EU Nationals that have moved to the city during the last two years as a proportion of the total population	8.705
Non-EU Nationals that have moved to the city during the last two years as a proportion of the total population	1.593
Proportion of Residents who are not EU Nationals and citizens of a country with high HDI	2.159
Moves to city during the last 2 years/moves out of the city during the last 2 years	0.952
Tolerance Index - environment	
Total number of recorded crimes per 1,000 population (1/X)	0.101
Green space to which the public has access (m2 per capita)	1.693
Proportion of the area in recreational, sports and leisure use	0.317
Annual cinema attendance per resident	0.548
Number of cinema seats per 1,000 residents	0.835
Annual number of visitors to museums per resident	1.683
Total book and other media loans per resident	1.784
Proportion of employment in culture and entertainment industry	3.553
Tourist overnight stays per 1,000 population at high season	3.784
Tourist overnight stays per 1,000 population at low season	7.481

Source: Urban Audit - Eurostat; own calculations.

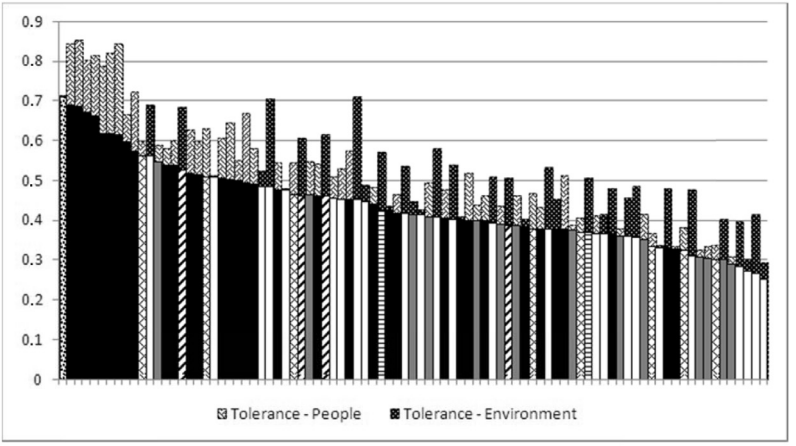
Analysis outputs confirm the presumption that regions with high creative potential attract other inhabitants. The significant positive correlation was confirmed either in field of the residents mobility within a state and in field of ratio of incomers to total population of a region.

The mobility sub-index itself correlates with New Creative Index with strong relation of 0.72.

Much smaller dependence was proved at environment sub-index. Significant positive dependence was found at index of ratio of employment rate at culture and entertainment industry and indexes connected with tourism industry which corresponds to listed ratio between regions with high and low creative potential.

The following graph Fig. 5 depicts the order of the analysed regions within the framework of the tolerance index. In contrast to previous graph depictions, this graph is expanded by two smaller indexes. One of these concerns the openness of the area (Tolerance – People) while the second is focused on the quality of the locality and its sporting-cultural possibilities (Tolerance – Environment).

Fig. 5: Tolerance Index



Source: Urban Audit - Eurostat; own calculations.

The city of Luxembourg was prominent out of the concrete towns and cities in the area of the tolerance index as it revealed two completely balanced areas Tolerance – People and the Tolerance Environment. It was followed by two German towns which clearly revealed their placement at the forefront of the list thanks to having indexes in the areas of Tolerance – People.

3.4 New Creative Index

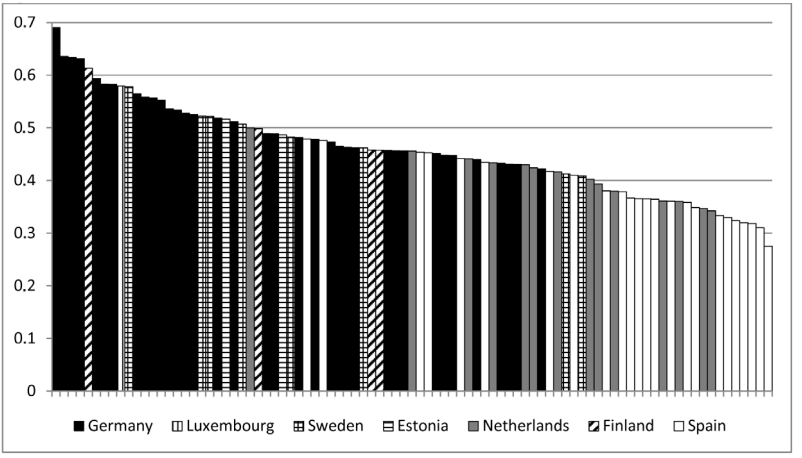
The output of the new creative index is presented here through methodology which serves to indicate the creative potential of selected European regions. A retrospect analysis of the creative indexes makes it possible to discover the insufficiencies of the analysed region. The definition of these insufficiencies is the first step toward rectifying them and for thereby introducing effective support which can significantly contribute to preserving and increasing the competitiveness of a region.

Two methodologies were employed within the framework of the visualization of the results. The first visualization is the graph Fig. 6 where all of the analysed regions are arranged in a bar graph in accordance with the size of the index. It is apparent at first glance that German towns and cities are situated in leading positions (Darmstadt, Munich, Karlsruhe, Mainz) along with representatives of other countries. Helsinki was at the forefront concerning Finnish towns and cities. Luxembourg was situated in front of the highest Swedish city Stockholm. Of interest is the fact that two Estonian cities (Tartu, Tallinn) were situated in the upper half of the examined group.

Towns and cities with a low creative potential are located in the right part of graph

Fig. 6. It is apparent at first glance that the majority of these regions consist of towns and cities from Spain and the Netherlands with several exceptions being located in Sweden (Őrebro, Jönköping) and Germany (Bielefeld, Műlheim an der Ruhr, Schwerin). As concerns Spanish regions, towns and cities in the north-east of the country found themselves in leading positions (Barcelona, Vitoria- Gasteiz). The last positions were held by the towns and cities of Sta. Cruz de Tenerife, Málaga, Vigo and Córdoba.

Fig 6: New Creative Index



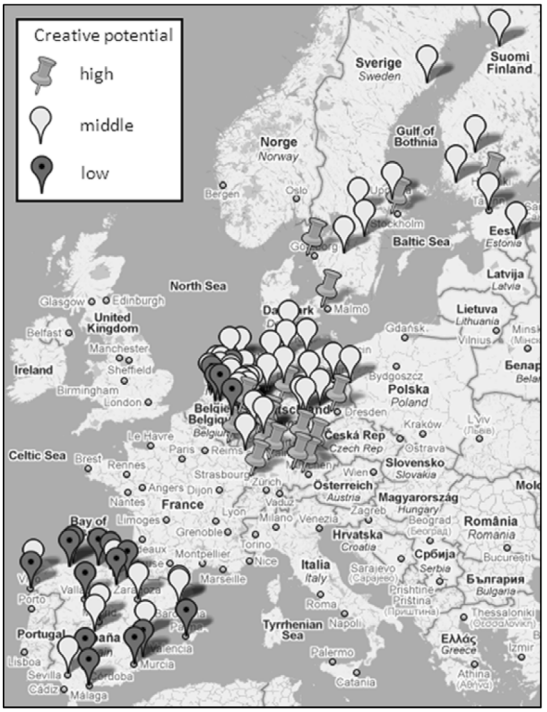
Source: Urban Audit – Eurostat; own calculations

The second method of presentation of the results of the creative potential works with the geographic placement of the regions. This method makes it possible to detect whether the division of creative potential is divided randomly from a geographic perspective or whether there exists a connection between the allocation of the region and its territorial location.

The greatest creative potential can be seen in the towns and cities marked in green (Fig. 7). These locales are most frequently located in Germany, specifically in the centre and southern parts (More on clusters and geographic allocation in Porter [27]). Additional high creative regions consist of cities located in Northern Europe. Towns and cities with low creative potential (marked in red) are most often located in the Netherlands and Spain.

The criterion can be loosely adapted and observed in the required parts of the areas in order to achieve clarity. Figure 8 only depicts Spanish towns and cities which were revealed to be localities to a greater or lesser extent with low creative potential in comparison with the observed group. A number of the analysed localities were focused to a significant extent on tourism. It was specifically these towns and cities which demonstrated a low creative potential. It should be admitted, however, that the tourist regions have other competitive advantages. The geographic location is additionally non-transferable with significant limited substitutes. For these reasons these towns and cities will not face significant competitive pressure in the area of creativity. They will be able to increase the economic potential of the region if and when they successfully develop and support tourism despite the fact that the economic growth will not be connected with innovations and high-tech production.

Fig. 7: The new creative index – the geographical allocation



Note:
high = green
low = red

Source: Google maps; own research

Fig. 8: The new creative index – the geographical allocation of the Spanish regions

Source: Google maps; own research.

4. Testing of Selected Methodology with Using of External Indicators

Contribution of creativity within the economic growth was outlined at the beginning of this work. Subsequently, the New Creative Index was created which used for the detection of creative potential ratio in selected regions. Basic presumption of creative centres is not just about greater representation of talent, technology or tolerance but mainly about competitive advantage, which appears in economic results. This basic premise is confirmed in Table 4 that represents the dependence of selected economic indicators with New Creative Index and its associated 3T indexes.

Tab. 4: The economic index and the creative potential of regions

	Creativity	Tolerance	Technology	Talent	Top / bottom
GDP per employed person	0.422	0.471	0.399	0.039	1.311
Proportion of companies that have gone bankrupt	0.125	0.084	0.233	-0.06	2.337
New businesses registered as a proportion of existing companies	0.437	0.425	0.451	0.074	3.461

Source: Urban Audit – Eurostat; own calculations.

Basic premise which emphasised the importance of creativity is the positive correlation (0.42) between New Creative Index of examined regions and GDP indicator per employed person. In comparison of absolute numbers the creative centres reached by 31% higher GDP per employed person than regions with low creative potential. There was proved bigger business sector activity in creative centres. In creative centres went bankruptcy more businesses but on the other hand at the same time much more companies were set up. So the regions with higher creative potential respond much faster to changes. The presence of creativity enables the easier transformation of private sector and creates new businesses and posts which reflect to changes in environment.

Data regarding demography, employment and the accessibility of the region were included among accompanying external indicators which involve non-economical variables (Tab. 5). A significant connection in relation to creativity was not demonstrated with the demographic data concerning the proportion of people of a productive age in relation to the population, despite the fact that a minor positive correlation in relation to the increased mobility of the creative class could be expected.

Tab. 5: The demography, employment and accessibility of the regions in relation to creative potential

	Creativity	Tolerance	Technology	Talent	Top / bottom
Proportion of total population aged 25-54	0.091	0.459	-0.076	-0.153	1.005
Proportion of residents unemployed, 15-24 years	-0.484	-0.363	-0.329	-0.453	0.590
Proportion in part-time employment	0.409	0.178	0.405	0.339	1.942
Accessibility by air (EU27=100)	0.421	0.476	0.380	0.057	1.471
Accessibility by rail (EU27=100)	0.341	0.292	0.329	0.119	2.070
Accessibility by road (EU27=100)	0.338	0.277	0.334	0.120	2.018

Source: Urban Audit – Eurostat; own calculations

As concerns the unemployment of young people, the study confirmed that unemployment in the 15-24 age group in creative centres was at a much lower level (a negative correlation coefficient). This reality exists due to reasons of a higher representation of students in the tertiary education and at the same time the demand for new work positions. The labour market in creative centres is much more flexible with this being confirmed by additional data concerning part-time work. Last but not least, it has been demonstrated that creative centres have superior accessibility concerning all types of transportation.

Conclusion

This study works with current topic of creative economy. Since this is a new field of economic research, there are still no generally accepted definitions and concept. Because of that it was necessary to state the perspective to creative economics at the beginning. In this work the creative economics is taken for next step in growth theories, which should include also the social changes. The creative economics is based on previous theories and complete them by socio-cultural and urban aspect.

Party the expansion of creative economics is caused by the development of ICT sector. The progress in ICT sector caused changes in monotonous business models, modified the requirement for common jobs and also created absolutely new business areas with specific requirements for employees. In developed countries these changes are giving rise to the decline of basic production factors and the rise in importance of knowledge, ideas and creativity.

Creativity in and of itself significantly contributes to economic growth despite the fact that economic success is not only related to the level of creativity in an analysed territory, but to more factors. The primary aspect is the creation of a supporting, independent institutional framework (Figure 2). It is additionally of importance that the analysed areas be capable of transforming the output from the creative economy into the production phase; this fact depends on the successful transformation of ideas into innovation.

Analytic part of this work deals with mapping of creative potential in selected European countries and their regional locations by using “New Creative Index” [21], which tries eliminating the shortcoming of previous models. This model works with transparent indexes, which are available within all European countries and even within selected urban areas. The re-analysis of individual components of New creative index are used as the basic guideline for the analysis of regions.

At the end of the work there is an analysis of New Creative Index in relation to external economical and accompanying indicators. The work confirmed the existence of dependence between this index and economic indicators, what supports the basic presumption about creativity and its influence on economic growth. Countries with high creative potential reached by 31% higher GDP per employed head than countries with low creative potential. Within the correlation analysis the proximity was about level of 0.42. The analysis of private sector based on number of new established businesses and bankruptcy companies proved the much high activity in creative centres. So the creativity contributes to much effective development of privet business sector.

Furthermore, the work proved in the geographical point of view that creative centres from the monitored complex are found mainly in Germany and big cities of Sweden and Finland. On the other hand the regions with low creative potential are found predominantly in Spain, which is followed by the Netherland. Closer view on Spanish regions verified that touristic location is not sufficient for formation of creative centres. Regions focused on tourism might be economically successful and benefit from geographical position and range of offered services. It is still remains a question if the targeted expansion of tourism is capable to keep the competitiveness of regions within the European context.

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