# Macroeconomic aspects of the development of Slovak regions in the post-accession period

## *Makroekonomické aspekty rozvoja regiónov Slovenskej republiky po vstupe do EÚ*

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**Abstract:** The objective of this paper is the analysis of the macroeconomic aspects of regional development in the Slovak Republic. Regional development is a much frequented topic recently. In the pre-accession period, Slovak regions had the opportunity of benefiting from the pre-accession funds and competing for finances through projects and strategies. The EU support did not stop with the accession, it continues with the increasing intensity and variability at present. The real challenge is how efficiently is this support used and if it goes to the destinations where it is most needed. For the purposes of the identification of regional development tendencies, we have tried to analyze the selected macroeconomic characteristics for Slovak regions at the NUTS III level. We analyze the following indicators: GDP per capita, labor productivity, foreign direct investment, so that we can explore the situation of living standards in the regions and the determinants. We use the cluster analysis approach in order to specify and identify the regions with similar development characteristics. Based on our findings, we make some recommendations on the support and development strategies for Slovak regions.

**Key words:** macroeconomics, regional development, Slovak regions, NUTS III, post-accession period

**Abstrakt:** Cieľom článku je analyzovať regionálny rozvoj v Slovenskej republike z hľadiska makroekonomických aspektov. Regionálny rozvoj patrí v súčasnom období medzi aktuálne témy. V predvstupovom období mali slovenské regióny príležitosť získať z fondov predvstupovej pomoci finančné prostriedky prostredníctvom rôznych projektov a konkurujúcich stratégií. Podpora EÚ sa vstupom Slovenska do Únie neskončili, pokračuje s väčšou intenzitou a variabilitou aj v súčasnosti. Najväčšou výzvou pre slovenské regióny je čo najefektívnejšie využiť túto podporu predovšetkým tými, ktorí ju najviac potrebujú. Pri identifikácii tendencií v regionálnom rozvoji sme analyzovali nasledovné vybrané makroekonomické ukazovatele regiónov SR na úrovni NUTS III: HDP na obyvateľa, produktivitu práce, priame zahraničné investície a nezamestnanosť. Na ich základe sme hodnotili životnú úroveň v regiónoch ako aj ich determinanty. Regióny s podobnými rozvojovými charakteristikami sme identifikovali pomocou zhlukovej analýzy. Na základe zistených skutočností navrhujeme odporučenia orientované na stratégie podpory a rozvoja slovenských regiónov.

**Kľúčové slová:** makroekonomika, regionálny rozvoj, slovenské regióny, NUTS III, povstupové obdobie

Nineteen years after the fall of communism and four years after the accession into the European Union, the Slovak Republic has entered a new phase of socio-economic development. Increasing living standards and prosperity, decreasing unemployment and rapid economic growth are the typical characteristics of the current development. However, the country has not benefited symmetrically from the success of the transformation and reform process. Disparities have been created and deepened between social groups and regions in Slovakia. Regional development is a much frequented research topic recently. The notion of development itself is the object of polemics and debate between economists (Sachs 1989; Maier, Todtling 1998; Nohlen and Nuscheler, 2002). The concept of development has been closely analyzed in terms of economic development and closely related to the concept and theory of economic growth. In

the industrialized countries, the data on economic growth and development are closely followed and analyzed by economists in different economic models (Maier, Todtling 1998).

Economic growth means the expansion of the potential GDP of a country or its national output. In other words, economic growth happens while the production possibility frontier (PPF) of a country shifts outwards. This is a process which is closely related with the growth rate of output per capita that in turn determines the growth rates in living standards of a certain country (Samuelson, Nordhaus, 2000). Growth is a long-term phenomenon and an occasional increase in one macroeconomic figure does not serve yet as an evidence of economic growth (Salin, 1993). An important evidence of growth are the increasing rates of Gross Domestic Product per capita. This important indicator of living standards is determined by factors like the scale of technical and technological progress, institutional and socio-economic conditions (Lisý et al. 1999).

Economists in general agree that there are four main engines of growth (and it is not important if one speaks about a developed or a developing country), which are: (1) Human capital (labor supply, education, discipline, motivation); (2) Natural resources (land, mineral resources, oil, the quality of environment); (3) Capital formation (machinery, facilities, infrastructure); (4) Technology (science, technical progress, management, entrepreneurship); (Samuelson, Nordhaus 2000).

Many economists are convinced that labor input (number and qualification of employees, their knowledge and discipline) is the most important factor affecting growth. A country can invest into modern telecommunication technologies, computers, energy production facilities or military equipment. However, their efficiency depends on the qualification and education of persons that are supposed to use them i.e. the labor force. Labor productivity is very crucial for countries or regions that are trying to increase their living standards through a rapid economic growth. Improving education, health conditions and discipline and computer skills represent crucial steps toward increasing labor productivity as a way toward increasing living standards (Samuelson, Nordhaus 2000; Frank, Bernanke 2003; Tvrdoň 2006; Majerová 2007; Svatošová 2005).

Recently, the role of natural resources in the economy as a whole is increasing. It is true, though, that they can be acquired in the international markets and that there are many resources insufficient in countries that rank among the developed nations or regions of the world as Japan, Hongkong, Singapor or Switzerland (Frank, Bernanke 2003). However, the recent development in the international markets (oil, agricultural prices, etc); give some reason to sceptical economists that the potential of economic growth will sooner or later reach its limits due to the constraints in resources (Salin, 1993; Tvrdoň 2006).

Many economists emphasize the crucial role of capital as a factor that determines economic growth. In the most dramatic events of the world economic development, capital formation factor has proven to be crucial. In countries registering the highest growth rates, net capital formation represents 10–20% of domestic output. Sources of capital might be private and public in character. Especially in less developed countries and regions, the government spending and investment creates the conditions for the development of private sector and the economy as a whole. This is known as the social infrastructure capital. This means projects that include big investments that sometimes are associated with the increasing returns to scale (Samuelson, Nordhaus 2000; Solow 1962; Romer 1986).

Some economists emphasize the role of technological progress on the process of economic growth, saying that: "The majority of economists probably would agree with the hypothesis that new technologies are the most important source of productivity growth and thus of economic growth" (Frank, Bernanke 2003). Technical progress is mainly a gradual process and depends mainly on innovations and innovators (Samuelson, Nordhaus 2000). New technologies lead to increases in productivity also in the sectors other than those where they are applied. With the decreasing transport costs in the age of globalization, market opportunities increase and so do profits. Firms can buy raw materials and inputs at the lowest cost wherever they are and produce the optimal quantity of products which they can sell at any place in the world. This creates the prerequisites for firms and countries or regions to exploit comparative advantages, leading to increasing productivity due to their specialization on activities where they are the most efficient (Frank, Bernanke 2003; Romer 1986).

Most Central and Eastern European countries have tried to substitute the shortage of domestic capital resources immediately after the changes in 1989, for foreign capital acquired in the form of foreign direct investment (FDI). Actually one of the objectives of their reform process was to turn their respective countries into the attractive destinations for foreign investors. FDI brought to these countries not only the desperately needed capital but also the know-how, new technologies, as well as new expertise in different aspects through the so- called "spill – over

effect"(Swinnen et al. 2005; Sojkova et al. 2008; Bielik et al. 2007).

## MATERIAL AND METHODS

The objective of this paper is the analysis of the macroeconomic aspects of regional development in the Slovak Republic. In the pre-accession period, Slovak regions had the opportunity of benefiting from the pre-accession funds and competing for finances through projects and strategies. The EU support did not stop with the accession, it continues with the increasing intensity and variability nowadays. The real challenge is how efficiently is this support used and if it goes to the destinations where it is most needed. For the purposes of the identification of regional development tendencies, we have tried to analyze the selected macroeconomic characteristics for Slovak regions at the NUTS III level. This is necessary in order to determine the development dynamics of every region and its securities. We analyze the following indicators at the regional level: GDP per capita, unemployment, labor productivity, foreign direct investments. These indicators help to create a clear picture on the situation of living standards in the regions and the determinants. In this paper, we use the cluster analysis approach in order to specify and identify the regions with similar development characteristics. Clustering is the classification of objects into different groups, or more precisely, the partitioning of a data set into subsets (clusters), so that the data in each subset (ideally) share some common trait - often the proximity according to some defined distance measure. Data clustering is a common technique for the statistical data analysis, which is used in many fields. The computational task of classifying the data set into clusters is often referred to as k-clustering. More specifically, we use the ruler distance approach (Euclidean distance), the specification of which is:

$$D_{rs} = [(x_r - x_r)' \times (x_r - x_s)]^{1/2}$$

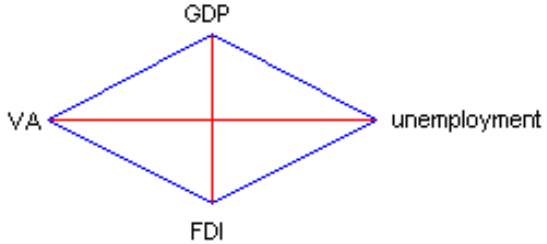


Figure 1. Graphical analysis of SUN RAY PLOT

In the framework of the clustering method, we apply hierarchical clustering where the observed data points are grouped into a nested sequence of clustering. More specifically, we use the agglomerative method which starts with each observation as a separate cluster. Clusters are merged until only one cluster is present. In our paper, we have applied the cluster analysis in order to group the regions so that those belonging to one group (cluster) are as "similar" as possible (the internal group variability to be as low as possible), while the regions from different clusters are "as distant or different as possible" (the inter-cluster variability is as big as possible) (Kejkula 1979a, b).

In our analysis, we have used the STATGRAPHICS SUN RAY PLOT, similar to the one demonstrated in Figure 1. The system draws for each region a "star", with elements forming a polygon. The elements represent the selected indicators, and in the polygon they show the level of each indicator for the given region. The shape of polygons serves to analyzing the visual similarities of regions based on the analyzed indicators (Hair et al. 1995).

The clusters and plots are built based on the following regional indicators: regional GDP, regional unemployment, regional breakdown of foreign direct investment (FDI), and value added per worker (VA).

The methodology of compilation of the regional gross domestic product and the indicators from regional accounts is based on the European System of National and Regional Accounts in the Community (ESA 95). National accounts are the base for the estimates of regional gross domestic product, which have been gradually harmonized with the ESA 95 methodology since 1996. The main sources of statistical data are surveyed by the EUROSTAT Slovakia on the basis of the specific annual reports for a set of organizations with one and more employees registered in the Business Register and for a set of not incorporated natural persons including expert statistical estimates for the production on own use, production of paid personnel and for the imputed production of housing services.

The Purchasing Power Standard is calculated on the basis of prices and volumes of goods sale, which are intercomparable and representative for the countries included into comparison. The Purchasing Power Standard eliminates the effects of the different price level between countries. Value added is a balancing item and is calculated by the subtraction of the intermediate consumption from the production of individual sectors or branches. The Regional gross domestic product per capita is the share of two in-

dicators – regional gross domestic product (where the criteria of compilation by the place of work is applied) and the average number of the population permanently residing in the given region (based on the principle of the residence). The comparison of both indicators based on different principles does not cause big problems in most regions. In regions with a very high commuting to work from the surrounding regions, especially regions of the capital cities, the indicator is overestimated. Gross value added at basic prices is calculated as the difference between the production at basic prices and the intermediate consumption at purchase prices. The production consists of products produced during the current accounting period and the intermediate consumption is composed of the value of products and services consumed in the production process as inputs excluding the fixed assets, the consumption of which is regarded as the consumption of fixed capital. The process of the regional value added compilation includes more steps. The basic access consists in the individual quantification of gross value added in branches (NACE, A–Q) in the region (NUTS 3) using the regionalization methodology "bottom-up" and the "combination method". Foreign direct investments (FDI) in the Slovak Republic and investments of the Slovak Republic abroad represent the equity capital and the reinvested profit. The data on FDI come out from the data in accounting of the reporting units. Transactions are calculated by the exchange rate of the commercial bank or branch office of the foreign bank on the date of the accounting item realization, in the case of volumes, these are the data as of December 31 registered in the Business Register. The data are expressed in the domestic currency. The value of flows has not a definite connection to the volumes by the reason of the exchange rate and other reasons, e.g. capital surplus, rounding, bankruptcy of companies, capitalization of loans etc. (the formula "volumes of the previous year + flows of the current year = volumes of the current year" is not valid).Unemployed by the LFS are persons aged 15 and over who were not working for pay or profit during the reference week, who were actively seeking work during the last four weeks (or who have already found a job to start within 3 months) and who are able to start work in the next two weeks. These unemployed persons are not obliged to be registered at the labor offices,

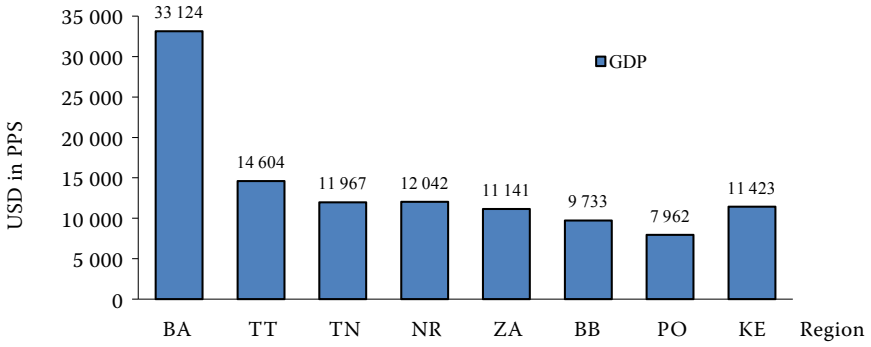


Figure 2. Regional breakdown of GDP per capita
Regions: BA – Bratislava, TT – Trnava, TN – Trenčín, NR – Nitra, ZA – Žilina, BB – Banská Bystrica, PO – Prešov, KE – Košice

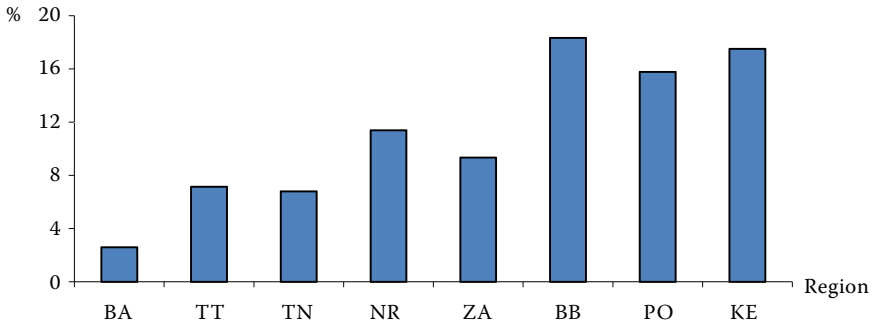


Figure 3. Regional breakdown of unemployment figures (for explanation see Figure 2)

social affairs and family as applicants for a job. The unemployment rate by the LFS is calculated according to the following formula:

U = (number of unemployed persons/economically active population) × 100

(Economically active population in the denominator of the formula excludes persons on the parental leave). All published data are the results of the processing of the SO SR (EUROSTAT Slovakia).We apply also the centroid approach – the distances between clusters are the distances between the cluster means (Sokal, Michener 1958; Milligan 1980).

## RESULTS AND DISCUSSION

The highest living standards from the regional aspect in Slovakia in 2005 are registered in the Bratislava region, making it the most developed region in the country. As it can be seen in Figure 2, during the transformation process disparities were created between regions, ending up in the so called ´development scissors' where the GDP per capita of the Bratislava region represents 127% of the second most developed region – Trenčín (TN), and 316% of the poorest region – Prešov (PO). The Bratislava region in terms of the GDP per capita ranks well above the EU 27 average as well.

Figures show the logical tendencies in terms of unemployment as well. The most developed regions show low unemployment figures and vice versa. In contrast with the picture demonstrated by the indicator of GDP per capita, regions located in the Eastern part of Slovakia show high unemployment figures. This confirms the negative correlation between high unemployment and low level of development. So, the highest level of unemployment in 2005 was registered in the Banská Bystrica region (BB 18.32%), then in the Košice region (KE 17.5%) and the Prešov region (PO 15.77%). The lowest level of unemployment was registered in the Bratislava region, where there is a broad scale of labour opportunities. There the level of unemployment was at 2.6% in 2005 (Figure 3).

The situation regarding the regional breakdown of foreign direct investment is characterized by even bigger differences than in the case of the previous two indicators (GDP per capita and unemployment). Given the favorable location of Bratislava, close to the most developed EU markets, one considers as logical that a certain degree of differences should be normal

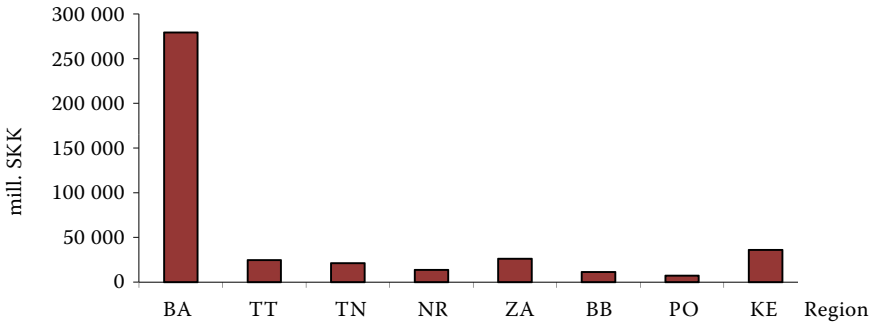


Figure 4. Regional breakdown of FDI (for explanation see Figure 2)

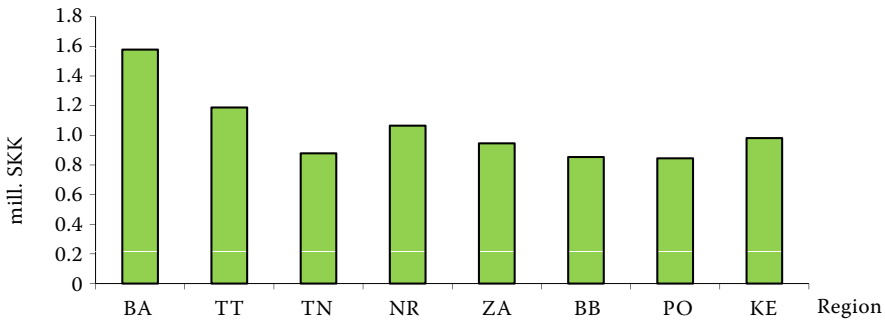


Figure 5. Regional breakdown of labor productivity (for explanation see Figure 2)

between the Bratislava region and the rest of the country. However, the differences between Bratislava and other Slovak regions in 2005, in the terms of FDI, were quite huge (due to the unavailability of data, we could not show the more recent situation). Second to Bratislava follows the Košice region. However, the FDI of the Košice region represented only 13% of the Bratislava region (Figure 4).

We analyzed the regions also from the aspect of labour productivity expressed in terms of value added per capita. It is interesting to see that in this case the differences between regions are not as large as in the previous cases. Bratislava still ranks first even in this case but the level of value added per worker for the Bratislava region represents only 87% for the poorest Prešov region (Figure 5).

As a result of the application of the multidimensional statistical classification (cluster approach), 3 clusters i.e. homogenous groups of regions were identified based on two selected indicators – GDP per capita and the level of unemployment demonstrated in the Figure 6.

The process of formation of different groups is demonstrated by the dendrograme in the Figure 7.

The dendrogram (Figure 7) shows that in the first stage of the cluster approach, 2 regions formed a common cluster: the regions of Banská Bystrica (BB) and Prešov (PO). These two regions were very similar in terms of the analyzed indicators. In the next stage, the regions of Trnava (TN) and Žilina (ZA) were included in a common cluster. In the next step, the Košice region (KE) was joined the cluster of the BB and PO regions (forming a common cluster with them). This was followed by a common cluster of the Trenčin (TN) and Nitra (NR) regions which later joined the group of the Trnava (TT) and Žilina (ZA) region concluding a second common cluster. The third cluster was represented by the Bratislava region (BA), and that is very different according to all indicators from all other Slovak regions.

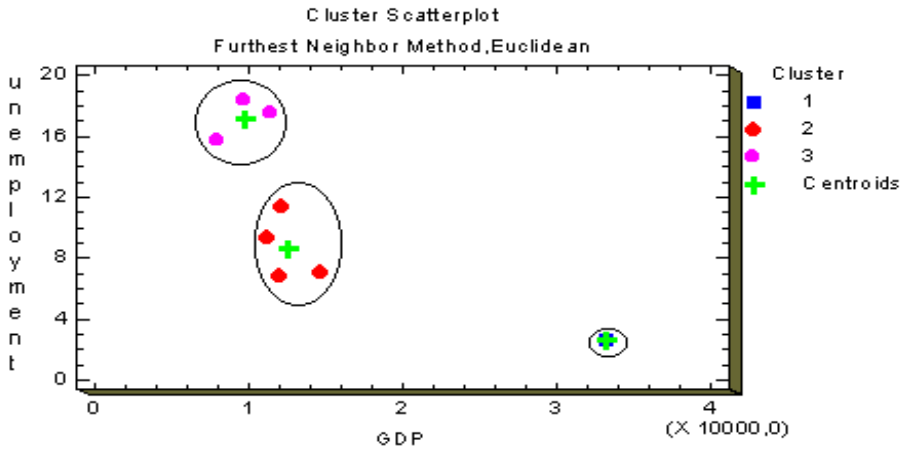


Figure 6. Groups (clusters) of regions

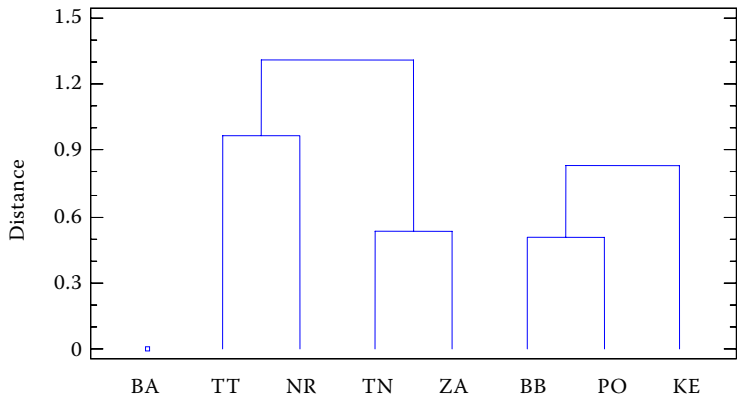


Figure 7. The dendrogram of regional groups (clusters) formation (furthest neighbor method, Euclidean) (for explanation see Figure 2)

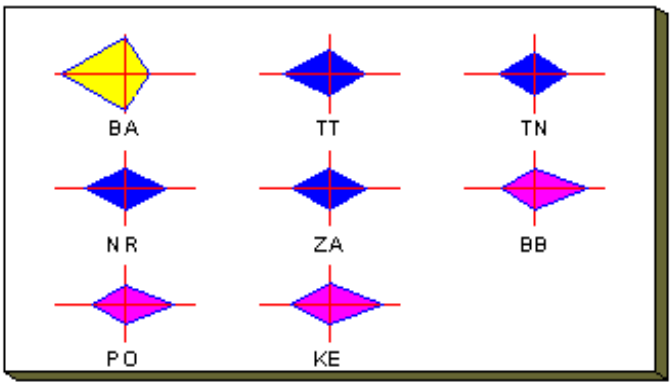


Figure 8. SUN RAY PLOT of Slovak regions (for explanation see Figure 2)

The similarities resp. differences between the regions are demonstrated by the SUN RAY PLOT that is shown in the Figure 8. The polygons of different regions are distinctive by the color according to the clusters where they belong.

The results of cluster analyses are presented in the Table 1 below, where, besides the components and the number of regions in clusters, there is included also the percentage share of different regions. In Table 2, we present the calculated centroids, where a centroid represents the average of the cluster from the aspect of the selected indicators.

As demonstrated in Tables 1 and 2, the first cluster is formed by the Bratislava region (BA) that is characterized by the highest level of GDP per capita, FDI and VA per worker. It registered the lowest unemployment level. The second cluster is formed by 4 regions: Trenčín (TN), Trnava (TT), Nitra (NR) and Žilina (ZA). The regions from this cluster rank below the Bratislava region in terms of the selected indicators, thus confirming their status as less developed regions than Bratislava. The biggest difference between Bratislava and the second cluster was in terms of FDI. However, the second cluster is at a higher level of development than the third one. The third cluster is formed by regions located in Eastern Slovakia: Prešov (PO), Košice (KE) and Banská Bystrica (BB). These regions are the least developed regions of Slovakia registering the highest level of unemployment and the lowest level of GDP per capita, FDI and VA per capita.

Table 1. Cluster summary

| Cluster | Count | Percent | Members |
|---|---|---|---|
| 1 | 1 | 12.50 | BA |
| 2 | 4 | 50.00 | TT, TN, NR, ZA |
| 3 | 3 | 37.50 | BB, PO, KE |

Table 2. Centroids

| Cluster | GDP | Unemployment | FDI | VA |
|---|---|---|---|---|
| 1 | 33 124.0 | 2.6 | 279 441 | 1.58 |
| 2 | 12 438.5 | 8.7 | 21 508 | 1.02 |
| 3 | 9 706.0 | 17.2 | 18 313 | 0.89 |

## CONCLUSION

What do all these facts and results mean for Slovakia in general and its policy makers in particular?

1. Regional and development policies in Slovakia clearly should give priority to less developed regions i.e. the regions from the third cluster (PO, KE and BB).The priority should consist in terms of the regional EUROFUNDS, infrastructure public investment and human capital development. Differentiation and innovative solutions are required in terms of the applied development policies even among the regions of this cluster.
2. The regions of the second cluster should be assisted in such a way that they can benefit from the dynamic development of the Bratislava region, given the fact that they are located closer. A specific attention should be given to human capital and the qualification of labor force.
3. Slovak authorities at the central and local government level should coordinate their efforts in order to "channel" FDI into regions other than Bratislava, especially into the regions of the third cluster (there is evidence that the regions of second cluster are already experiencing higher FDI inflows). The propagation of positive aspects of the above mentioned regions, investing in the improvement of

## APPENDIX

**Summary statistics**

| | GDP/capita | Unemployment | FDI | VA per worker |
|---|---|---|---|---|
| Count | 8 | 8 | 8 | 8 |
| Average | 13 999.5 | 11.1075 | 52 551.4 | 1.04176 |
| Standard deviation | 7 960.07 | 5.66261 | 92 137.6 | 0.246077 |
| Coefficient of variation (%) | 56.86 | 50.98 | 175.33 | 23.62 |
| Minimum | 7 962.0 | 2.6 | 7 398.0 | 0.844412 |
| Maximum | 33 124.0 | 18.32 | 279 441 | 1.57827 |
| Range | 25 162.0 | 15.72 | 272 043 | 0.733862 |
| Standard skewness | 2.8959 | –0.0308577 | 3.20147 | 2.03255 |
| Standard kurtosis | 3.85535 | –0.771587 | 4.48109 | 1.86287 |

**Correlations**

| | GDP/capita | Unemployment | FDI | VA/worker |
|---|---|---|---|---|
| GDP/capita | | –0.7201<br>(8)<br>0.0440 | 0.9793<br>(8)<br>0.0000 | 0.9526<br>(8)<br>0.0003 |
| Unemployment | –0.7201<br>(8)<br>0.0440 | | –0.6193<br>(8)<br>0.1015 | –0.7103<br>(8)<br>0.0483 |
| FDI | 0.9793<br>(8)<br>0.0000 | –0.6193<br>(8)<br>0.1015 | | 0.8953<br>(8)<br>0.0027 |
| VA/worker | 0.9526<br>(8)<br>0.0003 | –0.7103<br>(8)<br>0.0483 | 0.8953<br>(8)<br>0.0027 | |

their infrastructure and other similar steps might help to attract FDI in the regions of the third cluster i.e. the less developed regions.

4. A special attention should be given to the trade exchanges and special relations with the non -EU neighboring countries like Ukraine that borders the less developed regions of the third cluster.
5. The EU cohesion and social funds should be used to improve the qualification of labor force, increase human capital, make the regions attractive to young people and open up the perspective to increased labor productivity and in this way increasing living standards.

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