MEASURING THE SIZE OF THE TECHNOLOGY GAP AT A LEVEL OF CZECH REGIONS

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Abstract: *The technology gap is one of key determinants of spillovers. This paper aims to quantify the size of the technology gap between foreign direct investments, which received investment incentives and business environment in six regions of the Czech Republic in time series of 2002-2014. The development of regional technology gap was determined by using the Shift-share analysis method - decomposition of the region's technological level into productivity, employment, and a combination of both of the effects. The main data source was the statistics issued decisions of investment incentives published by the agency CzechInvest; annual reports of foreign companies; data of the Czech Statistical Office and the OECD. The established indicator tracks the difference between the technological advancement of foreign firms and a regional business environment. The higher the value of this indicator than in other regions is, the higher the potential for technological growth the region has than regions compared. The magnitude of the value is given by the technological level of foreign companies and their share in regional employment. The best position takes the Pilsen region, which has the highest potential for spillovers in terms of the technology gap. On the contrary, the worst position has the Carlsbad region.*

Keywords: *Foreign Direct Investment, Foreign Presence, Investment Incentives, Productivity, Technology Gap.*

JEL Classification: *F23, O33.*

Introduction

Foreign direct investment (FDI) is considered to be an economic phenomenon with an ambiguous interpretation of the professional public, as this type of foreign capital produces a number of effects and influences on the host business environment, the final impact of which is often contradictory. Another complication is the difficult identification and quantification of spillovers (Mišun and Tomšík, 2002), which have the character of externalities and do not have a clearly specified link to FDI. However, this kind of effects result from direct effects and the location of FDI (Pavlínek and Žížalová, 2016).

Opinions on FDI are even more divergent if the flow of capital is supported by investment incentives. Governments spend considerable volumes of public support to obtain positive effects that are considered to be self-evident but in reality, very difficult to measure. The issue is deepened while monitoring the effects or determining and evaluating of the potential for the emergence of effects at a lower regional level than the level of individual economies.

1 Statement of a problem

Even though the effects of FDI are under broad discussion in the literature, there are very few studies and approaches that would quantify, comprehensively evaluate and compare direct and indirect effects of FDI and their potential at lower regional levels - to identify their effects and the potential for emergence in the regional business environment. Particularly spillover effects are very difficult to measure (Blomström and Kokko, 2001). For example, it is not possible to determine whether domestic enterprises have increased productivity due to

competitive pressure or imitation process (Navaretti and Venables, 2013). Although contemporary literature focuses on the aspects and effects of FDI, which helps to better understanding of analyzing problematics from a microeconomic point of view, the quantification of individual effects or their determinants at the lower regional level is not dealt with at all. There is no standardized methodology to quantify the magnitude of spillover effects on the regional business environment, or whether the regional business environment has the potential to generate positive effects of spillovers.

However, the determinants of indirect positive effects of spillovers are known. These include, particularly, the size of the host market and the level of competition therein, the absorption capacity of domestic firms, the adaptability of workers, the institutional environment, foreign presence (FP) and the size of the technology gap (Görg et al., 2008).

The first to deal with research into the secondary impact of FDI on the host economy was Finlay (1978), who found out in his research that spillover effects are determined by so-called relative lagging, it means technology gap between parent and host economies. Finlay claimed in his work that the larger the technological gap, the greater the spillover effect. The author is based on the basic assumption that a foreign investor is always from a more advanced economy than the area where FDI locates.

On the other hand, Görg et al., (2011), Cantwell (2017) and Cohen and Levinthal (1990), modify opinions on the position of the factor of the technology gap and its effect on the spillover effects. From their conclusions follows that if the technology gap is too large, domestic enterprises are unable to transfer technology both in the horizontal (for example through the imitation effect of FDI) and in the vertical direction as well. A large technological gap may lead to a crowding-out effect when local businesses are not able to compete with FDI.

As with a significant technology gap, FDI can function as so-called cathedrals in the desert. In this case, they are large production plants that use relatively advanced technology (cathedral), with a sparse number of links to the host region (desert). The cathedral in the desert is also characterized by two subordinates - both ownership and management and decision-making, as well as subordination to production where such FDI provides only a certain stage of production. FDI perspectives depend on both the efficiency of production and the commercial success of the complete product (for example a car). For successful in the dissemination of knowledge (spillover effect), can be considered such regions without the dominance of these individual actors (cathedrals), but regions with a dense network of links between entities.

In the case of a significant technology gap, the positive spillover effect does not arise. Due to the size of the technology gap, the isolation of FDI will cause workers not to disseminate their knowledge and experience, which may be due to a fundamental separation of production and conceptual processes where the branch is fully subordinated to the headquarter in the parent economy. Massey (2007) sees the solution in providing a varied structure of job functions at all skill levels. However, this also raises the question of whether the qualifications structure and the employers' demands in the host labor market are reconciled.

On the other hand, too little technology gap does not allow for learning and technology transfer. Consequently, the most likely positive spillover effect may occur with the mild technological gap.

Kokko (1994, 1996, 2014) has dealt with finding a link between the degree of foreign presence and existence of spillover effects. Based on a competition analysis of the Mexican

case, he came to the conclusion that this relationship does not always exist. On the one hand, he found that the spillover effect does not occur in areas where are dominant MNCs, but on the other hand, in areas where the foreign presence is up to 50% and increases over time, this effect has been identified.

The degree of foreign presence in a region or industry is an indicator that affects a variety of factors, such as product differentiation, industry specialization or the role of global networks (Benáček, 2000, 2006).

Whether or not the effects will eventually occur does not only depend on the presence of foreign firms. The FDI localization itself is only a first step, the ultimate effect is mainly dependent on the interaction between domestic and foreign enterprises. It also follows from the above that the spillover effects are also conditioned by the mutual position of the companies (Kotíková and Čuhlová, 2016).

The aim of the contribution is to quantify the size of the technological gap between FDI that received an investment incentive and entrepreneurial environment in six regions of the Czech Republic in the time series from 2002 to 2014. To contribute to the expert discussion on the FDI impact on the regional business environment to a certain extent infills a gap in current economic research to assess the impact of FDI on the business environment of lower regional levels. Given the criterion of awarding investment incentives, the conclusions may also be used in the arguments relating to this type of public support.

2 Methods

FDI effects are examined on a sample of six regions of the Czech Republic. Respectively, impacts of FDI effects are identified within the business environment of the Pilsen, Carlsbad, Ústí nad Labem, Liberec, Hradec Králové and Pardubice regions (at NUTS 3 level). The common characteristics of these regions are the border position and the neighboring of regions. These are NUTS 2 Northeast, NUTS 2 Northeast and the Pilsen region. The Pilsen region appears to be a control case in the surveyed region sample. The Pilsen region was chosen as a control case due to unique position within Czech Republic. Given its strategic position it enjoys spillovers from well-developed Bavaria that are caused by both short distance, above-average level of infrastructure with Bavaria and long-term cooperation between entrepreneur environments. In comparison with other regions, in terms of contribution to GDP, concentration of business activity and FDI inflow, as well as the firm anchoring and continuous tradition of important industries it can be concluded that the greatest results of technology gap will be quantified in the Pilsen region (Czech Statistical Office, 2017). In these circumstances is possible to expect the best position of Pilsen region in analyzed set of regions, the opposite situation could indicate anomalies in the surveyed set of regions.

It is difficult to identify the effects of all FDI because of the lack of relevant data, but it is possible to rely on resources of CzechInvest, which files projects of foreign investors – applicants for investment incentives. The main source of data was statistics issued by the CzechInvest agency on investment incentives provision (CzechInvest, 2017). A secondary source is the financial statements and annual reports of foreign companies that have received a promise of investment incentives (Ministry of Justice, 2017). From the CzechInvest evidence, were obtained a list of FDIs including information on regional location, investor's country of origin, sector, accorded investment incentives, promises of the number of newly created jobs and other information. This information was subsequently extended by data on

the number of employees obtained from the annual reports by the analyzed company for each year of the analyzed period.

The CzechInvest agency (2017) states that as of January 1, 2017 out of a total of 1053 projects, 536 were foreign company projects. Of which 230, i.e. 43%, of them went to the surveyed region sample.

Foreign presence (FP) is the level of foreign investment in the economy, region or industry, expressed by the share of foreign companies' employment in total employment in the economy, region or industry (Görg and Greenaway, 2004). It must be borne in mind that this indicator does not correspond with degrees of inflows of FDI. The assessment of regions' attractiveness in terms of FDI inflows has a low perceptive value as it does not provide more detailed information on foreign investment. The indicator of FDI inflow into the region does not indicate the character of the investments, Respectively, does not reflect whether and to what extent it affects the local labor market. It does not show whether the regions have fully automated production with a sparse number of workers, whether the growth of the indicator has been achieved by the entry of new investors into the local market or by only increasing the value of the investment, etc. The foreign presence is therefore measured by the formula (1), which can at least partially eliminate these shortcomings through the monitoring of the number of employees (Kotíková, 2016).

$$FP = \frac{E_{FDI}}{E} * 100 \quad (1)$$

E_{FDI} is the number of FDI employees who have gained investment incentives in particular regions. E are employed persons according to Czech Statistical Office classification and statistics (Czech Statistical Office, 2017).

As noted above, the size of the gap is one of the major determinants of spillover effects, along with FP. Productivity of domestic and foreign companies is mutually determined. The amount of foreign company productivity on the host market leads to growth in productivity in domestic enterprises, and productivity growth by domestic enterprises will lead to increased technology transfer and increased productivity of other firms. In professional literature, the size of the technology gap for identifying spillover effects is measured by differences in labor productivity between the country of origin of the investor and the host economy (Ferenčiková and Fifeková, 2008). However, for the quantification of the technological gap at the regional level, it is necessary to modify this approach and to come down from the observation of the technology gap at the national level in terms of the host economy to the regional level.

The "Relative Regional Technology Gap of Foreign Presence" (RRTG) focuses on the difference between the productivity (technological advancement) of foreign companies that have received investment incentives and regional business environments. Based on the development of this indicator over time, it is possible to predict the dynamics of productivity growth in the future with a high level of foreign firms compared to a region with a low representation of these companies. The indicator, along with its values and values of individual components, indicates the lagging of the region, respectively selected groups of regions, from the technological level of foreign companies and identifies where this lag is generated:

a) in the width of lagging – the degree of foreign presence,

b) in the depth of lagging – in the difference in labor productivity.

A technology gap's development is calculated using the shift-share analysis method. It means decomposition of the technological level of the regions into a technological effect, the effect of employment and a combination of both effects. RRTG is calculated according to the formula (2):

$$RRTG_n = \frac{\sum_{i=1}^{r}(AP_{Li}^{FDI} - AAP_B^{reg}) \cdot FP_B^{reg}}{AAP_B^{reg}} + \frac{\sum_{i=1}^{r}(FP_i^{FDI} - FP_B^{reg}) \cdot AAP_B^{reg}}{AAP_B^{reg}} + \frac{\sum_{i=1}^{r}(AP_{Li}^{FDI} - AAP_B^{reg}) \cdot (FP_i^{FDI} - FP_B^{reg})}{AAP_B^{reg}} \quad (2)$$

where:

AP_{Li}^{FDI} is the productivity of foreign companies of the given country (OECD, 2017) (expressed as the FDI producer's country of origin) in the year n[1],

AAP_B^{reg} is the productivity of the benchmark (expressed as the arithmetic mean of the productivity of the surveyed regions[2]) in the given year n,

FP_i^{FDI} is the share of the employees of the foreign companies of the given country and the total number of employed persons in the region in the year n,

FP_B^{reg} is the benchmark of the share of employees in foreign firms in the surveyed regions in the year n (calculated as an arithmetic mean of the share of employees in the surveyed regions).

Although the size of the technological gap is usually quantified at higher regional levels (NUTS 0, NUTS 1), regarding of using of the shift-share analysis can be monitor differences in lower regional level (in this case at the level of business environment of the NUTS 3 level) and brings interesting findings about regional disparities at the lower regional level. Shift-share analysis is often used in professional literature to determine the dynamics of employment, labor productivity, or added value (Zdeněk and Střeleček, 2012). E.g. Maudos et. al. (2008) explain the changes in labor productivity through the intra sectoral effect, the static sectoral effect and the dynamic sectoral effect. This method recalls the decomposition of labor productivity changes with the rest. The authors dealt with labor productivity from 47 branches in the European Union (EU) and the United States (US). Esteban (2000), through shift-share analysis evaluates the multisectoral structure of labor productivity with regional differences at the national level of the EU.

In the Czech Republic, for example, Šimanová and Trešl (2011) used the method to pursue the development of the technology gap by decomposing the shift-share analysis into technological, sectoral and a combination of these effects. The benchmark was the productivity of the Capital City of Prague, respectively, the region with the highest productivity. Productivities of the four selected branches in the time series 1998-2008 were compared with this selected benchmark. In addition, for example, Zdeněk and Střeleček (2012) also used a method for assessing the development of labor productivity, average wage and employment in terms of regions and sectors for the period 2004-2008, when acceleration of economic growth was expected.

[1] Represents the labor productivity of foreign companies reported by the OECD at constant prices in 2010, where the rate of use of labor inputs is measured by the total number of worked hours.

[2] Measured in dollars; Czech National Bank exchange rate as at Dec. 31, 2010, USD / CZK = 18.751 (Czech National Bank, 2017)

The main advantage of the shift-share analysis method is its use at any regional level and the choice of assessed components. In the construction of formula (2) it is possible to trace its possible decomposition – respectively, it is formed as the sum of three components of the RRTG:

The first component – the productivity component – shows the extent of regional productivity lag behind the productivity of foreign firms. Given that it is a relative indicator in which construction in the denomination is the average region's productivity, the value should be understood as a relative value in the development. Specifically, this means that its reporting power is higher in the case of comparison to a selected set of regions. In the case of over-proportional growth of the average productivity of the regions (benchmark), this indicator should decrease over time, indicating a decreasing growth potential, but on the other hand a high absorption capacity of the knowledge and skills of the surveyed regions.

The second component – the employment component – is the share of the contribution of the relative difference in the technological level generated by the difference in FP size. The component shows the width of technological lag and the possibility of reducing it with the help of a high foreign presence in the region (see formula 1). If this component grows, it can be concluded that foreign firms with an investment incentive in the region collectively create a high number of jobs. The high number of jobs in these companies allows faster transfer of technological level and knowledge to the economic life of the region. However, in the context of the above mentioned, it is also necessary to bear in mind the following facts, which may help in interpreting the results of RRTG:

a) Component values may, even in excess of the over-proportional growth in productivity of the benchmark or the region itself, decline. Such development may signal many facts – for example: the region's lagging in the share of workers in companies with investment incentives behind the benchmark, the presence of countries with low productivity in the region.
b) Employment component values may be negative, even at a relatively higher level of the share of employees in the region compared to other regions of the benchmark, and lower than the productivity component. In this case, the region may have relatively higher productivity growth but also much higher dynamics or level of employment of companies with investment incentives in the region.

The third component is a combination of both the above-mentioned effects. This component summarizes the degree of interdependence of both effects. The described approach has to be taken in certain time and space with some assumptions (some are simplifying - but it cannot be fully included in the model, for example, the approach does not consider the absolute contribution of foreign companies to the region or abstracts from the interconnectedness of the regions). For final total values of the indicator, RRTG is valid:

The factor of the size of the technology gap can be understood both in the positive and the negative sense, depending on the construction of the indicator, by which the size of the technology gap is quantified. Due to the construction of the RRTG indicator, where the first member in the individual components always represents the FDI values and the values for the region are subtracted from them, it is necessary to understand the positive results of the indicator in the positive sense. The higher the value the region achieves, the higher the expected potential for creating indirect effects of spillovers. The higher the value of this indicator than in other regions, the higher the potential of technological growth (abstracted from growth constraints), compared to the comparator regions. The magnitude of the value is given by the number of foreign companies in the region, their technological level

(productivity of labor of their country of origin) and the share of these firms in regional employment. The amount of the RRTG is then determined by the number of newly arrived and remaining foreign companies to and in the region. More specifically, if the region has relatively more FDI with investment incentives, with a high rate of job creation (the region shows a high degree of FP) and FDI are from countries with advanced technology, then the region shows relatively higher potential for economic and technological growth than a region with low degree of FP, with a dwindling number of FDI jobs created and FDI are from countries with relatively low productivity of labor.

3 Problem solving

In this chapter attention is focused on the calculations and evaluation of the RRTG development in the selected group of regions. In terms of countries of origin, FDI investors in the analyzed regions are dominated by Germany and the United Kingdom (UK)[3]. Investors from these countries were represented in all regions.

The development of productivity of labor during the monitored period is shown in Tab. 1. The table shows that at the beginning of the monitored period, the Ústí nad Labem region was ranked third in the region's survey of productivity, but at the time of the increasing inflow of foreign investment with an investment incentive, it maintained a leading position along with the Pilsen region. This fact clearly confirms how vital it is for a region with economic and social problems to be able to offer investors the right conditions for doing business, for example in the form of investment incentives.

Tab. 1: Developments of labor productivity in the surveyed regions

Regions	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Pilsen	14.72	16.13	17.56	17.48	19.62	20.63	20.15
Carlsbad	13.28	13.57	14.5	14.59	15.5	17.17	16.76
Ústí nad Labem	14.39	15.71	16.73	17.75	19.04	20.54	20.47
Liberec	14.36	14.17	14.84	16.57	17.88	18.58	19.18
Hradec Králové	14.21	15	16.97	17.04	18.1	19.96	20.57
Pardubice	14.84	15.56	16.46	16.94	18.82	20.13	20.53
Benchmark (AAP_B)	**14.3**	**15.02**	**16.18**	**16.73**	**18.16**	**19.5**	**19.61**
Regions	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Mean**
Pilsen	21.4	20.75	21.2	21	21.84	24.24	19.75
Carlsbad	17.72	17.42	17.55	17.88	18.38	18.25	16.35
Ústí nad Labem	21.99	20.99	21.1	21.88	22.09	21.81	19.58
Liberec	19.28	19.42	19.82	21.5	21.59	21.75	18.38
Hradec Králové	20.73	20.96	20.91	21.02	21.79	23.86	19.32
Pardubice	20.57	20.66	21.33	20.5	20.46	20.57	19.03
Benchmark (AAP_B)	**20.28**	**20.03**	**20.32**	**20.63**	**21.03**	**21.75**	**18.73**

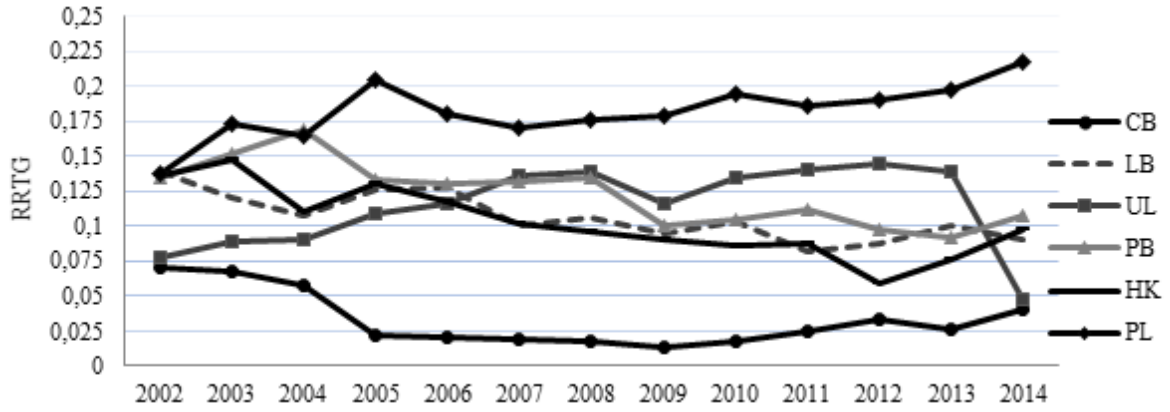
Source: Our own processing based on data of the Czech Statistical Office

[3] In the Pilsen region is located FDI from: Germany, France, Belgium, Switzerland, Spain, Austria, Italy, UK, Japan and from US. In the Carlsbad region from: Germany, Netherlands, UK, Switzerland, Sweden and from Japan. In the Ústí nad Labem region from: Germany, France, UK, Switzerland, Spain, Austria, Italy, Norway, Sweden, Israel, Netherlands, Luxembourg, Mexico, Japan, USA and from China. In the Liberec region from: Germany, France, Belgium, UK, Switzerland, Spain, Denmark, Japan and from US. In the Hradec Králové region from: Germany, France, Belgium, UK, Austria, Netherlands, Luxembourg and from US. In the Pardubice region from: Germany, France, UK, Switzerland, Spain, Italy, Netherlands, Denmark, India and from Japan.

In order to provide a clear picture of the development of the technology gap in the monitored regions, it is suitable to compare the development of the constructed RRTG indicator across all surveyed regions. The development of the RRTG and comparison of the RRTG of all observed regions is shown in Fig. 1.

With the development of the total value of the RRTG the highest rate of a technology gap was recorded throughout the Pilsen region. The difference in the ratio of the RRTG between the Pilsen region and the other regions, except for the Ústí nad Labem region, was rather deepening. The Ústí nad Labem region was the second and also the last region where the RRTG managed to increase over the period. Only in the last reference year did its RRTG drop sharply. The explanation for this is the sharp decline of the FP due to a change in the recruitment trend. The 3% decline in the Ústí nad Labem region in the last year of the survey was not caused by an outflow of investors. It was a new trend of recruitment through specialized agencies, most prominently in Ústí nad Labem and partly in the Hradec Králové region. In this case, hired workers are not employees of the company in which they work, but of agencies, and are not reported in FDI annual reports as permanent employees.

Fig. 1: Development of the RRTG of all analyzed regions



Source: Our own processing based on our own calculations from data of the OECD, Czech Statistical Office and annual reports of analyzed FDI

Other regions, at the time of the RRTG, decreased with the lows between 2007 and 2010 (the period of the financial crisis and the debt crisis in the Eurozone), and at the end of the period (2013-2014) with the RRTG renewal increasing signals. This trend can be correlated with the economic cycle, but this conclusion can be verified in the future when a longer time horizon is available and the Czech economy will go through another period of economic recovery and growth.

4 Discussion

In regions where the RRTG has seen a growing trend, it is possible to see above-average growth in labor productivity.[4] Conversely, the regions showing a decreasing or low level of the RRTG indicator had below-average growth in labor productivity (the Hradec Králové region was an exception to this rule). It can be said that the surveyed regions are able to use the emerging technology gap for their economic growth. Conversely, regions that are unable or

[4] It should be noted here that the dependence of the RRTG and labor productivity is both interrelated and positive. Thus, the RRTG growth can cause a labor productivity growth in the surveyed region and on the other hand a productivity growth in the region may create favorable conditions for further transfer of technological knowledge.

unwilling to attract investors from advanced foreign countries to their region are unnecessarily losing the possibility of economic growth from the transfer of technological knowledge.

Relatively interesting facts were found in the RRTG decomposition analysis. The decomposition, as described earlier, can be divided into three components – the productivity component, the employment component, and the component of combination of both effects. For the productivity component, the surveyed regions experienced similar developments. This was caused by the construction of the formula in which an average benchmark's productivity subtracts in the numerator and it is the denominator. Because it grew with higher dynamics than the productivity growth of companies from abroad, the component had to have a declining shape. However, this development illustrates the region's ability to absorb and exploit emerging technological gaps for its economic growth.

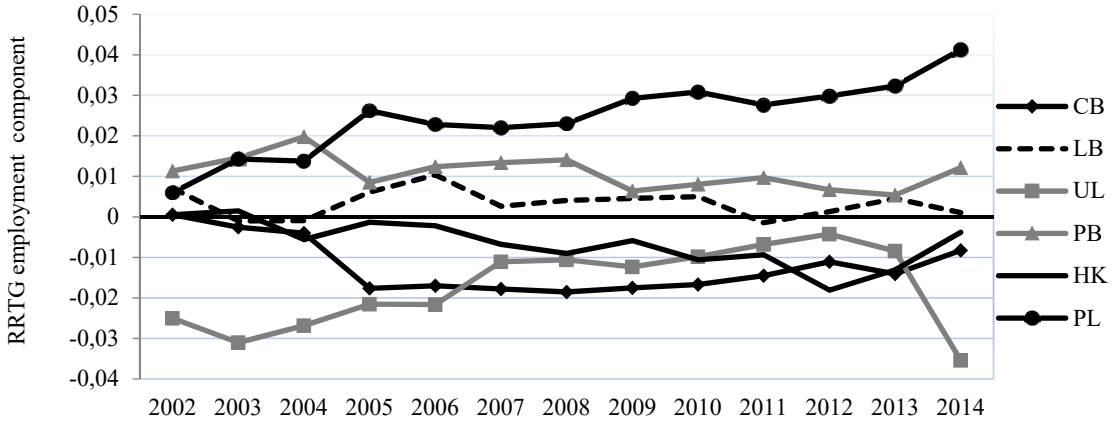
The development of the productivity component was, however, influenced by the different situations in the surveyed regions. E.g. while the Ústí nad Labem region generated the value of the component mainly by a high proportion of foreign-owned firms with an investment incentive, on the other hand the Hradec Králové region showed higher than the above-average values due to high labor productivity (among countries of origin of FDI the dominant and highly above-average Luxembourg).

The low values of the Carlsbad region are due to the low interest of foreign investors in the creation of new jobs in the region (the lowest share of FDI in total employment from all analyzed regions) and the composition of the investing countries (among them countries with below-average productivity compared to other developed countries – Japan, UK).

The behavior of the employment component curves for the individual surveyed regions is more varied. The shape of these curves reflects the development and shape of the RRTG curves constructed for each region (see fig. 2).

The dominance of the Pilsen region, which was able to attract enough foreign companies from highly developed countries, who were interested in creating new jobs, is quite clearly confirmed. The opposite is the Carlsbad region with a small number of FDI, which made up a small share of regional employment. A very interesting development can be seen in the Ústí nad Labem region. The region has seen a growing RRTG curve, which has had a positive effect on the region's productivity growth, among other things, thanks to the fact that there were high total employees' shares in FDI that received investment incentives recorded in the region. The employment component curve is at one of the lowest levels between the surveyed regions. This is because employment in FDI with an investment incentive in the region has been accompanied by a significant spread of foreign firms. Thus, technology transfer has gone through a significantly higher set of incoming FDI.

Fig. 2: Development of the RRTG employment component in the monitored regions



Source: own processing based on own calculations from data OECD, Czech Statistical Office and annual reports of analyzed FDI

In the Pilsen region, the depth of employment was formed by a small spread of companies and countries. More specifically, the growth of the RRTG in the Pilsen region is more driven by the intensity of the use of the technology gap, and the growth of the RRTG in the Ústí nad Labem region is being driven by extensive use of the technology gap brought by the FDI into the region.

Conclusion

The use of the shift-share analysis method to calculate the size of the technological gap represents to a certain extent the filling in of the missing space in the current research concerning the competitiveness of the regions and the impacts of the FDI on the business environment of the Czech Republic. Although there are known determinants that support the emergence of FDI effects, there is no general methodology to quantify which region has great potential for effects to occur. One of the key determinants for determining whether there is potential for the spillover of FDI effects in a host environment is the size of the technology gap. Using the above described methodology, it is possible to specify which region has the greatest potential for spillover effects in terms of the technology gap. At the same time, it is also possible, by using a benchmark, to compare the regions within the group. More precisely, to determine which regions are below average compared to average benchmark values and which, on the contrary, are above average benchmark values.

Going down to the level of the regions in the calculation of the size of the technology gap, results in a better presentation and evaluation of the situation in the business environment, because the chosen methodology works with data from the annual reports of concrete localized FDI. It means the evaluation of the economic level that FDI directly affected. Another advantage of the chosen approach is easy modification. The selected group of regions can be extended practically indefinitely, both in terms of the number of regions and the length of the time series. The main drawback is the time-consuming data collection, which generally involves working with annual company reports connected with each analyzed year.

In the current form of the indicator within the evaluated group of regions, the highest potential of technological growth was identified in the Pilsen region. This is not a surprising result due to the economic position of the region within the evaluated group. On the contrary, the lowest was identified in the Carlsbad region. The main reason for the overall low level of the RRTG in the Carlsbad region is above all the small representation of companies in the

region, which is also borne by a small share of employees of foreign companies, there is low degree of the FP. In view of the fact that the level and dynamics of the development of labor productivity in the Carlsbad region (see Tab. 1) were lower than in other regions, the development of the RRTG (especially between 2002 and 2009) represents a bad signal and the finding that the region almost always lacked the opportunity of so-called "economic locomotives" in the form of benefits from the possibility of transferring technological level from more advanced foreign companies.

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References

Benáček, V. (2000) Přímé zahraniční investice v české ekonomice. *Politická ekonomie*, 48 (1), pp. 7-22. DOI 10.18267/j.polek.100

Benáček, V. (2006). The rise of the 'grand entrepreneurs' in the Czech Republic and their contest for capitalism. *Sociologický časopis*, 42 (6), pp. 1151-1170.

Blomström, M., Kokko, A. (2001) Foreign direct investment and spillovers of technology. *International Journal of Technology Manage bment,* 22 (5-6), pp. 435-454. DOI 10.1504/IJTM.2001.002972

Cantwell, J. (2017). Innovation and international business. *Industry and Innovation*, 24 (1), pp. 41-60. DOI 10.1080/13662716.2016.1257422

Cohen, W. M., Levinthal, D. A. (1990) Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35 (1), pp.128 – 152. DOI 10.2307/2393553

CzechInvest (2017). Investiční pobídky. [online]. Investiční pobídky. Available at: http://www.czechinvest.org/investicni-pobidky-czechinvest [Accessed 7. 1. 2017].

Czech National Bank (2017). Kurzy devizového trhu. [online] Česká národní banka. Available at: https://www.cnb.cz/cs/financni_trhy/devizovy_trh/kurzy_devizoveho_trhu/denni_kurz.jsp [Accessed 30. 5. 2017].

Czech Statistical Office (2017). Statistické ročenky. [online]. Katalog produktů. Available at: https://www.czso.cz/csu/czso/katalog-produktu [Accessed 7. 3. 2017].

Esteban, J. (2000) Regional convergence in Europe and the industry mix: a shift-share analysis. *Regional Science and Urban Economics*, 30 (3), pp. 353-364. DOI 10.1016/S0166-0462(00)00035-1

Finlay, R. (1978). Relative Backwardness, Direct Foreign Investments and the Transfer of Technology: A Simple Dynamic Model. *Quarterly Journal of Economics*, 92 (1), pp. 1-16. DOI 10.2307/1885996

Ferenčiková, S., Fifeková, M. (2008) Foreign Direct Investment Spillovers in Slovakia. *Ekonomický časopis,* 56 (9), pp. 855-872.

Görg, H. et al. (2008). Productivity spillovers through vertical linkages: Evidence from 17 OECD countries. *Economics Letters,* 99 (2), pp. 328-331. **DOI** 10.1016/j.econlet.2007.07.015

Görg, H. et al. (2011). Spillovers through backward linkages from multinationals: Measurement matters! *European Economic Review*, 55 (6), pp. 862-875. DOI 10.1016/j.euroecorev.2010.10.002

Greenaway, D., Görg, H. (2004) Much I do about nothing? Do domestic firms really benefit from foreign direct investment? *World Bank Research Observer*, 19 (2), pp. 171-197. DOI 10.1093/wbro/lkh019

Kokko, A. (1994). Technology, Market Charakteristics, and Spillovers. *Journals of Development Economics*, 43 (2), pp. 279-293. DOI 10.1016/0304-3878(94)90008-6

Kokko, A., Tingvall, G. P. (2014) Distance, Transaction Costs, and Preferences in European Trade. *International Trade Journal,* 28 (2), pp. 87-120. DOI 10.1080/08853908.2013.830941

Kotíková, S. (2016) T he Foreign Presence as a Determinant of Creation of Spillover Effects of Foreign Direct Investment. *Ad Alta: Journal of Interdisciplinary Research, 6 (1),* pp. 32 – 36. WOS 000384792600007

Kotíková, S., Čuhlová, R. (2016). Foreign Presence, Cultural Distance and Technology Gap as Indicators of Globalization in the Czech Republic. *In: 16th International Scientific Conference Globalization and Its Socio-Economics Consequences.* Žilina: University of Žilina, pp. 337 – 344.

Massey, D. (2007). In what sense a regional problem? *Regional Studies*, 41 (1), pp. 49-59. DOI 10.1080/00343300701232181

Maudos, J., Pastor, J. M., Serrano, L. (2008) Explaining the US–EU productivity growth gap: Structural change vs. intra-sectoral effect. *Economics Letters*, 100 (2), pp 311-313. DOI 10.1016/j.econlet.2008.02.017

Ministry of Justice (2017). Veřejný rejstřík a sbírka listin. [online]. eJustice. Available at: http://www.justice.cz [Accessed 11. 2. 2017].

Mišun, J., Tomšík, V. (2002) Does Foreign Direct Investment Crowd in or Crowd out Domestic Investment? *Eastern European Economics*, 40 (2), pp. 38–56.

Navaretti, G. B., Venables, A. J. (2013) Multinationals and industrial policy. *Oxford Review of Economic policy*, 29 (2), pp. 361 - 382. DOI 10.1093/oxrep/grt016

OECD (2017). Level of GDP and productivity. [online] OECD Statistics. Available at: http://stats.oecd.org/Index.aspx?DataSetCode=PDB_LV [Accessed 27. 5. 2017].

Pavlínek, P., Žížalová, P. (2016) Linkages and spillovers in global production networks: firm-level analysis of the Czech automotive industry. *Journal of Economic Geography*, 16 (2), pp. 331-363. DOI 10.1093/jeg/lbu041

Šimanová, J., Trešl, F. (2011) Vývoj průmyslové koncentrace a specializace v regionech NUTS3 České republiky v kontextu dynamizace regionální komparativní výhody. *E + M Ekonomie a Management*. 14 (1), pp. 38 – 52. DOI 000296411900004

Zdeněk, R., Střeleček, F. (2012) Hodnocení vývoje zaměstnanosti, průměrné mzdy a produktivity práce pomocí shift-share analýzy. *E + M Ekonomie a Management*, 15 (3), pp. 4 – 15.

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