ЕКОНОМИКА
ISSN 0350-137X, EISSN 2334-9190, UDK 338 (497,1)
Vol. 60, october-december 2014, № 4
Стр. 197-208

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SCIENTIFIC REVIEW ARTICLE
Received: October 28, 2014
Accepted: November 30, 2014

THE READINESS OF THE SELECTED EUROPEAN COUNTRIES FOR THE DEVELOPMENT OF KNOWLEDGE ECONOMY

Abstract

The country's readiness for the development of knowledge economy was measured using the Knowledge Economy Index (KEI) and the Knowledge Index (KI) of The World Bank Institute's Knowledge for Development Program, 2012. The assessment of the position of the observed countries for the development of knowledge economy is based on the use of a number of analytical procedures. Cluster analysis was used first in order to check for the level of differences according to the KEI parameters and to group the selected countries into clusters, aimed at detecting the deviation of the observed European countries from the remainder of the group. Then we used the radar cart analysis of the four KEI pillars and their key variables in order to identify the current situation with respect to the values of partial indicators of the KEI pillars and establish the relative positions of the selected countries. Finally, over time comparison of the current values of the KEI pillars with the 2000 data was used to illustrate the dynamics of the development of the KEI pillars in crisis conditions. Research results have indicated that there is a prominent lag in the readiness of the Western Balkan countries (Albania, Bosnia and Herzegovina, Macedonia and Serbia) behind their EU environment (Austria, Greece, Bulgaria, Romania, Croatia and Slovenia).

***Key words**: knowledge economy, Knowledge Economy Index, Knowledge Index.*

JEL Classification: I250

СПРЕМНОСТ СЕЛЕКТВАНИХ ЗЕМАЉА ЕВРОПЕ ЗА РАЗВОЈ ЕКОНОМИЈЕ БАЗИРАНЕ НА ЗНАЊУ

Апстракт

Мерење спремности земаља за развој економује базиране на знању у раду је реализовано на основу Knowledge Economy Index (KEI) и Knowledge Index (KI) развијеног у оквиру програма Института Светске банке под називом Знање за развој (The World Bank Institute's Knowledge for Development Program),

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2012. Оцена позиције посматраних земаља за развој економије базиране на знању дата је коришћењем већег броја аналитичких поступака. Најпре је помоћу кластер анализе проверен степен различитости према параметрима KEI и извршено је груписање посматраних земаља по кластерима са основним циљем да се детектује одступање посматраних земаља Европе од остака групе. Потом, путем радар царт анализе четири стуба KEI и њихових кључних варијабли идентификована је тренутна ситуација у погледу вредности парцијалних показатеља KEI стуба и сагледаване су релативне позиције посматраних земаља. Коначно, овер тиме компарацијом актуелних вредности KEI стубова у односу на податке из 2000. године илустрована је динамика развоја KEI стубова у условима кризе. Резултати истраживања су указали на изражено заостајање спремности земаља Западног Балкана (Албанија, Босна и Херцеговина, Македонија и Србија) за својим ЕУ окружењем (Аустрија, Грчка, Бугарска, Румунија, Хрватска и Словенија).

Кључне речи: *економија знања, индекс економије знања, индекс знања*

Introduction

On the theoretical level, in the developed countries, the paradigm of "knowledge economy" is becoming more and more dominant in social sciences. The leading researchers consider it to be the starting point for the interpretation of changes. It is based on three general tenets: complexity, chaos and synergy (Komnenić, 2009). The principle of complexity refers to a large number of non-linearly organised components, disorder, openness and a holistic approach to the system (not only does it consist of a large number of components, but it also resembles anorganism); the tenet of chaos points to the need for being creative in solving and studying new relations, while synergy stands for the fact that joining together brings about the effects that are larger than the sum of effects being joined. This paradigm indicates that the new business environment is not constructed from the bottom up, by applying a general model to all cases. Instead, it is constructed based on a number of feedback relations on all levels and in all directions, not relying on the established regularities, but creating them parallel with the development itself (Chesbrough et al. 2006). Simultaneously with the occurrence of the new paradigm and the changes it brought about in the context of the change in the appearance, structure and the functioning of the business environment, there came a realisation that the traditional business models of the industrial age were no longer capable of coping with the dynamic conditions on the global market that constantly transforms its structure under the pressure of changes that become more and more radical (Greenhalgh and Rogers, 2012).

Powell and Snellman defined the knowledge economy as the production of goods and services dominantly based on knowledge-intensive activities that contribute to generating technical advance by causing the key changes in the economy and the society as a whole (Powell &Snellman, 2004). These researchers state that the key component of knowledge economy is a greater reliance of economy on intellectual capabilities than on physical input and natural resources (Hollenbeck et. al. 1997).

In order to efficiently advance towards the knowledge economy, the countries need to invest into creation and dissemination of the new knowledge (Saisana, 2005; Fischer, 2001). The significance of knowledge for the economic processes has changed fundamentally over the past years (Nijkamp &Siedschlag, 2011). The increase in

productivity, caused by technological and organisational innovations, has become a key source of country's economic progress. Bearing in mind the ecological concerns, it is becoming more obvious that natural resources are limited and this reflects on generating the economic growth (Cvetanović et. al. 2014). The factor used to overcome these limits is the generation and dissemination of knowledge (Huggins & Izushi, 2007). The activities related to the creation and use of knowledge have become a key initiator of economic growth in the developed market economies (Wickham, 2001).

For the countries of the Western Balkans, the readiness for the development of knowledge economy is an important aspect of the completion of the transition process and the dynamics of fulfilling numerous conditions on their path towards the European Union (Nedić and Ilić, 2013).

Research methodology

In order to facilitate the development of the knowledge-based society for different countries, the World Bank has compiled the Knowledge Assessment Methodology (KAM, 2014), aimed at enabling the basic assessment of the country's readiness for the development of knowledge (Ilić and Nedić 2014).

In order to facilitate the development of the knowledge-based society for different countries, the World Bank has compiled the Knowledge Assessment Methodology (KAM), aimed at enabling the basic assessment of the country's readiness for the development of knowledge economy and identifying the fields in which economic policy creators should invest more. This is an interactive tool that makes it possible to compare the countries according to the level of development of knowledge economy. The knowledge is measured based on 148 structural and qualitative variables for 146 countries, with more than 90 developing countries included. In order to enable a flexible comparison between countries each variable is available in its absolute and relative value (a normalised scale of 0 to 10, relative to other countries in the comparison group). The comparison can be performed between individual countries (all 146 of them), relative to other countries in one of the seven regions (Northern America, East Asia and the Pacific, Southern Asia, Europe and Central Asia, Latin America and the Caribbean, the Middle East and the Sub-Saharan Africa) or relative to the region as a whole. Additionally, comparisons can be made according to the country's readiness for the development of knowledge economy depending on the value of the gross domestic product per capita, depending on the development of certain areas et al.

The measurement and comparison of countries based on this methodology is suitable for providing the preliminary assessment of the development of knowledge economy. The KAM methodology provides a quick and concise overview of the most important advantages and weaknesses, as well as the fields where there is an advance in the development of knowledge economy (Chen and Dahlman, 2005). Knowledge indicators are also used for calculating the overall knowledge index and the knowledge economy index.

The Knowledge Economy Index (KEI) measures a country's or region's ability to develop knowledge economy, i.e. whether the environment is conducive for knowledge to be used effectively for economic development. The KEI is an aggregate index that represents the overall level of development of a country or a region towards the Knowledge Economy. It is calculated based on the average of the normalised performance scores of a country or a region on all 4 pillars related to the knowledge economy – economic incentive and institutional regime, education and human resources, the innovation system and the ICT.

The Knowledge Index (KI) is an indicator of the overall potential of knowledge development in a given country and measures a country's ability to generate, adopt and diffuse knowledge. It is calculated as the simple average of the normalized performance scores of a country or a region on the key variables in three Knowledge Economy pillars – education and human resources, the innovation system and the ICT. Unlike the Knowledge Economy Index, which is calculated based on all four pillars of the knowledge economy, The Knowledge Index includes three pillars (the first pillar, economic incentive and institutional regime, is left out).

The economic and institutional regime enables the incentives for the efficient use of the existing and new knowledge and leads towards entrepreneurship affirmation. An educated and adequately trained population can generate, disseminate and use knowledge. An efficient innovation system of companies, research facilities, universities, consultancies and other organisations can fit into the increasing trends of global knowledge, assimilate and adapt to the local needs and create new technology. Modern and accessible ICT structure can enhance communication, diffusion and processing of information.

The subject of this paper is to obtain insight into the readiness for the development of knowledge economy of the four countries of the Western Balkan region (Albania, Bosnia and Herzegovina, Macedonia and Serbia) and the six EU countries from their nearest environment (Austria, Greece, Bulgaria, Romania, Croatia and Slovenia). The starting point was the hypothesis that possible great lag of the Western Balkan countries behind the selected EU countries in the level of the achieved readiness for the development of knowledge economy limits the pace of the accession of these countries to the European Union.

The assessment of the situation in the observed countries in the field of development of knowledge economy will be provided by:

a) Cluster analysis used to:

- test for the degree of differences according to the KEI parameters,
- group the observed countries into clusters, and
- detect the observed countries with a high deviation from the remainder of their group.

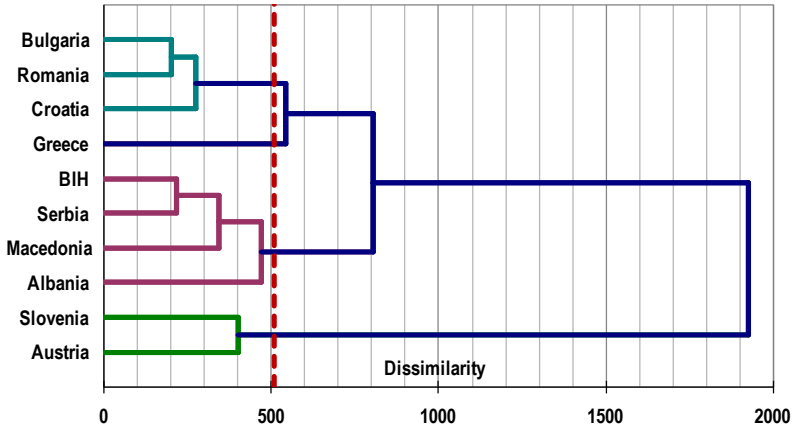
b) Radar cart analysis of the four KEI pillars and their key variables in order to identify the current situation with respect to the values of the partial KEI pillar indicators and to enable the observation of a relative position of the observed economies,

c) Over time comparison of the most recent a vailable values of the KEI pillars compared to the data from2000, in order to point to the dynamics of the development of the KEI pillars of knowledge economy in the conditions of crisis.

Results and discussion

The clustering of the observed ten countries on all variables that comprise the KEI is provided in Figure 1.

Figure 1 A dendogram of the conducted cluster analysis according to differences – the calculation included all variables of the KAM framework (normalized values min=1; max=10) for all the selected countries



Source: Authors' calculation based on http://info.worldbank.org/etools/kam2/KAM_page1.asp.

In the process of grouping (clustering) of the 10 selected countries, a bottom-up method of agglomerative hierarchical clustering was used. In the initial step, each country was treated as a separate cluster. Their paring on the basis of mutual similarity in terms of the value of the observed variables is a result of all subsequent iterations of grouping until the observed entities were all grouped into one cluster. If the level of difference between 500 and 600 is taken as the possible cutting point of the dendogram, three clusters of observed countries are clearly identified. The first cluster includes the four members of the observed group that are EU members (Greece, Croatia, Bulgaria and Romania), the second cluster is formed of the four members of the group outside the EU (Albania, Bosnia and Herzegovina, Macedonia and Serbia), while the third cluster comprises only two members of the observed group –Slovenia and Austria.

It is only at the level of difference of 2000 that Slovenia and Austria join the second and third cluster. It is obvious that there is a link between the clustering and the EU membership of the observed countries. The difference is especially prominent in the case of Austria and Slovenia, even with respect to other four EU members from the observed group.

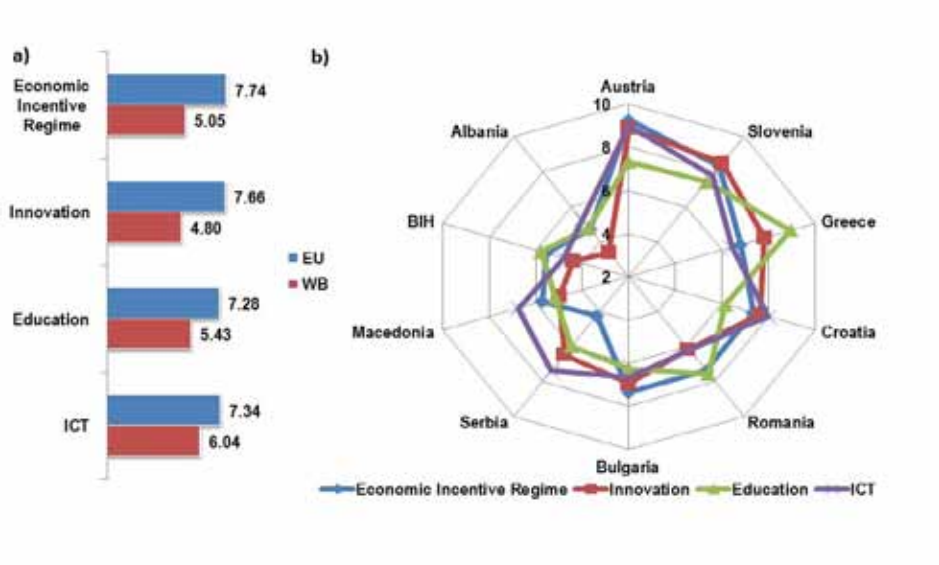
On the other hand, there are significant differences between the countries inside one cluster. They do not decrease until the initial level of clustering (each country from the observed group forms a cluster on its own).

It is our opinion that cluster analysis additionally confirms the purposefulness of the selected countries, since the formed clusters largely overlap with the groups of countries that we compare. The members of the overall observed population do not show extreme deviations.

Considering the differences found among countries, it is necessary to look into the fields and the countries in which the differences are most prominent. In order to identify the influence of individual fields (the so-called pillars of knowledge economy) underlying the development of knowledge economy, the analysis will continue in such a way as to decompose the aggregate KEI into pillars as well as into key variables of these pillars that serve as more detailed partial indicators.

In the following section, we will present a comparative overview of the KEI pillars for the most recent available data in the form of: a) bar charts for the average values according to the observed groups of countries, whereby the observed variables according to the selected groups of countries were determined as an average of the results achieved in the KEI domain by the countries belonging to the observed groups, and b) radar charts for all the observed countries individually (Figure 2).

Figure 2 TheKEI main pillar score (normalized values min=0; max=10) of the selected countries



Source: Authors' calculation based on http://info.worldbank.org/etools/kam2/KAM_page1.asp.

Based on the above Figure, the following can be concluded:

a) The Western Balkan countries lag behind on all four KEI pillars, and this lag is most prominent on the Economic Incentive Regime and Innovation, while it is least prominent on the ICT pillar.

b) Based on the presentation of values on the level of individually observed countries it can be concluded that:

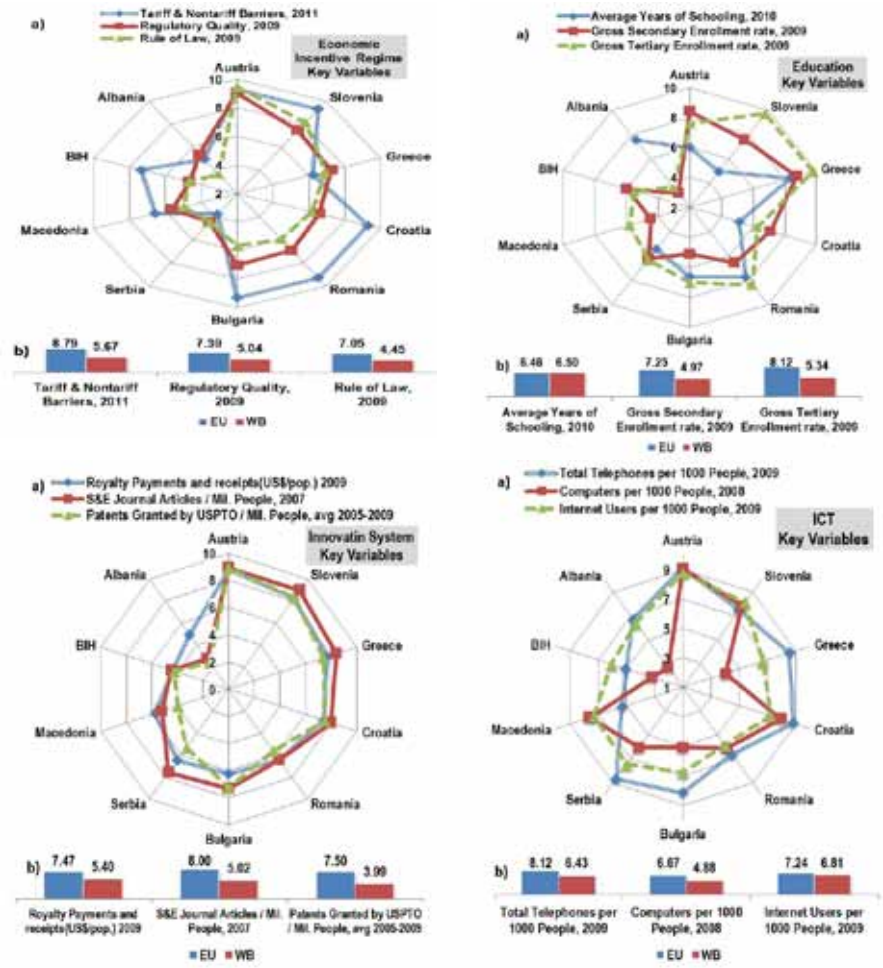
- All countries from the group are fairly unequal in terms of values of the KEI pillars, except for Slovenia and partially Bulgaria,
- The above-mentioned inequality is most prominent in the case of Serbia; the good position of the ICT pillar value is in discrepancy with by far the worst economic and institutional framework compared to all other observed countries,

- Austria holds the leadership position in the group according to all pillars, except education, where Greece is the leader.

A general impression is that Bosnia and Herzegovina and Albania lag behind most prominently while Austria (with the exception of education) and Slovenia hold the most equal and highest positions.

Figure 3 provides a comparative overview of the key variables of the KEI pillars a) on the level of individually observed countries and b) average values according to the formed groups of countries.

Figure 3 A comparative overview of the key pillar variables(normalized values min=0; max=10) for the selected countries



Source: Authors' calculation based on http://info.worldbank.org/etools/kam2/KAM_page1.asp.

The following conclusions can be made based on Figure 3:

In the domain of institutional and economic regime:

a) Individual overviews show that:

- Within the EU, Greece has the lowest value of the variable*Tariff & Nontariff Barriers*, even lower than both Macedonia and Bosnia and Herzegovina that belong to the Western Balkan countries.
- Serbia has the worst performance in terms of the average values of variables, while as far as the variable *Tariff & Nontariff Barriers* is concerned, it is at the bottom of all observed countries.
- Albania has the worst position of all observed countries on the variable *Rule of Law.*

b) The Western Balkan countries achieve significantly lower results on all observed key variables compared to the six EU countries from their closest environment. The greatest lag is present on the variable*Tariff & Nontariff Barriers.*

In the field of education it can be observed that:

- In the individual overview, observed on the average according to all three key variables of the pillar *Education*, Albania is at the bottom, and Greece at the top of all the observed countries.
- The EU countries show significant advantage on the variable *Gross Tertiary Enrollment* rate,followed by the *Gross Secondary Enrollment rate*, while both groups of countries are equal on the average when it comes to the variableAverage Years of Schooling.

In the field of the innovation system,

a) Observed individually:

- On all three variables, Serbia has the highest scores in the group of Western Balkan countries, and even the same rank as the EU countries regarding the score on the S&E Journal Articles / Mil. People variable. This gives us the right to assume that there is respectable innovative potential in Serbia, which, unfortunately, does not yield adequate results.
- According to the average on all three key variables on this pillar, Albania is at the bottom of the list.

b) The EU countries have the advantage on all three key variables compared to the Western Balkan countries. By far the most prominent lag is on the variable reflecting the number of patents.

In the field of the ICT:

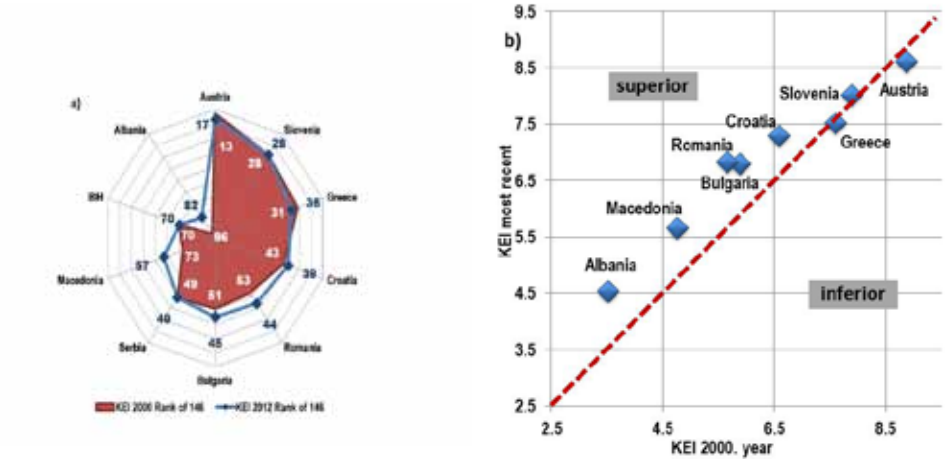
a) A detailed overview by countries shows that:

- On all three variables, Austria, Slovenia and Croatia hold a leadership position, and show a convergence of all three variables (convergence is also detected in the case of Romania, but at a significantly lower level from the leaders).
- There are large deviations among countries on the variable Computers per 1,000 people(but this finding is also imprecise since data originate from 2008, which is fairly outdated for such a changeable variable). On the other hand, the greatest stability in the group of ten observed countries is shown by the variable Internet users per 1,000 people, which is discrepant with the previous parameter and speaks more about the inadequacy of metrics for the ICT pillar.
- The third key variable Telephones per 1,000 people also varies from country to country, and Serbia holds the top position out of ten observed countries according to this parameter, slightly below Croatia.

b) The ICT pillar on the average shows a considerable advantage in favour of the EU countries, except for the variable Internet Users, where this difference is somewhat less prominent.

The remainder of the paper provides an overview of ranks and values of the KEI and its pillars that compares the situation from the year 2000 and the most recent a vailable situation and includes all the observed countries.

Figure 4 Over time comparison of ranks and values for the selected countries on the Knowledge Economy Index (2000 vs. 2012)



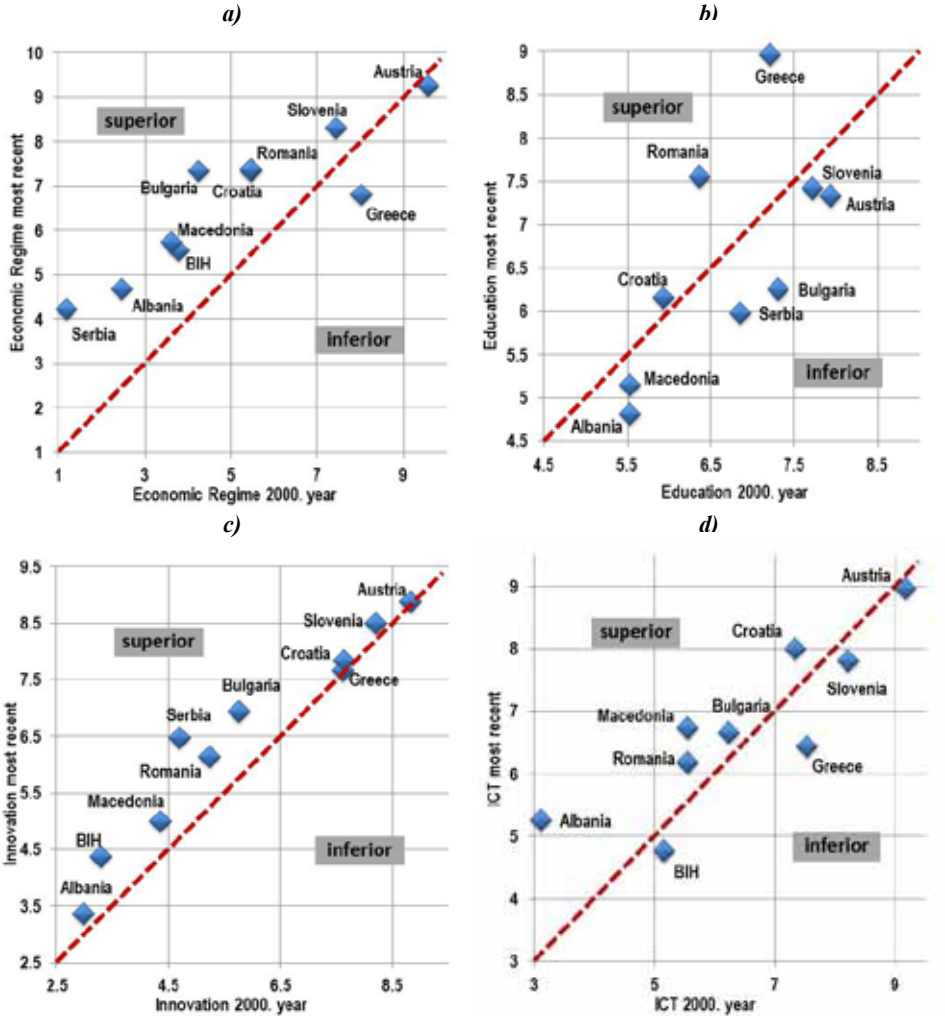
Source: Authors' calculation based on http://info.worldbank.org/etools/kam2/KAM_ page1.asp.

Note: The data for the KEI value in 2000 for Serbia and Bosnia and Herzegovina are incomplete (the ICT score is missing for Serbia, and Education for Bosnia and Herzegovina)

Figure 4a shows the trend of change in the KEI rank (a relative change) on the global level for the selected countries in the period from 2000 to 2012. The EU member countries hold generally better rank positions, which can be expected. There is a noticeable positive trend for the majority of countries (the biggest positive advance in the case of Macedonia), while Greece and Austria are the only countries with the negative rank trend (which is expected in the case of Greece due to an exhausting economic crisis). On the other hand, in the case of Slovenia, Serbia and Bosnia and Herzegovina there is no recorded change in the global KEI rank for the observed period.

Over time comparison of the KEI values (Figure 4b)provides an overview of absolute changes in the observed period. There is a clearly visible stagnation of the leading three countries (Austria, Slovenia and Greece), while all the other members of the observed population show a trend of progress. For Serbia and Bosnia and Herzegovina that are at the bottom of the group there are no available data on the rank in 2000 (which is a partial reason for their grouping into a separate subcluster).

Figure 5. Over time comparison of the current values of the KEI pillars:2000 vs.the most recent available



Source: Authors' calculation based on http://info.worldbank.org/etools/kam2/KAM_page1.asp.

Based on over time comparison of the four KEI pillars(Figure 5) it can be concluded that on the pillar of:

a) *Economic Regime* all countries except Greece show considerable progress,

b) *Education* the majority of the countries show regression, with the exception of Greece and Romania that have shown a considerable progress, and Croatia,which shows a slight positive change.

c) *Innovation* all countries show progress.

d) *ICT* Slovenia, Greece and Bosnia and Herzegovina show negative changes, while Austria, as a highly positioned country, holds a fairly same position.

Conclusion

The observation of the KEI elements for four Western Balkan countries (Albania, Bosnia and Herzegovina, Macedonia and Serbia) and six EU countries from their closest environment (Austria, Bulgaria, Greece, Croatia, Romania and Slovenia) has pointed to a significant lag of the selected Balkan countries behind the selected EU members. It is especially concerning that the most prominent lag, besides the field of Innovation, is present in the field of *Economic Incentive Regime*, which is a fundamental precondition for the development of knowledge economy, and hence a possible advance on other KEI elements is relativized.

What is encouraging is that we have detected a trend of improvement in the values of the KEI pillars (besides the Education pillar, whose trend is negative for the majority of observed countries) of the Western Balkan countries based on over time analysis. This positive trend is especially prominent in those pillars where there is the greatest lag behind the EU group. On the other hand, in the most developed countries of the observed group of the EU members (Austria and Slovenia) there are no significant changes in the values (the over time chart) and there is a particular convergence of the achieved values, expect in the field of education (the radar chart of the KEI pillars).

The countries of the Western Balkans need a strategy of comprehensive reforms of the business and institutional environment, which is a necessary prerequisite for the investments in other fields to yield adequate and expected effects.

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