Petr Hlaváček

University of J.E. Purkyně in Ústí nad Labem, Faculty of Social and Economic Studies,
Department of Regional and Local Development
Moskevská 54, 400 96 Ústí nad Labem, Czech Republic
email: petr.hlavacek@ujep.cz

Economic and Innovation Adaptability of Regions in the Czech Republic

Abstract

The article is focused on assessment of regional adaptability in the Czech Republic and capability of regions to respond to changing economic environment where innovations and growth of the region's innovation potential plays important role. The research goal is analysis of development trajectories of regions in the Czech Republic and assessment of cohesion of economic changes with respect to the development processes in the fields of innovations. The development processes have been analysed on a group of macro-economic data (inflow of direct foreign investments, development of unemployment rate, development of population, development of gross wages, development of gross domestic product per capita) and indicators (growth of employment in R&D, increase of expenses for R&D, growth in number of innovation businesses and increase of university-degree persons) that analyze regional differences in the innovation potential at the level of regions of the Czech Republic. The data analysis revealed certain dependency among the regions of higher economic potential and innovation dynamics that supports ability of economically stronger regions to create better conditions for development and implementation of innovations. The research also confirmed differences in economic development between structurally impaired and economically undeveloped regions that adapt to economic changes slowly due to weaker economic potential while displaying lower dynamics of change to growth of the innovation potential.

Key Words

regional adaptability, regional resilience, regional development, innovation, transformation, regional economy

JEL Clasification: R11, R 12, O18

Introduction

Importance of so-called regional resilience and regional adaptability [5, 6, 10, 13, 18], i.e. capability of the regional environment to implement new economic impulses and to soften negative economic and social impacts are currently considered in the research of the regional development in association with the regional competitiveness [2, 9, 21]. For example Simmie, Martin [18] define four basic responses of the regions to shock changes where the regional resilience may be reflected in neutral, negative as well as positive impact on the regional development.

At present, there are also many articles dealing with the analysis of the regional resilience [14, 6] or of the state-level resilience [5], which supports the regional

resilience concept topicality for the research of impacts of the economic crisis on the regional development. At the level of regions, the regional framework created in this way produces specific environment of convergence and divergence development processes [7] that reflect different capability of implementation or development of new innovations.

Whereas in the 1990s we were talking about economic transformation resulting in principal change to regional development trajectories (e.g. in Moravian-Silesian Region or Ústí Region), we can monitor these transformation processes in the capability of the regions to adapt to economic changes due to economy growth decline across the European Union. According to Blažek, Csank [1], the divergent processes were terminated after 2000 and new, already stabilized spatial template of regional development level in the Czech Republic was created. However, the economic development is continuous process that may bring new development impulses and impacts on regional economies on continuous basis.

Schumpeter's analysis of benefits of innovations for economic growth [17] became the foundation for other works involved in importance of innovations for economic growth. The innovations and research and development expenses are the tool for increased competitiveness, productivity of production factors, and improvement of economic growth [15]. Quality research and tertiary education are important for reinforcement of the innovation potential and this is also associated with the need of developing of the region innovation systems [4]. The development of innovation environment in the theoretical point [12] of view emphasized importance of linking between private and public sector for cultivation of innovative and productive environment. Proven mechanisms of knowledge transfer and innovations require a cooperation between business and R&D sector at the regional, national, and international level.

The inflow of direct foreign investments [8], which contributed to the growth of external competitiveness and added value, was the key for economic development of the national and regional economies in the Central Europe. The effect of the foreign direct investments on the transfer of innovation and new knowledge also resulted in improved integration of economies into European and global market mechanism. The determinants of the foreign direct investments based on which attractiveness of national and regional economies was assessed include a set of factors such as industrial tradition, education level of citizens, economic and political stability, and particularly attractive geographic location of the territory in relation to Western countries.

The research goal is capture and analysis of development trajectories of regions in the Czech Republic and assessment of cohesion of economic changes with respect to the development processes in the fields of innovations. The research focus follows from the fact that the economic development is significantly cohesive with the social and demographic development in many aspects and evokes differentiated responses at the region level. According to Bristow [2], the regional resilience is also a relevant tool for creation of regional policies and regional development strategy. It could also be used for analyses and determination of priorities and capacities in the field regional policy [19] focused on entrepreneurship [20, 3] or city marketing [11].

1. Research methodology

It is suitable to use a wide range of indicators for analysis of the regional development processes that are sufficiently representative with long-term statistical monitoring. The paper will use a group of selected indicators that sufficiently describe main development changes in the selected fields of transformation of the regional economy. The first analyzed data range includes indicators based on the main macro-economic indicators, whereas the other group of the indicators of interest is based on the field of criteria focused on innovative potential of the region. In the field of macro-economic data, the group of indicators was used, whereas the first is development of GDP per capita [5] and its difference between distant periods from 2001 to 2010. For the purpose of evaluation of the development trajectories, the development of GDP per capita in the period of question provides rather representative view on monitoring of the economic development of the region.

This sub-category also monitors accumulated inflow of foreign investments [for example 8] from 2001 to 2010 (per capita,in CZK). The importance of said criterion (sum of annual volumes of foreign investments from 2001 to 2010) lies in elimination of impact of annual fluctuations in the inflow of foreign direct investments that is associated with the progress of the economic cycle of global economy to a certain extent. Regional labour markets represent unemployment rate and their change between 2001 and 2010. Another indicator that points out the development of economic potential of regions is the indicator of average salaries and their growth (in %) during the monitored period from 2000 to 2010 because growth in gross monthly wages depends on the level of economic development of region and profitability of local companies. When analysing the resilience of regions to the crisis, the last monitored indicator is comparison of development in the number of inhabitants between 2001 and 2010 (in %). This type of demographical indicator is applied e.g. by Chapple, Lester [10] in the analysis of the regional resilience.

The second monitored area, where comparisons of development-based processes were performed, was the field of innovations. For this category, several types of indicators were selected. The first indicator analyses growth of employment in research and development (in %) with respect to either increase or decrease of R&D headcount in 2001 – 2010, which points out to capability of the regions to create qualified jobs associated with development of innovations. The second indicator (R&D expenses from public and private resources) is a growth of R&D expenses (in %) between 2001 and 2010 paid in individual regions of the Czech Republic. The regional differences in the institutional structures are monitored by the indicator of growth of number of innovative businesses (in %) where data for period from 2001 to 2010 was used due to limited availability of information. The last indicator in this category was calculated from growth of share of persons in the region with university education (in %) between 2001 and 2010. The share of university-degree educated inhabitants was used by Chapple, Lester [10] in the analysis of the resilience of regional labour markets in the USA.

2. Development trends of the regional economies in the Czech Republic

The first part of the review focused on the main selected macro-economic indicators. Table 1 shows calculated data and its changes between 2001 and 2010. Volume of the foreign investments between 2001 and 2010 was higher in Prague. Substantially higher values compared to other regions in the Czech Republic are associated with Central Bohemian Region.

Tab. 1 Development of macro-economic indicators of regions in the Czech Republic between years 2001 – 2010

Region	IFDI 01/10	IWG 01/10	IUNEM 01/10	IPOP 01/10	IGDP 01/10
South Bohemian Region	914.2	73.1	-2.5	2.3	47.7
South Moravian Region	762.0	66.3	-1.1	2.0	57.7
Karlovy Vary Region	593.7	58.9	-2.7	1.2	41.8
Hradec Králové Region	513.9	63.7	-2.1	1.0	45.3
Liberec Region	999.9	68.2	-3.2	2.9	33.0
Moravian-Silesian Region	902.2	61.6	2.8	-1.4	65.3
Olomouc Region	457.5	65.9	-0.7	-0.2	51.3
Pardubice Region	746.4	64.0	-1.9	2.0	46.6
Plzeň Region	968.3	66.7	-1.7	4.1	41.5
Praha	6824.0	45.4	-0.7	8.4	63.3
Central Bohemian Region	1432.0	73.5	-1.0	12.5	51.1
Ústí Region	991.1	83.5	4.7	2.0	64.0
Vysočina Region	821.0	67.8	-3.7	0.6	44.0
Zlín Region	570.6	61.3	-2.2	-0.6	58.1

Note: IFDI – accumulated inflow of foreign direct investments per capita between years 2001 and 2010 (in CZK), IUNEM – differentiation between unemployment rates in years 2001 and 2010 (in %), IPOP – population growth between years 2001 and 2010 (in %), IWG – growth of gross wages between years 2001 and 2010 (in %), IGDP – growth of GDP per capita between years 2001 and 2010 (in %)

Source: own research based on data of Czech statistical office

In case of the inflow of foreign investments, the comparison of other regions with Prague is rather unsuitable because Prague as the capital city with registered offices of central branches of foreign companies has a different position. The lowest volume of foreign direct investments was recorded in Olomouc, Hradec Králové and Zlín regions where the volume achieves roughly one third of the FDI per capita in Central Bohemian Region. The increase of gross wages index between 2001 and 2010 is the indicator of lower variability level. Rather surprising fact is that Prague saw the least increase of average wage from among all regions, which is due to long-term above-average level of average wage in this region that is higher than the average in the Czech Republic from the longer point of view. Lower increase of gross wages was also seen between 2001 and 2010 in Karlovy Vary Region (+58.9 %), Zlín Region (61.3 %). On the other hand, the highest increase of gross wages was seen Ústí Region (+83.5 %).

Development of the unemployment rate index between 2001 and 2010 shows unemployment rate drop and growth in case of positive and negative figures, respectively. The calculated values point out to capability of structurally impaired regions, which are generally those with obsolete industrial potential, to reduce unemployment level. In these regions, i.e. Moravian-Silesian Region and Ústí Region, the highest unemployment drop was reported and this fact must be seen in the context of original values early in the beginning of the period in question when the unemployment rate was much higher than in other regions of the Czech Republic. No significant changes were observed in the regions with stabilized low unemployment rate.

Prague and Central Bohemian Region clearly dominate in the population growth over the other regions; the growth of Central Bohemian Region is caused its function as a background for Prague and they together produce the most migration attractive region in the Czech Republic. The highest GDP growth was recorded in Moravian-Silesian Region, Prague and Ústí Region; on the other hand, the lowest GDP growth was seen in Liberec Region, Plzeň Region and Karlovy Vary Region.

Tab. 2 Development of innovation potential of the regions in the Czech Republic

Region	ILAB 01/10	ITER 01/10	IEXP 01/10	IEN 01/10
South Bohemian Region	110.2	69.2	162.2	20.2
South Moravian Region	132.4	60.7	74.6	19.9
Karlovy Vary Region	-9.6	34.0	21.1	32.0
Hradec Králové Region	166.5	68.5	41.2	18.2
Liberec Region	104.3	74.1	19.7	24.6
Moravian-Silesian Region	110.2	69.2	38.9	27.9
Olomouc Region	128.4	46.7	18.1	14.1
Pardubice Region	87.2	53.9	18.8	27.9
Plzeň Region	119.0	74.1	41.5	17.5
Praha	84.8	61.1	32.0	21.9
Central Bohemian Region	86.4	140.9	17.4	18.2
Ústí Region	44.3	58.2	10.7	27.5
Vysočina Region	119.1	75.6	-8.6	28.8
Zlín Region	127.1	66.9	0.8	26.6

Note: ILAB – growth of employees in R&D between years 2001 and 2010 (in %), ITER – growth in number of university-degree persons in population between years 2001 and 2010 (in %), IEXP – growth of R&D expenses between years 2001 and 2010 (in %), IEN – growth of number of innovative businesses between years 2001 and 2010(in %).

Source: own research based on data of Czech statistical office

In the field of evaluation of the development of innovative potential of regions (Tab. 2), the changes to the field of human resources, R&D expenses and changes to the number of innovative businesses were analyzed. Prague is characterized by high number of R&D staff in long-term run and where more employees would be needed to achieve comparable increase in per cents. However, generally lower growing dynamic is reported by Ústí Region, Central Bohemian Region and Pardubice Region with substantially lower increase in the number of R&D employees compared to other

regions. Should we monitor changes to share in persons with university degree in general population, Central Bohemian Region is ranked first followed by Vysočina Region, Plzeň Region and Liberec Region. The lowest growth in persons with university-degree education in the population between 2001 and 2010 was reported in Karlovy Vary Region as well as Olomouc Region.

Another indicator, which monitored growth of expenses to R&D between 2001 and 2010, reported the highest increase in South Bohemian Region. Second was South Moravian Region, particularly due to role of the city of Brno that becomes one of the most important research and development centre in the Czech Republic. Plzeň Region ranks third, which is the case similar to South Moravian Region because the city of Plzeň dominates here, which is one of the biggest cities in the Czech Republic as well as the key centre of the economic development. The last investigated indicator was the growth in number of innovative businesses between 2001 and 2010; because of limited data availability, regional data for these years were used. Low increase in Prague may not be seen negatively because there are many innovative businesses in Prague with high margin compared to other regions. On the other hand, Olomouc Region, despite rather high number of innovative businesses at the beginning of the period of question, reports very low increase in their number and therefore, it ranked last.

3. General assessment of the regional adaptability

The data for the indicator of the economic growth and indicator of growth in the innovation potential was first standardized in order to allow comparison. These indicators were calculated from Tab. 1 (indicator of economic growth) and Tab. 2 (indicators of growth of innovative potential). The average values for individual indicators were determined including standard deviation used for obtaining of positive and negative values for each region, where positive number stands for above-than-average value and negative number stands for lower-than-average value when compared to average for the field in question.

The purpose of categorization of the regions into groups (Tab. 3) was to define three categories of regions of similar size: a) with higher dynamics of economic changes, b) average dynamics, c) lower-than-average dynamics. The first group consists of Prague and Central Bohemian Region, which are the regions with above-than-average economic development level in long-term run and they reported stable and high economic dynamics between 2001 and 2010. South Moravian Region is an example of the region of very strong and dynamic growth centre in Brno and its background having impact on results of the region as a whole. Rather surprising are the aggregated results of Moravian-Silesian Region and Ústí Region, being the regions regarded as structurally impaired in long-term run where industrial and mining activities undergo long-term restructuralization [16]. Compared to the second category of economically underdeveloped regions, both regions have great economic potential despite structural problems. Favourable location of these regions also supports positive results of ongoing economic restructuralization of the regional economies.

Tab. 3 Categorization of regions according to aggregated indicator of the economic growth

Intensity	Value	Region
higher	more than 0.3	Ústí Region, Prague, Central Bohemian Region, Moravian-Silesian Region, South Moravian Region
average	from 0.2 to -1.5	South Bohemian Region, Plzeň Region, Olomouc Region, Pardubice Region
lower	less than -1.9	Zlín Region, Hradec Králové Region, Vysočina Region Region, Liberec Region, Karlovy Vary Region

Source: own research based on data of Czech statistical office

The second area focused on assessment of the innovation dynamics of the regions (Tab. 4) indicates the differences in the structure of regions less significant than in the first area. As far as the growth of innovation dynamics between 2001 and 2010 is concerned, the first category of regions (with higher growth in the innovation dynamics) is now occupied by South Bohemian Region, Central Bohemia Region and Moravian-Silesian Region, whereas Prague moved to the second category and Ústí Region moved to third category. It should be mentioned in case of Prague and Central Bohemian Region that these regions show above-than-average level of innovative potential in the parameters in question. Very good ranking of the structurally impaired region of Moravian-Silesian Region is, however, confirmed by rather successful transformation processes of the regional economy and, in particular, its industrial base.

Tab. 4 Categorization of regions according to aggregated indicator of growth in the innovation potential

| Intensity	Value	Region
higher	more than 1.3	South Bohemian Region, Central Bohemian Region, Moravian-Silesian Region
average	from 1.2 to -0.4	South Moravia Region, Hradec Králové Region, Vysočina Region, Zlín Region, Liberec Region, Plzeň Region, Pardubice Region
lower	less than -0.5	Prague, Ústí Region, Olomouc Region, Karlovy Vary Region

Source: own research based on data of Czech statistical office

Lower intensity of macro-economic development changes is also reflected in the category of regions with lower growth of the innovation potential (for example) Karlovy Vary Region. Figure 1 (below) shows categorization of these regions (indicator of the economic growth and innovation potential together). This result points out to weaker potential of the transformation processes that are reflected in a lower level of social and economic changes of said regions. Rather surprising is ranking of Liberec Region, which – contrary to other regions – is more industrialized, offers good transport infrastructure to Prague and Central Bohemia, particularly to concern Volkswagen (Škoda).

Summarized assessment of macro-economic and innovation intensity points out to relative interconnection of both areas in question. Several main findings can be deducted based on said assessment. The regions with long-term stable above-than-average developed economy and higher gross domestic product keep their higher economic growth despite growth in the innovation activity is not so intensive in these regions. Indirectly, growth in Prague shifts to Central Bohemian Region that in fact stands as a social and economic background for Prague and both regions together create growing macro-region in the Czech Republic. Very good results are achieved by South

Moravian Region both in the field of growth of macro-economic data as well as indicators in the field of innovations. Moravian-Silesian Region and Ústí Region, which represent an example of old industrial regions within the Czech Republic, achieve rather good results (in macroeconomic indicators) compared to other regions and this fact can be regarded as an evidence of relatively successful economic transformation.

Fig. 1 Summarized assessment of regions according to dynamics of development changes (2001 – 2010)
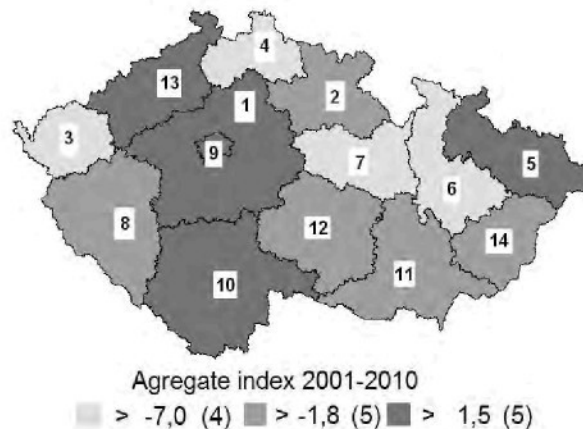
Note: 1 – Central Bohemian Region, 2 – Hradec Králové Region, 3 – Karlovy Vary Region, 4 – Liberec Region, 5 – Moravian-Silesian Region, 6 – Olomouc Region, 7 – Pardubice Region, 8 – Plzeň Region, 9 – Praha, 10 – South Bohemian Region, 11 – South Moravian Region, 12 – Vysočina Region, 13 – Ústí Region, 14 – Zlín Region.

Source: own research based on data of Czech statistical office

Conclusion

The research goal is to analyze development trajectories of regions in the Czech Republic and assessment of economic changes with respect to the development processes in the fields of innovations. Data analysis confirmed differences in economic development between categories of structurally impaired and economic underdeveloped regions. Second category of regions, due to lower economic potential, adapt slower to economic changes and higher risk of growing economic differentiation between successful and stagnating regions can be expected. Also revealed was certain dependency among the regions of higher economic potential and innovation dynamics that supports ability of economically stronger regions to create better conditions for development and implementation of innovations to economy.

Some regional economies reported more intensive growth in expenses related to research and development activities. The differences among the regions in intensity of growth in R&D expenses between 2001 and 2010 are rather significant. The regions with lower volumes of expenses at the beginning of the period grow faster, but do not achieve the level of R&D expenses in the regions at average level. However, this trend shows a turnover happening in the regions with lower development of R&D because the area of research and development attempts to be developed more intensively. In this

case, intensive involvement of universities in development of innovations is important, because the regions with absence of innovation-focused universities (Karlovy Vary Region) do not have any significant innovation potential that would be able to get funds for R&D activities. The statistic data of regional distribution of number of jobs in the research and development area provide obvious differences among the regions with public universities because these regions get more funds from public resources.

Acknowledgements

References

[1] BLAŽEK, J., CSANK, P. Nová fáze regionálního vývoje? *Sociologický časopis*, 2007, **43**(5): 945 – 965. ISSN 0038-0288.

[2] BRISTOW, G. Resilient regions: re-'place'ing regional competitiveness. *Cambridge Journal of Regions, Economy and Society*, 2010, **3**(1): 153 – 167. ISSN 1752-1386.

[3] FELIXOVÁ, K. Zhodnocení intenzity absorpce podpory podnikání v regionech se soustředěnou podporou státu. *E+M Ekonomie a management*, 2012, **10**(1): 17 – 27. ISSN 1212-3609.

[4] COOKE, P. Regional innovation systems: competitive regulation in the new Europe. *Geoforum*, 1992, **23**(3): 365 – 382. ISSN 0016-7185.

[5] DAVIES, S. Regional resilience in the 2008 – 2010 downturn: comparative evidence from European countries. *Cambridge Journal of Regions, Economy and Society*, 2011, **4**(3): 369 – 382. ISSN 1752-1386.

[6] DIODATO, D., WETERINGS, A. *The Resilience of Dutch Regions to Economic Shocks. Measuring the relevance of interactions among firms and workers* [online]. Utrecht: Utrecht University, 2012. [cit. 2013-03-10]. Available from WWW: <http://ideas.re pec.org/p/egu/wpaper/1215.html>

[7] HAMPL, M., BLAŽEK, J., ŽÍŽALOVÁ, P. Faktory-mechanismy-procesy v regionálním vývoji: aplikace konceptu kritického realismu. *Ekonomický časopis*, 2008, **56**(7): 696 – 711. ISSN 0013-3035.

[8] HLAVÁČEK, P., KOUTSKÝ, J. The Polarisation Tendencies in Localization of Foreign Direct Investments in the Czech Republic. In KOCOUREK, A. (ed.) *Proceedings of the 10th International Conference Liberec Economic Forum 2011*. Liberec: Technical University of Liberec, 2011, pp. 186 – 194. ISBN 978-80-7372-755-0.

[9] HUGGINS, R., WILLIAMS, N. Entrepreneurship and regional competitiveness: The role and progression of policy. *Entrepreneurship and regional development*, 2011, **23**(9 – 10): 907 – 32, 2011. ISSN 0898-5626.

[10] CHAPPLE, K., LESTER, W. T. The resilient regional labour market? The US case. *Cambridge Journal of Regions, Economy and Society*, 2010, **3**(1): 85 – 104. ISSN 1752-1386.

[11] JEŽEK, J. Městský marketing – koncepty, aplikace, kritická analýza. *Ekonomický časopis*, 2011, **59**(3): 243 – 258. ISSN 0013-3035.

[12] LUNDVALL, B., JOHNSON, B. et al. National systems of production, innovation and competence building. *Research Policy*, 2002, **31**(2): 213 – 231. ISSN 0048-7333.

[13] MARTIN, R. Regional economic resilience, hysteresis and recessionary shocks. *Journal of Economic Geography*, 2012, **12**(1): 1 – 32. ISSN 1468-2702.

[14] PIKE, A., DAWLEY, S., TOMANEY, J. Resilience, adaptation and adaptability. *Cambridge Journal of Regions, Economy and Society*, 2010, **3**(1): 59 – 70. ISSN 1752-1378.

[15] ROMER, P. Endogenous Technological Change. *Journal of Political Economy*, 1990, **98**(5): 71 – 102, 1990. ISSN 0022-3808.

[16] RUMPEL, P., SLACH, O., KOUTSKY, J. Creative Industries in Spatial Perspective in the Old Industrial Moravian-Silesian Region. *E+M Ekonomie a management*, 2010, **13**(4): 30 – 46. ISSN 1212-3609.

[17] SCHUMPETER, J. *Capitalism, Socialism and Democracy.* Harper & Row, New York, 1950. ISBN 0-06-1330008-6.

[18] SIMMIE, J., MARTIN, R. The economic resilience of regions: towards an evolutionary approach. *Cambridge Journal of Regions,Economy and Society*, 2010, **3**(1): 27 – 43. ISSN 1752-1386.

[19] TODTLING, F., TRIPPL, M. *One size fits all? Towards a differentiated regional innovation policy approach. Research Policy*, 2005, **34**(8): 1203 – 1219. ISSN 0048-7333.

[20] VITURKA, M. Regional disparities and their evaluation in the context of regional policy. *Geografie*, 2010, **115**(2): 131 – 143. ISSN 1212-0014.

[21] WOKOUN, R. Regional Competitiveness and Regional Development Factors in the Czech Republic. In BUCEK, M., CAPELLO, R. et al. (eds.) *The 3rd Central European Conference in Regional Science*, 2009, Košice. ISBN 978-80-553-0363-5.