# Efekt rozdílného časového horizontu při měření ekonomické odolnosti regionů
# The Effect of Different Time Horizon in Measuring the Regional Economic Resilience

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**Anotace**
Hodnocení ekonomické odolnosti regionů je v současné době spojováno především s dopady ekonomické krize. Ekonomická odolnost regionů může být stanovena na základě různých přístupů a i různých ukazatelů. V rámci tohoto hodnocení lze sledovat velikost odolnosti regionální ekonomiky vůči určitému vnějšímu negativnímu působení. Dále lze posoudit vliv potenciálních determinant ovlivňujících velikost odolnosti regionu. V každém případě je však nutné stanovit vhodnou délku zkoumaného období, na konci kterého je vyhodnocována situace regionů. Cílem tohoto příspěvku je posoudit efekt rozdílné délky zkoumaného období. Efekt rozdílného časového horizontu je zkoumán nejprve pomocí klasifikace typů regionů z hlediska ekonomické odolnosti a v druhé řadě také pomocí zhodnocení odlišností v síle vazby mezi potenciálními determinanty ekonomické odolnosti regionů a zvoleným ukazatelem odolnosti. Analytická část příspěvku je založena na datové sadě regionů úrovně NUTS 2 v návaznosti na hospodářskou krizi z roku 2008. Hlavní výzkumnou metodou je korelační analýza. Výsledky ukazují, že rozdílná délka časového horizontu významným způsobem ovlivňuje jak klasifikaci regionů z hlediska jejich odolnosti, tak i intenzitu vazeb mezi determinanty a použitým ukazatelem odolnosti.

**Klíčová slova**
Regionální rozvoj, odolnost regionů, hospodářská krize, determinanty regionální odolnosti, zaměstnanost

**Annotation**
Evaluation of the economic resilience of regions is currently associated primarily with the effects of the economic crisis. Economic resilience of regions can be determined by applying different approaches and also different indicators. Under this assessment, the size of the resilience of the regional economy can be monitored to some external negative effects. It is also possible to assess the influence of potential determinants to the economic resilience. In any case, it is necessary to determine the appropriate length of the analysed period, at the end of which the situation of regions is assessed. The aim of this paper is to evaluate the effect of different lengths of the analysed period. The effect of different time horizon is investigated first by classifying types of regions in terms of economic resilience and second also by the assessment of differences in strength of the relationship between potential determinants of economic resilience and a selected indicator of resilience. The analytical part of this paper is based on a dataset NUTS level 2 regions in connection with the economic crisis starting in 2008. The main research method used is a correlation analysis. The results show that the different length of a time horizon significantly influences both the classification of regions in terms of

their resilience and also the strength of links between determinants and the indicator used for measuring economic resilience.

**Key words**
Regional development, Regional resilience, Economic Crisis, Determinants of Regional resilience, Employment

**JEL classification:** R00, R10, R11

**Introduction**
The Regional Economic Resilience (RER) is often described as a property, more precisely as a process that allows regions to deal appropriately with adversity. The ability to resist is perceived as a return to equilibrium which presents the desired condition of a region. The term regional economic resilience is widely put to practice in recent years, especially in connection with assessment of impacts of the 2008 economic crisis. The term has quite a broad meaning and utilization thanks to its multidisciplinary origin; it could be found in area of crisis management during evaluation of impacts of extraordinary events in a region. Regional resilience is commonly looked upon through the eyes of regional development concerning regional indicators of labour market or regional product.

**1. Definition of the Regional Economic Resilience and approaches to it's measuring**
Economic resilience is often defined variously as (1) the ability of a system to recover from a severe shock and includes both inherent and adaptive resilience (Stewart et al., 2009); or as (2) being composed of people, firms, and institutions that interact to accomplish the production, distribution, and consumption of goods and services (Longstaff et al., 2010);

Potential approaches that might be used to measure economic resilience at the regional level include the following (Macaulay, 2009):

- Building Resilient Regions Resilience Capacity Index (RCI),
- Shannon Diversity Index (which can also be used to measure the level of diversification of the local economy),
- Input-output modelling of critical infrastructure interdependencies.

All of these approaches are influenced by the time horizon that is used. The aim of the research described in this study is to evaluate the effect of different duration of examined period in connection with an evaluation of regional economic resilience. The analytical part of this paper evaluates two hypotheses focused to prove the relevance of the length of the period examined in the evaluation of both (1) the region in terms of its economic resilience, as well as (2) the effect of potential determinants of economic resilience. Results of this study can be useful for further research in the field of resilience measurement.

This article assumes the regional resilience as a resilience of the regional (local) economy to the economic shocks. Based on the NUTS 2 level data, it describes the effect of two different assessment periods (after 4.5 resp. 6 years after beginning of economic crisis).

**2. Research Methodology**
In this study we use a regional employment level for measuring of economic resilience. This indicator is more useful in comparison with the other indicators such as gross value added (GVA) or gross domestic product (GDP), regional wages, regional labor productivity or regional investments which could be also used to measure the economic resilience of regions (Duval, Vogel, 2008). However, due to the problematic determination of regional product and others indicators, the development of regional employment if often analyzed (Martin, 2012).

For the purpose of quantification of regional resilience we used quarterly data on regional employment that has been obtained from the Labour Force Survey (LFS, 2013). It allows calculating the exact the

percentage change of regional employment within specific number of examined quarters from the beginning of the crisis.

From the theory of resilience point of view, we can talk about resilient or non-resilient regions. The category of regions depends on region's ability to reach pre-crisis level of regional employment after specific period – in this research we use two different periods for this purpose: eighteen (resp. twenty) quarters of a year since a first quarter of 2008 (this quarter can be considered as the beginning of the economic crisis in terms of employment decline - for more details see (Kraft at al., 2010) - and in many cases this quarter correspond with a start of decline of employment level also at regional level).

For classification of region we use classification according to resilience on the basis of methodology of ECR2 ESPON project (ESPON, 2014). Therefore, we identify four categories of resilience:

- Resistant regions (RS) – those regions that have not experienced an absolute decline in regional employment level following the economic shock.
- Recovered regions (RC) – those regions that experienced a decline in regional employment level, but have since recovered to pre-shock levels.
- Not-recovered, but in upturn (NR1) – those regions that experienced a decline in regional employment level, have passed the trough of the recession, but have not yet recovered to pre-shock activity levels
- Not-recovered, still in decline (NR2) – those regions that experienced a decline in regional employment level, which was still ongoing at 3Q2013 (because we analyse period from 1Q2008 to 3Q2013).

The focus of this study is only the ability of regions to recover from crisis. Due to that we study only regions type RC, NR1 and NR2. For the purpose of this paper we use only two categories of regions: RC and specially category "NR" which involves both regions of type NR1 and NR2 together.

For the classification of regions we used suggested criterion that resilient regions are regions which recorded return of employment level to the pre-crisis level (level of employment is greater or equal as the pre-crisis level). Considering the duration of examined period it could be said that 18 and 24 quarters of a year (resp. 4.5 and 6 years) represent suitable periods for evaluation of economic recession (e.g. Duval and Vogel (Duval, Vogel, 2008) suggest that the minimal period for this evaluation are at least 4 years). However, there is a significant question: Could different time horizons influence the evaluation of determinants that could affect economic regional resilience?

From this point of view, the **aim of this research** is to evaluate differences of relationship of determinants to economic regional resilience in connection with two different periods – the first from 1Q 2008 to 3Q 2012 and the second from 1Q 2008 to 1Q 2014. The relationship of determinants is showed by correlation coefficients. These coefficients represent relationship between selected potential determinants of regional resilience and indicator of regional resilience calculated on the basis of regional employment level. In this paper we use the Percentage Change of Employment Level as indicator of regional resilience calculated in the two mentioned periods.

We used the above suggestion for classification of regions (whether or not are resilient) and therefore we used the percentage change in employment levels measured the first between the first quarter of 2008 and the third quarter of the year 2012 and the second between the first quarter of 2008 and the first quarter of the year 2014 (indicator with symbol CH, where "CH" symbolizes "change"). Resilient regions in our study has the indicator CH > = 100 %. This indicator is calculated according to the formula (1):

$$CH = Et_2/Et_1 \times 100 \quad (1)$$

Where CH represents the percentage change of employed people measured after 4.5 (resp. 6) years from the beginning of the recession (in %). $Et_2$ represents number of people employed at the end of the investigation periods (3Q2012 resp. 1Q2014) and $Et_1$ represents number of people employed at the

start of the examined period, which is for the purposes of this paper set for 1Q2008. Because of the quarterly data, we rearranged the data by the X12-ARIMA method so that we get seasonally adjusted time series (to remove the seasonal component in time series).

The research is based on the statistical sample of 175 regions NUTS 2 of 9 countries of the EU (Austria (AT), Czech Republic (CZ), Germany (DE), Spain (ES), France (FR), Italy (IT), Poland (PL), Slovakia (SK), and United Kingdom (UK)). It represents about 50 % of all NUTS 2 regions in European Union (EU).

The choice of the above countries is based on the current fulfillment of the following criteria:

- sample regions must come from EU,
- selected regions are from the countries of the latest EU enlargement in 2004 (in order to assess the impact of the economic crisis in 2008).

It was necessary to include only the regions that have shown to be affected by the economic crisis from the year 2008. The group of 175 regions excluded those for which the following conditions apply:

1. the regions where there was no decrease in the estimated annual real regional GDP in at least one of the periods of 2007-2008 and 2008-2009 (real regional GDP was estimated based on using implicit price deflator),
2. the data on the annual change in regional GDP were available in 2007-2008 and 2008-2009 periods,

After that 131 regions were involved in further analysis.

In accordance with our previous research we used a set of determinants which showed medium and strong correlation with economic resilience (CH) in past research. This set of indicators includes three indicators belonging to the factor "Labor Market". The factors "Human Capital" and "Structure of the economy" are each also represented by three indicators. Two indicators include the factor of “Innovation activities and R&D." Factors "Economic Performance" and "Socio-demographic characteristics” are represented each by one indicator. The indicators used in this research are provided below:

- **Labour Market (3 indicators)**: The Job Vacancy Rate; Employment rate with age 15 to 64 years; The Unemployment Rate.
- **Human Capital (3 indicators)**: Human Resources in Science and Technology – according to occupation; Percentage of People with age 25-64 with Upper Secondary or Tertiary Education according to ISCED-97 (level from 3 to 6); Percentage of People with age 25-64 with Lower Secondary Education according to ISCED-97 (level 2) - the second and the third indicator is according to the International Standard Classification of Education (ISCED-97).
- **Structure of the Economy (3 indicators)**: The Proportion of People Employed in Agriculture, Forestry and Fishing (A); The Proportion of People Employed in Industry, Mining (B, C, D, E), The Proportion of People Employed in Financial and Insurance Activities (K) – letters A, B, C, D, K are on the basis of NACE (The Statistical Classification of Economic Activities).
- **Innovation Activity and R&D (2 indicators)**: Total Intramural R&D Expenditure (in Purchasing Power Standard (PPS)); Number of Patent Applications per million inhabitants (European patent application).
- **Economic Performance (1 indicator):** Labour Productivity (gross value added of the number of persons employed).
- **Socio-demographic Characteristics (1 indicator)**: The Proportion of People at Risk of Poverty.

These indicators have been identified as important determinants of economic resilience of regions in previous research (Svoboda, Maštálka, 2013). This research was based on previous studies of economic resilience of regions - e.g. (Dawley, 2010), (Duval, Vogel, 2008), (ESPON, 2014), (Foster,

2007), (Hill, Wial, Wolman, 2008), (Martin, 2012), (Pendal, Foster, 2010), (Pike, 2010) and (Simmie, Martin, 2010). The regional data were collected from the Eurostat database from the year and 2007.

The specific objective of this research paper is to test the following hypotheses:
H1: With the increasing length of period, a growing number of recovered regions can be expected.
H2: The intensity of correlation relationships of selected determinant and change of employment level is not changing with increasing length of the time horizon from 4.5 years to 6 years after the beginning of an economic crisis.

**3. Analysis of Results**

The table 1 contains the number of regions by type (recovered regions – RC, non-recovered regions – NR) in both time periods (third quarter of the year 2012 and first quarter of the year 2014) for the nine examined countries. The last row of the table expresses the change of recovered regions in each country between both time periods. The last column of the table contains the total number of regions and is useful for confirmation of H1 hypothesis.

As shown in the Tab. 1, the H1 hypothesis is confirmed (in the first quarter of the year 2014 there was 48 recovered regions that is higher number of regions as compared with the situation in the third quarter of the year 2012 – there was only 45 recovered regions). However, detailed view on the table shows that many countries recorded reduction of the number of recovered regions (it is the case of regions in AT, FR, IT and UK). On the other hand, small increase of recovered regions was recorded in CZ, DE, ES, PL and SK (the biggest one especially in Germany – from 19 in 3Q 2012 to 22 recovered regions in 1Q 2014). The largest decline of recovered regions was recorded in the UK (from 14 to 12 recovered regions).

***Tab. 1: Number of region type RC and NR in 3Q 2012 and 1Q 2014***

| Type of region / State | AT | CZ | DE | ES | FR | IT | PL | SK | UK | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **RC in 3Q 2012** | 4 | 1 | 19 | 0 | 4 | 2 | 1 | 0 | 14 | 45 |
| **NR in 3Q 2012** | 1 | 7 | 7 | 18 | 12 | 16 | 6 | 4 | 15 | 86 |
| **RC in 1Q 2014** | 3 | 3 | 22 | 1 | 3 | 1 | 2 | 1 | 12 | 48 |
| **NR in 1Q 2014** | 2 | 5 | 4 | 17 | 13 | 17 | 5 | 3 | 17 | 83 |
| **No. of regions** | 5 | 8 | 26 | 18 | 16 | 18 | 7 | 4 | 29 | 131 |
| **Change in RC reg.** | -1 | 2 | 3 | 1 | -1 | -1 | 1 | 1 | -2 | 3 |

*Source: authors according data from (LABOUR FOURCE SURVEY,2013)*

The table no. 2 contains all indicators described in chapter 2. This set of indicators has been proven to has medium and strong relationship with indicator CH (Change of regional employment level in period from 1Q 2008 to 3Q 2012) expressed by Spearman's coefficient of correlation in previous research (Svoboda, Klementová, 2014). The first column of the table contains the names of factors, the second column contains the names of indexes and the third and the fourth column contain results of the correlation analysis.

Although Pearson's coefficient of correlation is more sensitive to non-compliance with the requirement of normality in dataset, we use this coefficient of correlation for purposes of confirmation of H2 hypothesis (although the normality of the data has not been proved). It can be said that Pearson's coefficient of correlation returns the similar results as Spearman's coefficient of correlation. However, the advantage of Pearson's coefficient is a possibility to check the conformity of two different coefficients using the conformity test. This test was used for confirmation of hypothesis H2.

The results of the correlation analysis are showed in the third and the fourth column of the table no. 2 (the third column expresses correlation relationship of indexes and indicator CH calculated in the third quarter of the year 2012 and the forth column expresses correlation relationship of the same indexes and indicator CH but calculated in the first quarter of the year 2014). Significant values of Pearson's

coefficient are provided in bold (alfa = 0.05). Hypothesis of the conformity of two different coefficients (calculated for two different times) is expresses by dark tint of rows. The level of significance of the conformity test of two different coefficients was 0.1.

As shown in the Tab. 2, the H2 hypothesis is not confirmed due to fact that only three of all indicators show the conformity of correlation coefficients (The job vacancy rate, Number of patent applications per million inhabitants, The proportion of people at risk of poverty). For other indicators we obtained slightly different Pearson's coefficients in both periods.

***Tab. 2: Results of correlation analysis - Pearson's coefficient (significant values are bold)***

| Factor | Index | CH 3Q2012 | CH 1Q2014 |
|---|---|---|---|
| **Labour Market** | The job vacancy rate | **0.723** | **0.719** |
| **Human Capital** | Human Resources in Science and Technology – according to occupation | **0.528** | **0.472** |
| **Human Capital** | Percentage of people with age 25-64 with upper secondary or tertiary education according to ISCED-97 (level from 3 to 6) | **0.513** | **0.611** |
| **Sectoral Structure** | Financial and insurance activities (K) | **0.485** | **0.258** |
| **Innovation and R&D** | Number of patent applications per million inhabitants | **0.469** | **0.484** |
| **Innovation and R&D** | Total intramural R&D expenditure(in PPS) | **0.404** | **0.331** |
| Economic Performance | Labour productivity (gross value added of the number of persons employed) | **0.318** | **0.171** |
| Labour Market | Employment rate with age 15 to 64 years | **0.255** | **0.292** |
| Sectoral Structure | Industry, mining (B, C, D, E) | -0.133 | -0.025 |
| Labour Market | The Unemployment Rate | **-0.175** | -0.099 |
| Sectoral Structure | Agriculture, forestry and fishing (A) | **-0.348** | -0.184 |
| **Socio-demogr. Characteristic** | The proportion of people at risk of poverty | **-0.379** | **-0.392** |
| **Human Capital** | Percentage of people with age 25-64 with lower secondary education according to ISCED-97 (level 2) | **-0.535** | **-0.623** |

*Source: authors according data from (LABOUR FOURCE SURVEY,2013) and (EUROSTAT,2014)*

The table no. 2 also shows that regardless of the selected duration of the analysed period, the Labour Market, Human Capital, Sectoral Structure, Innovation and R&D and Socio-demographic Characteristics (these factors showed correlation coefficient higher than 0.5 in absolute value – it is expresses in the table no. 2 by bold names of factors in the first column) belong among the most influential factors.

**Final Results Discussion**

This paper evaluates the effect of different durations of examined period in connection with an evaluation of the regional economic resilience. The analytical part of the paper evaluates two hypotheses where one has been proved to be true. Evaluated hypotheses proved the relevance (at least in some cases) of the importance of the length of the examined period in the evaluation of both the region in terms of its economic resilience, as well as the evaluation of the effect of potential determinants of the economic resilience of regions. Above mentioned “less resilient” regions are among those that had the lowest Human Capital level in 2007 and also were not well position from the view of Innovation and R&D activities.

Limits of the presented results are obvious. The presented results are influenced by the fact that only one shock was researched. For further research, the authors recommend prolonging the testing period

and putting focus on other economic crises. A further research would enrich the research attitude with the focus on sensitivity analysis of founded determinants.

**Literature**


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