

# THE R&D EXPENDITURES AND INNOVATION PERFORMANCE CHANGES IN THE CZECH REPUBLIC AND THE SLOVAK REPUBLIC IN CONDITIONS OF THE CRISIS

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## Abstract

The innovative activity of firms and effective support of research and development on the macroeconomic level is a prerequisite for obtaining and keeping competitiveness of firms and national economies. The continuing economic crisis is in some European countries associated with a lack of innovation. This article aims to analyse and compare the strengths and weaknesses of the innovation systems of both countries. The starting point is the analysis and comparison of the behaviour of economic actors in innovation in the Czech Republic and Slovakia. The first approach is based on the international innovative profiles, which are published by an independent organization and evaluate not only the situation in individual countries, but also development. The second approach use selected data regularly published by the statistical offices of both countries. When analysing these data, we focus mainly on the comparison of R & D expenditures and investments. The combination of macroeconomic and microeconomic approach enables the comparison of the strengths and weaknesses of individual countries in the field of innovative behaviour. Those were even more revealed by economic crisis acting as a catalyst. It also allows us to suggest optimal ways to support the development of both countries.

**Key words:** innovation, investment, R & D expenditures, innovation performance, Summary Innovation Index

**JEL Code:** E20, O11, O30, O34, O38

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## Introduction

R & D expenditures are considered to be a precondition for the future competitiveness of both enterprises and at the macroeconomic level. The Europe 2020 Strategy considered one of the flagship initiatives Innovation Union. The aim of this initiative is to create a dynamic,

innovative economy based on ideas and creativity, able to participate in global value chains, seize opportunities and create high quality jobs (European Commission, 2013b).

The aim of studies focused on the effect of R&D investment is to analyse the role that R&D plays in the Czech economy and to derive corresponding conclusions. Kristkova (2012) investigated the effect of R&D investment on economic growth from two perspectives. This study (Kristkova, 2012) expects positive effects on all GDP components, but the importance of knowledge inclusion does not necessarily lay in the dynamics of economic growth but rather in its effect on the structure of the economy.

Research studies aimed at evaluating the effectiveness of R & D expenditure exploring innovative behaviour of firms, depending on their size, industry classification, as well as the number of employees, but also assess the effectiveness of direct and indirect government support for these expenditures.

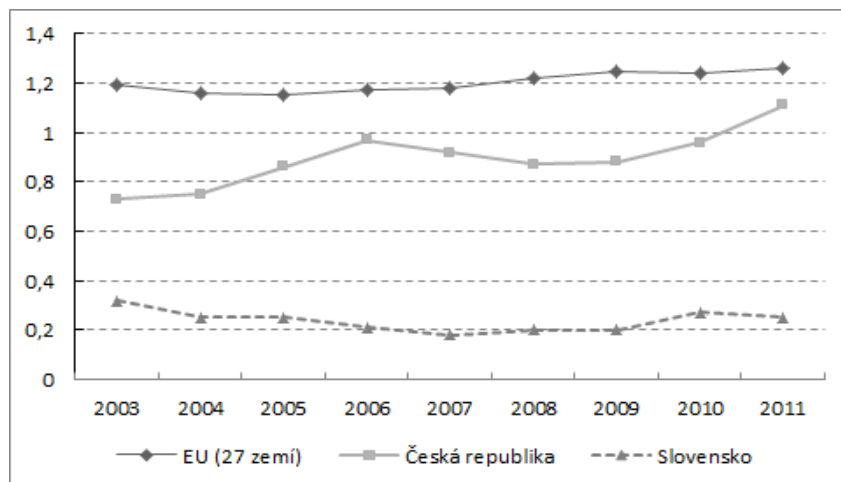
Zemplerova, Hromadkova (2012) analyses the relationships between growth, innovation and subsidies based on linking data from financial statements with data from innovation surveys of the Czech Statistical Office. This analysis proved that innovation input significantly increases innovation output, with increasing firm's size, however, ceteris paribus, the innovation output is decreasing. This means that bigger firms are less efficient in transforming the innovation input into output. Analysis of Zemplerova and Hromadkova (2012) shows that access to subsidies has significant, yet negative influence on innovation output. This result calls into question the efficiency of supported firms and has some implications for competition policy (Zemplerova, Hromadkova, 2012). The results of subsidies to R&D are re-distribution of resources, distortion of price signals and the change in behaviour of firms. Recipients of support may be cushioned and suffer by soft budget constraints. In addition large companies have better chances to succeed in getting subsidies due to their political power. (Zemplerová & Hromádková, 2012).

According Scholleová (2013) would be better indirect support innovative enterprises to increase the opportunities for raising funds by operating their own business rather than raising money from subsidy programs. Ideal tools are fiscal, administrative burden reduction, transparency and improving business environment, indirect instruments of venture capital, etc.

## 1 The expenditure on R & D in the business sector - comparison of the Czech Republic, Slovakia and the EU-27 average

Expenditure on R & D will be measured (for comparability) share of R & D expenditure to GDP. Figure 1 and Table 1 shows that EU-27 business expenditures on R & D (measured as a share of GDP) increased in conditions of crisis.

**Fig. 1: The expenditure on R & D to GDP (%)**



Source: Eurostat. Database. [http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database), online 21.05.2013

This is due sustained investment in research and development of European companies, both attractive European countries for foreign investors. Among EU Member States, but also between different industrial sectors there are significant differences that mean divergence of innovation performance between developed innovative countries (innovative leaders) and the countries of modest Innovators (see results SII 2012 below). In comparison with the average for EU-27 R & D expenditure in the business sector in the Czech Republic and Slovakia substandard. In Czech business enterprise sector R & D Expenditures are at roughly 88% on average of the EU-27 in 2011, in Slovakia only 20%. To clarify the causes of changes in the proportion of business expenditure on GDP, are presented in Table 1 with the annual change in GERD and GDP. The graph and table shows that in conditions of economic crisis, the share of GERD to GDP in the EU, the Czech Republic and the Slovak Republic stagnated. If we abstract from differences in the efficiency of utilization of GERD, then future economic growth indicate both annual changes GERD, GERD second change in 2011 compared to 2007, the last year of the boom.

**Tab. 1: Development of GERD and GDP in EU-27, Czech Republic and Slovakia**

year	2003	2004	2005	2006	2007	2008	2009	2010	2011
GERD/GDP EU-27	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.3
GDP EU-27 (annual changes)	1.7	5	4.4	5.7	6	0.5	-5.8	4.5	3
GERD EU-27(annual changes)	0.6	2.7	3.4	8	6.3	3.9	-3.5	4.2	4.9
GERD/GDP Czech Republic	0.7	0.7	0.9	1	0.9	0.9	0.9	1	1.1
GDP CR (annual changes)	1.3	8.8	13.9	13.1	11.5	17	-7.8	5.4	3.7
GERD CR(annual changes)	5.4	11.2	30.3	28	5.7	10.9	-6.4	15.3	19.8
GERD/GDP Slovakia	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.3
GDP SR (annual changes)	13.5	15.3	13.2	15.6	23.2	17.5	-2.5	4.9	4.9
GERD SR (annual changes)	-2.2	-8.3	13.2	-3.8	6.9	31.2	-4.9	40.9	-0.6

Source: : Eurostat. Database. [http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database) online 21.5. 2013 (Note: When calculating annual changes in GDP and GERD start from current prices in EUR as the share of GERD to GDP is also based on current prices.)

The significant annual increase in GERD in the Slovak Republic in 2008 and 2010 and the highest change from baseline of GERD can be associated with a positive impact of the adoption of the euro on FDI inflows (the euro reduce transaction costs and eliminate foreign exchange risk). On the Slovak GERD in the business sector in the period 2007-11 increased by 74.6% in the Czech Republic by 43.3%, while in the EU-27 by only 9.7%. The positive development of GERD in the business sector has significantly improved the position of Slovakia in international rankings of innovation performance IUS (see below).

Business investment in research and development (R&D) in enterprise innovation in the Czech Republic remain below the European average. In the case of business investment in R&D, there is an evident upward trend, suggesting that Czech companies gradually prefer a more technologically demanding production, for whose introduction, own research activities are necessary components (Scholleova & Kotulic, 2012).

## **2 Position of the Czech Republic and Slovakia in an international comparison of innovation performance (IUS and SII)**

The main tool for international comparisons of changes in an innovative environment within the EU is seen as Innovation Union Scoreboard - IUS (until 2009 called European Innovation Scoreboard - EIS). This ranking is compiled annually since 2001. In the last edition, published in March 2013 was IUS consists of 24 indicators that were grouped into three main groups

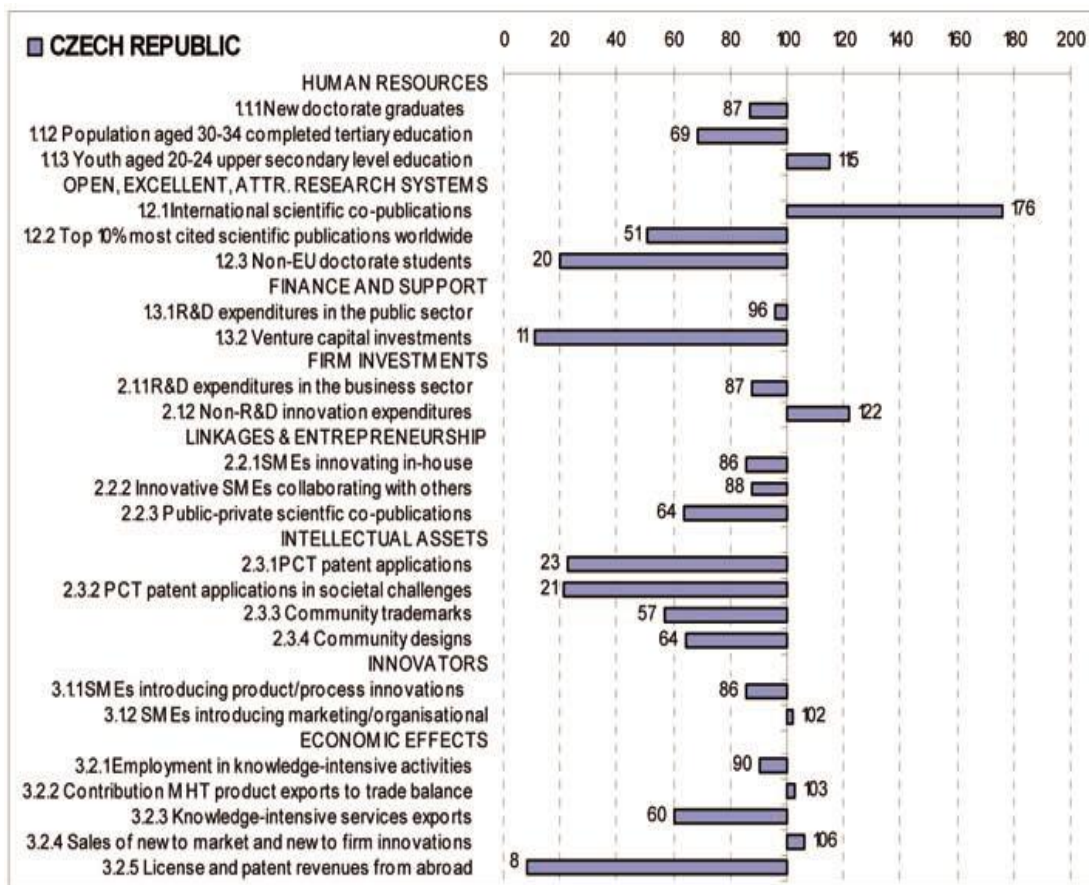
(activators, corporate activities, outputs) and eight categories. Countries are divided into four groups (Innovation leaders, Innovation followers, Moderate innovators, Modest innovators) by the Summary Innovation Index deviations from the average EU-27. Moderate innovators, among them the Czech Republic and Slovakia, the country reaching 50 to 90% of the EU-27 (more in Pavelka, 2013).

The average innovation performance is measured using a composite indicator (Summary Innovation Index - SII), which takes into account the "innovative results" countries based on 24 indicators already mentioned. The worst possible result is 0, the maximum possible result has a value of 1. The findings, published in the latest rankings reflect the real innovation performance in the years 2010/2011 - this is the time delay in the disclosure of relevant statistical data. Last ranking innovation performance thus captures the impact of the economic crisis on the innovative behaviour of individual countries. The results show that the process of convergence in innovation performance, within the EU stopped (Beta-convergence indicator reached -0.220, which means that less innovative countries are growing almost as fast as developed countries). The average rate of growth of the innovation is in the group of countries Modest Innovators lower (1.7%) than in the Innovation leaders (1.8%). This means that there is between these two groups of countries even divergence. The high rate of innovation growth achieved Moderate Innovators (2.1%). Slovakia has an average annual growth (of SII) 3.3% and is one of the leaders of growth (innovation performance has improved year on year by 15.8%). Position of the Czech Republic compared to 2011 SII deteriorated (see the aforementioned lower growth rate of GERD in the business sector in the Czech Republic and Slovakia to compare). The decline SII 2012 and related lower average growth rate of innovation performance (average innovative growth in 2008-12 was 2.6%) is the reason for the worse position. Both countries belong to the moderate innovators with a below-average innovation performance. Relative strengths of both the countries is the area of human resources (indicators: new doctor graduates, population aged 30-34 completed tertiary education, youth aged 20 to 24 upper secondary level education). In this area the most significant positive changes occurs in both countries. Number of doctoral studies at the Slovak Republic growing by 22% a year, double the average growth for the EU27, the Czech Republic is significantly above average results in the indicator International scientific co-publications and also in the indicator Youth aged 20 to 24 upper secondary level education.

The value of SII in both countries decrease results in open, excellent and attractive research systems (indicators: international scientific co-publications, top 10% most cited scientific publication worldwide, non-EU doctorate students) and the Intellectual assets (especially PCT

patent applications, PCT patent applications in societal challenges), although in both countries, that in this group of indicators, improved - in particular of Community trademarks. Negative impact on innovation performance of the CR has low utilization venture capital (share indicator Venture Capital to GDP) and the decline of SMEs Innovating in house and Innovative SMEs collaborating with others). Czech Republic still lags behind the EU-27 average in the number of PhD students from countries outside the EU, and the by-products of the innovation process, ie mainly in the protection of industrial property rights. In the field of industrial property rights is lagging Czech Republic, primarily due to lower than average number of patent applications at the European Patent Office.

**Fig. 2: Innovation performance in the CR compared to the average EU-27 (EU-27 = 100)**

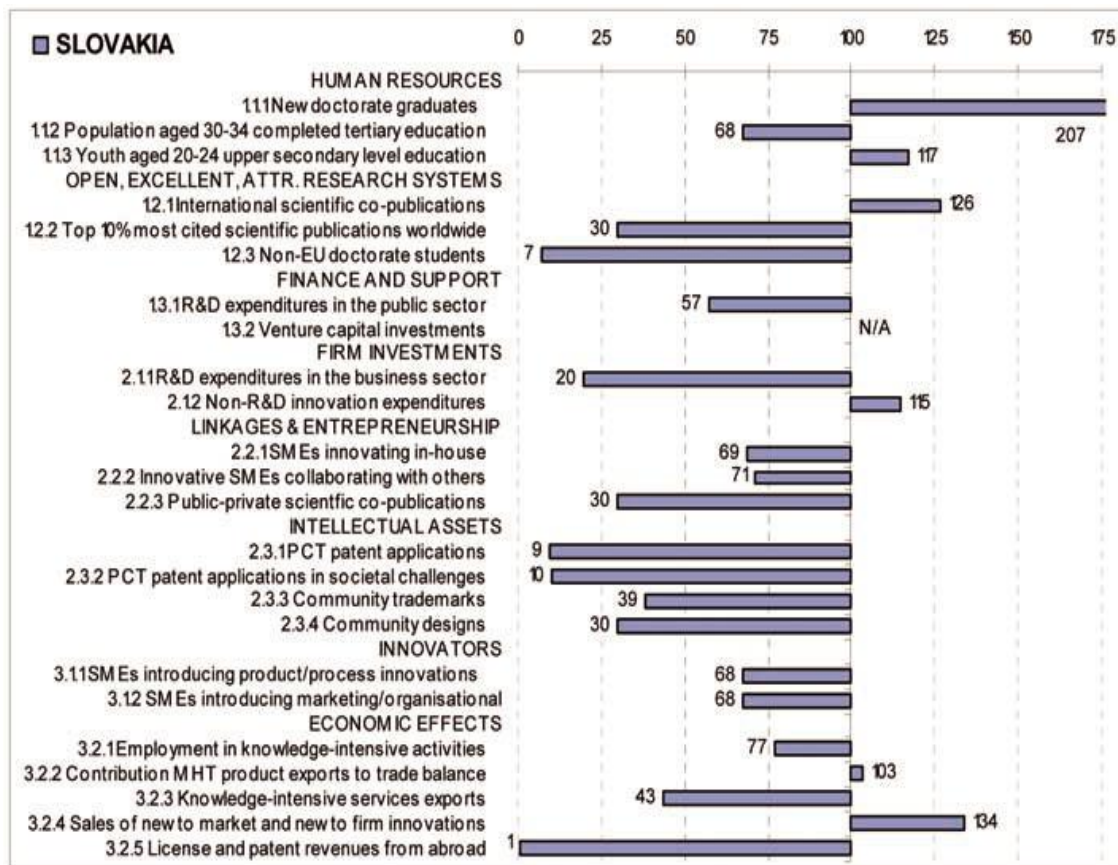


Source: EUROPEAN COMMISSION (2013a). Innovation Union Scoreboard 2013. 2013. Dostupné z: [http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013\\_en.pdf](http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf)

Czech Republic has above-average results in terms of economic effects. This is mainly due to the relatively high employment in high-tech and medium high-tech industries and also a relatively high share of these sectors in total exports. In the case of Slovakia, the innovation

performance positively affected by the aforementioned increase in the number of new doctorate graduates, increasing the number of PCT patents in societal challenges and Community trademarks. Innovation performance in Slovakia negatively affects the strong decline in Non-R & D innovation Expenditure and License and patent revenues from Abroad. The positive influence of the above mentioned increase in R & D Expenditure in business sector, however, is should be noted that Slovakia is based on a low base (see Figure 1 - Share of GERD in the corporate sector to GDP in the EU-27 significantly below average - about 20% of the EU-27). The following Figures 2 and 3 illustrate the strengths and weaknesses of the innovation performance of both countries compared to the average of EU-27.

**Fig. 3: Innovation performance in the SR compared to the average EU-27 (EU-27 = 100)**



Source: EUROPEAN COMMISSION (2013a). Innovation Union Scoreboard 2013. 2013. Dostupné z: [http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013\\_en.pdf](http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf)

Figure 2 and 3 show how CR and SR are lagging behind in meeting the benchmarks SII. But we should still see that the goal is not to win some scoring, but to build a competitive economy. In this area you can watch the results SII as incentives for building strategies. This

strategy can be offensive (using strengths) or defensive (improving weaknesses). Fig 4 shows the common and different strengths and weaknesses of both countries.

**Fig. 4: The Strengths and Weaknesses from SII in Czech Republic and Slovakia**

Country	Strength	Weakness
<b>Czech Republic</b>	SMEs innovation	New doctor graduates
<b>Together</b>	Youth aged 20 to 24 upper the 2nd level education	Venture Capital
	Non R & D innovation expenditures	Licence and patent revenues from abroad
	International scientific co-publication	Non EU doctorate students
	Sales of new market and new to firm innovations	
<b>Slovak Republic</b>	New doctor graduates	SMEs innovation

Source: own processing from EUROPEAN COMMISSION (2013a). Innovation Union Scoreboard 2013. 2013. Dostupné z: [http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013\\_en.pdf](http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf)

It is interesting that most of the strengths and weaknesses of both countries share, or do they complement (SMEs innovation, new doctor graduates), cooperation could improve their position. The economies of both countries have in the past and in the present are bundled, therefore, can be expected to improve even synergy effects. Strategic changes should focus on inputs (Youth aged 20 to 24 the upper 2nd level education, International scientific co-publication), but also monitor outputs (Venture Capital, SMEs innovation, Sales of new market and new to firm innovations). Inputs are a prerequisite for future output quality, but it is important to use the right to increase the innovation potential.

## Conclusion

The aim of the article was to analyze and compare the macroeconomic conditions for innovation and its consequences in terms of strengths and weaknesses in the Czech Republic and the Slovak Republic. For clarity, comparison with EU-27 is always added. It is important to watch innovation, because the innovative activity of firms and effective support of research



and development on the macroeconomic level is a prerequisite for obtaining and keeping competitiveness of firms and national economies.

Comparison was implemented at several levels. The first approach was based on macroeconomic data (GDP, GERD) and monitoring the effectiveness of state money spent on research and development. The second approach is based on the international innovative profiles, which are published by an independent organization, and evaluate not only the situation in individual countries, but also development. Analysis of changes will allow us to compare the behaviour of both countries in times of crisis. Due to the international standards, it is clear that it is not possible to select inputs based on which the innovation environment is evaluated. Processed data are regularly published by the statistical offices of both countries, but also by Eurostat. The advantage is the comparability of the data files. When analyzing these data, we have been focused mainly on the comparison of R & D expenditures. The combination of macroeconomic and microeconomic approach enables the comparison of the strengths and weaknesses of individual countries in the field of innovative behaviour. It also allows us to suggest optimal ways to support the development of both countries – the strengths are human resource, education and SMEs.

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## **References**

Eurostat (2013). Database. Retrieved from website:

[http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database), 21.5. 2013

European Commission. (2010a). Evropa 2020. Strategie pro inteligentní a udržitelný růst podporující začlenění. Retrieved from website:

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:CS:PDF>

European Commission (2010b). Stěžejní iniciativa strategie 2020. Unie inovací. Retrieved from website: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0546:FIN:CS:PDF> , 21.5. 2013

- European Commission (2012). Innovation Union Scoreboard 2011. Retrieved from website: [http://ec.europa.eu/enterprise/policies/innovation/files/ius-2011\\_en.pdf](http://ec.europa.eu/enterprise/policies/innovation/files/ius-2011_en.pdf), 21.5. 2013
- European Commission (2013a). Innovation Union Scoreboard 2013. Retrieved from website: [http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013\\_en.pdf](http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf), 21.5. 2013
- European Commission (2013b). State of the Innovation Union 2012. Accelerating Change. Retrieved from website: [http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2012/state\\_of\\_the\\_innovation\\_union\\_report\\_2012.pdf#view=fit&pagemode=none](http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2012/state_of_the_innovation_union_report_2012.pdf#view=fit&pagemode=none), 21.5. 2013
- NYSE: GE (2013). GE “Global Innovation Barometer“. Retrieved from website: [http://www.ge.com/sites/default/files/Innovation\\_Overview.pdf](http://www.ge.com/sites/default/files/Innovation_Overview.pdf), 21.5. 2013
- Křístková, Z.(2012). Impact of R&D Investment on Economic Growth of the Czech Republic, *Prague Economic Papers*. 21(4), pp.412-433.
- Pavelka, T. (2013). The Innovation Performance of the Czech Republic and a Comparison with Other European Union Member States. *Acta Oeconomica Pragensia*, 3/2013.
- Scholleová, H. (2013). Financování inovací – potřeby firem. In: Jedlička, P. (ed.). Hradec Králové: *Gaudeamus*, 2013, pp. 177–182.
- Scholleová, H. & Kotulič, C. (2012). Innovation behaviour support of Czech firms. In: *53rd International Riga Technical University Conference SCEE'2012 Proceedings*. Riga : Riga Technical University, Faculty of Engineering Economics and Management. 8 p.
- Zemplerová, A. (2010). Inovační aktivita firem a konkurence. *Politická ekonomie* 58(6), pp. 747-760.
- Zemplerová, A. & Hromádková, E. (2012). Determinants of Firm’s Innovation, *Prague Economic Papers*. 21(4), pp. 487-503.

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