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# Innovations as Factor of Absorptive Capacity of FDI Spillovers across Regions of Russian Federation\*

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**Abstract.** We study how innovations affect increase of regional total factor productivity (TFP) as a result of productivity spillovers from foreign direct investment (FDI), and confirm the presence of phenomenon in Russian data. TFP is modeled using data envelopment analysis (DEA) with the human capital, energy and capital as inputs, and the gross regional product as output. We develop innovations index for the regions of the RF, proxying for regional absorptive capacity, based on 17 variables, characterising economic, social and infrastructural aspects of regional development. FDI variable accounts for spatial distribution of FDI flows.

**Аннотация.** Мы исследуем, как инновации влияют на повышение совокупной производительности факторов (СПФ) в регионах в результате прямых иностранных инвестиций, и подтверждаем наличие феномена в российских данных. СПФ моделируется методом оболочечного анализа с человеческим капиталом, потреблением энергии и капитальными инвестициями в качестве входов и валовым региональным продуктом в качестве выходов. Влияние инноваций отражается при помощи специально разработанного индекса, основанного на 17 переменных, характеризующих экономические, инфраструктурные и социальные аспекты регионального развития.

**Keywords:** FDI spillovers, Data Envelopment Analysis, innovation indexes, regional development, international trade.

## 1. INTRODUCTION

The issue of foreign direct investments and their effects on the host countries, especially in respect of productivity spillovers, has been widely discussed in recent years. Naturally, the largest attention was paid to the emerging markets and developing economies. Although large body of research was accumulated, the evidence from Russia is rather scarce. Even though there are several studies that focus on Russia as a whole, no attempt has been made to investigate the regions of the Russian Federation. However, such research can provide important evidence from both science and policy perspectives. The present paper proposes research of the effects FDI have on regional productivity, the existence of spillover effects and the role, which the regional

absorptive capacity plays in these processes. Most researches nowadays agree that foreign direct investments boost local productivity in the form of spillovers; however, the extent to which the productivity can be increased is determined by the absorptive capacity of the given region. Therefore, modeling the absorptive capacity and implementing the results in researching FDI spillovers is essential for obtaining consistent results. The present paper discusses these issues in more detail and provides investigation of FDI spillovers over the regions of Russia.

Given the two megatrends taking place in Russia today, namely, the recent joining to the WTO and the official government's position regarding fostering innovation in the country, the present research seems to be rather relevant. First, the findings are

\* Инновации как фактор поглощающей способности переливов продуктивности в регионах Российской Федерации.

likely to provide valuable policy implications regarding fostering innovations and managing FDI in the region. Moreover, the research will help in identifying the best and the worst regions-outliers. The following hypothesis will be tested in the course of the present paper: the innovations absorptive capacity of the region affects its ability to absorb FDI productivity spillovers.

The rest of the paper is structured in the following way: section 2 provides an overview of the phenomenon of FDI spillovers followed by the literature review and evidence on the FDI spillovers from emerging markets; section 3 introduces the Index of Innovations Absorptive Capacity for regions of the Russian Federation. Section 4 provides the description of the model, the specification of the regression and the obtained results. Section 5 concludes.

## **2. DETERMINANTS OF FDI ABSORPTIVE CAPACITY ACROSS THE WORLD: META-ANALYSIS OF EVIDENCES FROM EMERGING MARKETS**

FDI is a transfer of capital across borders, which allows the receiving economy to increase investment beyond its savings rate. Traditionally, development economics have focused on this addition to the capital stock as core contribution of foreign investment to economic development (e.g. Lall and Streeten, 1977). FDI is a particularly appreciated source of capital because it has a more long-term character than portfolio investment, and direct investors make a stronger commitment to the host economy. It cannot be withdrawn quickly if the volatile environment goes through an economic downturn, such as the exchange rate crises in Mexico 1995, East Asia 1997 or Russia 1998. However, foreign investor's commitment comes at a price as investors expect high returns on high-risk investments, in the longer term this leads to capital outflows in terms of profit remittance or interest payments, which are reflected in other positions of the balance of payments. In recent years, scholarly attention has moved to the impact of international trade and FDI on economic growth in the host economy through productivity effects.

FDI spillover is an increase of total factor productivity of firms, regions or industries that are exposed to foreign direct investment to larger extent than the others. However, productivity rises even in the firms not obtaining FDI themselves. The reasons for this observation are knowledge and training obtained by employees of firms exposed to FDI, changes in staff and other communication arising

between FDI and non-FDI firms in the region. The key factor determining the associated positive FDI external effect is the absorptive capacity of a firm, region or industry. It is worth mentioning that researches in recent years have paid much attention to the effect, which FDI has on the productivity of domestic firms in emerging economies. Notably, most studies agree that usually foreign firms from developed countries are technologically more advanced and possess stronger management skills, and both features can be transferred to or repeated by domestic firms in emerging economies. These effects referred to as spillovers are treated as positive externalities that provide benefits to domestic firms due to the presence of FDI, leading to increase in productivity of domestic firms.

In recent years a lot of research was undertaken on the issue of spillover effects in innovation or knowledge production, especially in emerging economies. Generally, the findings of studies on FDI spillovers in emerging economies are mixed. There are many studies confirming existence of positive FDI spillover effects, for example, such evidence was found in the researches undertaken by Blomström, 1986; Buckley, Clegg, and Wang, 2007; Tian, 2007; Wei and Liu, 2006. Yet there are as well many works suggesting that FDI either leads to no spillover effect or even negatively affects productivity of domestic firms in emerging markets.

This section reviews existing studies on FDI spillovers in emerging markets, discusses models and approaches and summarizes the results. The review is organized in the following way: first, the general studies of spillovers will be discussed, followed by the review of the researches examining FDI spillovers in emerging economies, structured according to the region.

### **2.1. OVERVIEW OF GENERAL STUDIES ON FDI SPILLOVERS**

One of the first studies undertaken by Findlay (1978) suggests that FDI can lead to productivity increases in the host country due to the knowledge and management techniques diffusion to local firms. Worth mentioning is the research conducted by Lipsey (2002), which highlights that it is not sufficient to evaluate overall FDI contribution to home country productivity without undertaking any detailed analysis, examining factors determining productivity spillovers.

Several important studies were contributed to investigating mechanisms of FDI spillovers occurrence. The first mechanism refers to the demonstration effect, in this case domestic firms have an

opportunity to observe foreign firms' technologies and management practices and increase their productivity by imitating those practices (Blomstrom and Kokko, 1998). The second mechanism deals with building domestic linkages. First the knowledge from the FDI-firm subsidiary diffuses to domestic suppliers and distributors, and afterwards it can be adopted by domestic firms dealing with the same suppliers and distributors (Spencer, 2008). Thirdly, spillovers can result from employee turnover. When former employees of FDI-firms start working for domestic firms, the knowledge they obtained in foreign firms can be transferred to domestic ones. The fourth option is associated with increases in competition in the market after FDI-firms entrance. These increases force domestic firms to increase productivity, for example, by improving management standards or obtaining more technologies, in order to stay competitive in new circumstances (Blomstrom and Kokko, 1998). However, the research undertaken by Aitken and Harrison in 1999 suggests that the fourth mechanism, on contrary, may lead to decreases in domestic firms' productivity in case of demand shifts from them towards foreign firms or if the entrance of FDI-firms leads to increases in costs of production factors, such as labor.

The studies undertaken by North (1991) and Ghemawat (2003) suggest that there is a positive association with the divergence of FDI host countries and the spillover effects as domestic firms are able to absorb wider range of technologies and business practices. This fact is confirmed by researches made by North (1991) and Wan and Hoskisson (2003), suggesting that technological and strategic activities of firms differ among countries. Empirical study undertaken by Van Wijk, Van den Bosch, and Volberda (2001) confirms that the wider the spectrum of available knowledge, the higher is the propensity of local firms to absorb it. Moreover, due to different technological and management practices brought by international firms from various countries, the total "bank" of industry knowledge leads to economies of scope and scale, thus increasing the abilities of local firms to combine the knowledge elements for their benefit (Zhang and Li, 2010). Another important factor, noticed by Cohen and Levinthal (1990) is the absorptive capacity of the firm, or, to put it more simply, its ability to recognize the value of new technologies, management practice and knowledge and implement it to extract benefits.

In 2006 M. Kugler published the research on the likelihood of intra-industry and inter-industry spillovers. He argues that inter-industry spillovers are more likely to occur than the intra-industry ones,

as the international firms tend to prevent technology leakages to competitors. Thus, the productivity spillovers between non-competing or complementary industries are more likely. The data from Colombian Manufacturing Census was merged with FDI information from Central Bank transaction records to perform econometric analysis. The research results confirm existence of limited intra-industry spillovers and widespread inter-industry spillovers, associated with diffusion of technology, knowledge etc. to the firms, holding downstream and upstream positions relative to MNC subsidiary.

## 2.2. STUDIES OF FDI SPILLOVERS IN INDIA

Another research, conducted by M. Ghosh and S.S. Roy (2013), was analyzing FDI spillovers in India for the period 1991–2010. Their sample included more than 8000 firms in the following industries: textiles and garments, chemicals, metals and metal product, machinery and transport equipments. The results of the study suggest that FDI spillovers significantly affect technological strategies of Indian manufacturers as well as dependency on foreign technologies.

## 2.3. FDI SPILLOVERS IN AFRICAN COUNTRIES

Worth mentioning is the study undertaken by Thiam Hee Ng (2007) that focused on the FDI spillover effects in fourteen Sub-Sahara countries, namely, Benin, Botswana, Congo, Cote d'Ivoire, Gambia, Ghana, Malawi, Mauritius, Nigeria, Senegal, Seychelles, Togo, Tanzania and Zambia. Total factor productivity estimates from UNIDO on the country level and the FDI as a share of GDP were used to perform Granger causality test on the whole sample and the Toda-Yamamoto version of the Granger causality test on the sample of 8 countries characterized by non-stationary FDI inflows. The research results suggest only weak evidence of increases in TFP associated with FDI in two countries, namely, Botswana and Congo. Another important finding is the fact that FDI contributes more to the transfer of "soft" knowledge, like managerial or organizational skills, than to "hard" knowledge that forces technological changes. In addition, the study results suggest that FDI *per se* do not increase productivity, and other factors are important and should be considered.

Another research, undertaken by S. Ghali and S. Rezgui (2011) focused on FDI productivity spillovers in Tunisia. The DEA method was used to assess the sample of 674 manufacturing firms for the period 1997–2001, which can be treated as a representative one. The findings suggest the presence of

technology spillovers at the firm level, but provide no evidence of horizontal spillovers.

#### 2.4 EVIDENCE FROM LATIN AMERICA

The study undertaken by M. Blomström in 1989 was focused on 145 Mexican industries, in which both domestic and FDI firms are presented. Blomström analyzes and compares performance of domestic and foreign firms of similar size, the study focuses on labor productivity, capital-labor ratio, wage level, wage share of value-added and profitability. The industries are grouped according to specialization into: light consumer goods, intermediates, consumer durables and capital goods. The findings suggest that labor of international firms possess some intangible assets, which lead to their significantly higher productivity. The studies also confirmed the existence of spillover efficiency by means of regression analysis. In addition, the research identifies competitive pressure as the spillover transmission mechanism; however, their results did not support the hypothesis that FDI accelerates technology transfer.

Another interesting research was undertaken by Rajneesh Narula and Anabel Marin in 2005 and dealt with investigating the relationship between direct and indirect FDI spillovers in Argentina, based on the surveys for two periods 1992–1996 and 1998–2001. The authors examine limited spillover effects observed in Argentina despite the findings of multiple studies in other economies. The study suggests that there exist direct spillover effects in the form of human capital employment and development, however, no significant evidence of indirect spillovers was found. The results of this study also show that FDI *per se* do not contribute to higher economic growth, and spillover effects arise only in case domestic industry has sufficient capacity to absorb the externalities associated with FDI.

#### 2.5. FDI SPILLOVERS IN EUROPEAN DEVELOPING COUNTRIES

An interesting research was conducted by Priit Vahter (2011) regarding FDI spillovers in Estonia. He used the data on the whole population of Estonian manufacturing firms for the period 1995–2004 along with panel data set from two CIS surveys on innovation-related variables. The goal of the study was to examine the relationship between FDI entry and FDI share and total factor productivity of domestic firms. The findings suggest that there is no short-term association between FDI and increase in productivity of domestic firms; nevertheless there is a positive relationship between FDI and the follow-

ing innovation activities of domestic firms. Moreover, FDI inflow intensifies derivation of knowledge in the home country. In general, the research proves the existence of knowledge spillovers associated with FDI; however, these flows do affect the short-term productivity.

#### 2.6. EVIDENCE FROM CHINA

In general, there are numerous studies on FDI spillovers in China due to multiple factors. First, China has experienced large inflow of foreign direct investments during recent years. Second filing company data with the Chinese National Bureau of Statistics (CNBS) is obligatory for all Chinese firms, therefore large and consistent data sets are available for Chinese enterprises. In addition, it is worth highlighting the recent success in development and growth exhibited by China, therefore, this country definitely attracts the attention of researchers.

At first this section briefly presents the main conclusions of several studies and then focuses on some more recent researches in greater detail. The examination of Chinese provincial-level panel data for the period 1999–2008 carried out by Sang and Yue (2011) revealed the important role of FDI spillovers in encouraging independent innovation development by Chinese companies. These results confirmed similar findings obtained in studies undertaken by He and Xu (1999) and Yao and Zhang (2001). Another valuable research was undertaken by Zhang and Sun (2011) to evaluate the effect of four factors namely the level of human capital, the domestic R&D input, the perfection level of institutions, and the level of economic development on import trade and FDI spillovers. The obtained results prove the importance of those factors in fostering FDI spillovers in East China only. The influence of difference in FDI levels among regions was investigated by Xuan and Li (2010) using the data on thirty provinces for the period 1990–2007. The results suggest that FDI spillover effects depend on local absorptive capacity and the degree of FDI involvement in the regional economy.

The study undertaken by Yan Zhang, Haiyang Li, Yu Li and Li-An Zhou in 2008 is the first attempt to examine the effect of heterogeneous FDI arising from different countries on productivity of domestic firms in emerging economies. The authors complemented the data from the Annual Industrial Survey Database (1998–2003) of the Chinese National Bureau of Statistics (CNBS) with the information from the Foreign Direct Investment Enterprise Database. In the course of research, 3 hypotheses were tested and supported by the data: the diversity of FDI

country origins positively influences the productivity of industry domestic firms; this relationship is stronger for large domestic firms than for small ones; moreover, the strongest association is found for intermediate technology gap between international and domestic firms.

Another study, undertaken by Sizhong Sun in 2010 focused on export FDI spillovers in Chinese manufacturing industry for the period from 2000 to 2003. The firm-level data was analyzed using a Heckman sample selection model. The FDI lead to both export spillovers in participation and in export intensity decisions. The spillover effects are affected by firms' absorptive capacity and learning efforts and therefore are heterogeneous across firms.

Worth mentioning is the research conducted by Xiaowen Tian, Vai Io Lo, Shuanglin Lin and Shunfeng Song in 2011 examining the panel data set on 11 324 Chinese manufacturers. The study results suggest that intra-region FDI spillovers are generally positive; however, inter-industry ones can be both negative and positive. In general, negative spillovers affect the firms in backward periphery, but not the advanced growth pole firms. Moreover, the domestic firms in the growth pole are typically able to acquire benefits from FDI-firms in the periphery via products they sell. In general, the research supports evidence that FDI lead to spatial spillover effects, which are contributing to regional inequalities in emerging economies.

One of the most recent studies was undertaken by Hao Xu, Difang Wan, and Ying Sun in 2014. The authors used panel data on the coastal provinces of East China for the period 2001–2010, and arrived at the conclusion that the effects of FDI technology spillovers were insignificant, but their effects crucially depend on regional absorptive capacity.

## 2.7 FDI SPILLOVERS IN SOUTHEAST ASIA

The research performed by Takii (2004) suggests that the productivity of foreign firms in Indonesia is higher than that of local firms, the differences are attributed to the degree of foreign ownership. Another work by Takii and Ramstetter (2000) investigating productivity differences between international and domestic firms in Thailand, Malaysia and other Asian countries did not provide evidence of existence of significant differences. However, cross-sectional studies on Taiwan (Chuang and Lin, 1999), Indonesia (Sjoholm, 1999, Takii 2005), and Thailand (Kohpaiboon, 2005), report positive spillovers from foreign presence. Blalock and Gertler (2004) carried out a research on Indonesian data and found evidence of vertical, mainly upstream, spillovers, but

not horizontal ones. Noor Aini Khalifah and Radziah Adam Malaysia in 2009 researched the data derived from *Annual Survey of Manufacturing Industries of Malaysian* for the period 2000–2004, and concluded that there is no influence of FDI on local labor productivity. Yasuyuki Todo and Koji Miyamoto studies Indonesian manufacturing firms for the period 1994–1997; their findings suggest existence of intra-industry knowledge spillovers from R&D international firms to local firms, but no evidence of similar spillovers from non-R&D firms.

## 2.8 EVIDENCE FROM RUSSIA

The existing research on FDI spillovers in Russia is rather limited, in large extent due to lack of reliable and comparable data. Nonetheless, there are some studies worth mentioning. One was carried out in 2000 by Yudaeva, Kozlov, Melentieva and Ponomareva, and focused on investigating the effect of foreign direct investment on productivity. The authors used the data derived from the Registry of Foreign Owned Firms, and the Russian Enterprise Registry Longitudinal Database (RERLD) combined with GNOZIS database information for missing values. The results of the study suggest that the productivity of foreign firms is higher than that of the local ones. In addition, the research shows that the FDI effect on domestic firms' productivity depends on both location and size of domestic firm: small enterprises located in the same region are forced by foreign firms' entrance to decrease outputs; however, middle-size enterprises tend to increase outputs. These findings constitute an indirect evidence of FDI spillover effects existence. In addition, the research suggests that regions with higher level of education are more exposed to FDI spillover benefits. Another research made by Yudaeva *et al.* (2003) provides rather detailed study of FDI in Russia. The analysis of the data for 1994–1998 provides evidence that foreign firms in Russia are more than twice as efficient as the local ones. Moreover, the study suggests the existence of positive and significant spillovers from international to local firms. Worth mentioning is a relatively recent research carried out by Irina Tytell and Ksenia Yudaeva in 2005, focused on four developing economies, namely, Russia, Ukraine, Poland, and Romania. The research finding suggests the existence of foreign firms' productivity superiority only in less corrupt regions, while no significant advantage is present in highly corrupt regions. Particularly in Russia negative spillover effects are observable in less corrupt regions. In addition, worth highlighting are the positive spillovers that export-oriented international firms generate on local ones.

### 3. THE INDEX OF INNOVATIONS ABSORPTIVE CAPACITY OF REGIONS OF RUSSIAN FEDERATION

The total of 17 indicators are used to measure innovations absorptive capacity of Russian regions, each value being ranked from the lowest to the highest, and the corresponding score from 1 for the lowest value to 83 for the highest was assigned. Consequently, the assigned values, which can be treated as scores of a region for each indicator, were used to construct the Sub-Indexes and the main index. The Index of Innovations Absorptive Capacity of regions of Russian Federation is composed of four Sub-Indexes: the Business Activity Sub-Index, the Innovation Activity Sub-Index, the Regional Industrialization Sub-Index and the Social Welfare Sub-Index. All four sub-indexes are discussed further in more detail.

#### 3.1. THE BUSINESS ACTIVITY SUB-INDEX

The Business Activity Sub-Index reflects the entrepreneurship environment and consists of 5 equally weighted indicators:

- Business activity: The business activity level measured as the number of enterprises per 1000 citizens;
- Small business turnover: The turnover of small and medium businesses scaled to the region's GRP;
- Small business investments: The volume of investments into small businesses scaled to the region's GRP;
- Capital investments: The volume of capital investments scaled to the region's GRP;
- FDI: The volume of foreign direct investments scaled to the region's GRP.

The business environment plays an important role in determining innovation capacity. If the level of entrepreneurship activity is low, then there is practically no one to implement the innovation output. Therefore, the higher is the value of the Business Activity Sub-Index, the higher is the total innovation capacity of the region. The Business Activity Sub-Index is embodied in the total Index with the weight of 30%, chosen empirically.

#### 3.2. THE INNOVATION ACTIVITY SUB-INDEX

The Innovation Activity Sub-Index is designed to measure efforts put into the process of innovation. The indicators include:

- Innovation activity of organizations: Innovation activity of enterprises measured as the percentage of firms undertaking technological, marketing and organizational innovations;

- Patents: The number of patents scaled to the population;
- Technology production: The number of technological advances developed in the region scaled to the population;
- Technology usage: The number of technological advances put into practice in the region scaled to the population;
- Science: The number of enterprises undertaking scientific research and development activities scaled to the population.

All the indicators are equally weighted under the framework of the Innovation Activity Sub-Index. The ability to adopt and implement innovations is of crucial importance for the innovation capacity, as recognized by most researches. Therefore, the Innovation Activity Sub-Index is introduced to the total Index with the weight equal to 40%.

#### 3.3. REGIONAL INDUSTRIALIZATION SUB-INDEX

The Regional Industrialization Sub-Index is formed by four equally weighted indicators:

- Electricity production: the amount of electricity produced in the region in millions kW per hour, scaled to GRP;
- Electricity consumption: the amount of electricity consumed in the region in millions kW per hour, scaled to GRP;
- Automobile roads density: the density of paved roads for public use per 1000 square kilometers, in case the data for a particular region is unavailable, the figure for the Federal District is used;
- Railway roads density: the density of railway roads for public use per 1000 square kilometers, in case the data for a particular region is unavailable, the figure for the Federal District is used.

The industrialization of the region plays an important role in determining the innovation capacity. Electricity consumption is traditionally used as an indirect measure of economic activity. The density of roads plays a crucial role particularly in Russia, where there are numerous territories that are difficult to access. The Regional Industrialization Sub-Index is embedded into the total Index with the weight of 15%.

#### 3.4. THE SOCIAL WELFARE SUB-INDEX

The Social Welfare Sub-Index is presented by the half difference of the scores for the average salary level and the level of corruption, and embedded into the total Index with the weight of 15%. The following argument justifies the inclusion of both factors into the Social Welfare Sub-Index.

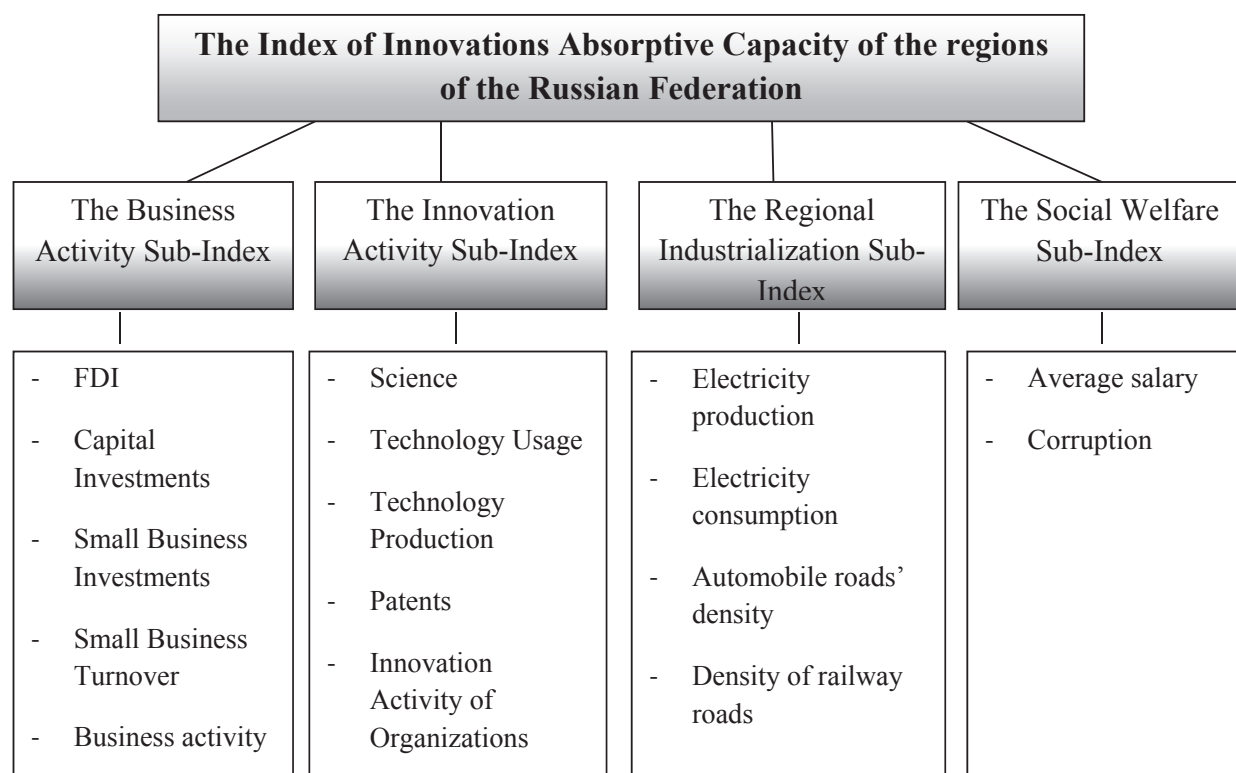


Figure 1. The structure of IACI for RF.

The higher salary in a particular region is the result of higher level of economic and business activity. Consequently, corruption also arises in those regions. First of all, this notion implies the existence of business at the given territory that corrupt officials are able to get bribes from. Secondly, the existence of so-called “kickback” that entails the return of certain amount of money in order to obtain a contract or state funding implies the allocation of state funding for some business activities, therefore there should exist some substantial number of enterprises. The third type of corruption arises inside firms when managers of middle-level making purchase decisions are able to collude with suppliers and make decisions maximizing their own return instead of firm’s profits. This fact implies that the business if of substantial size so that it is run by hired managers whose actions are not transparent and cannot be fully controlled by the owners.

Although the list of aforementioned factors is definitely not exclusive their assessment allows to construct a meaningful index and to make comparisons. Most likely the Index of Innovations Absorptive Capacity of regions of Russian Federation would benefit from introduction of additional meaningful indicators chosen with care and properly scaled.

The structure of the Index of Innovations Absorptive Capacity of regions of Russian Federation is shown at the Figure 1.

### 3.5. DATA SOURCES

All the data, except for the corruption, was derived from the official Rosstat statistics. The data for each indicator was available for the period 2007–2011; consequently the Index was calculated for each year of the given period. The main advantage is therefore the implementation of “hard” data; the whole 100% of all indicators are represented by actual figures and therefore not subject to perception bias. The official statistical data is, unfortunately, characterized by two main limitations: very narrow scope of available relevant indicators and far from ideal representation of underlying phenomena due to various reasons, one of the most important being the substantial share of shadow economy not reflected by the figures. Nevertheless, we can assume that the data limitations are evenly distributed among the regions and therefore do not significantly affect the ability of the Index to allow meaningful comparisons. The data on corruption is derived from the ranking made by the organization “Bezopasnoe otechestvo” on the corruption in the area of state purchases in 2013. Although there is no data for the corruption in each year under consideration, the data for 2013 is a good



**Table 1.** The IACI for RF results.

Region	Ranking 2007	Ranking 2008	Ranking 2009	Ranking 2010	Ranking 2011
Sverdlovskaya Oblast	2	1	2	2	1
Nizhegorodskaya Oblast	1	2	1	1	2
Magadanskaya Oblast	4	14	15	4	3
Novosibirskaya Oblast	8	4	8	8	4
Tomskaya Oblast	7	6	4	7	5
Tatarstan Republic	3	7	5	3	6
Chelyabinskaya Oblast	13	5	12	13	7
Moskovskaya Oblast	11	9	6	11	8
Karelia Republic	27	38	34	27	9

proxy due to the following argument. The example of Singapore, where the economy is highly democratic, while the state politics can be described as the dictatorship, shows that the level of corruption can be significantly decreased during a short period of time such as 10 years. However, the case of Russia does not seem to be similar to Singapore. It is more likely that Russia's case is closer to that of Europe, namely gradual step-by-step changes. From this point of view the Europe's current state of corruption is the result of developments over the course of 300 years. Therefore, any changes, which took place during 7 years, will account to approximately 2% of changes, which can definitely be neglected taking into account the overall level of data preciseness. The corruption ranking was constructed to measure the level of corruption in the area of government purchases among the regions of Russian Federation. The data was derived from the official statistics presented on the government website and includes 6 indicators:

- The existence of justified claims;
- The existence of tenders with a single application;
- The existence of procedures due to which only one applicant was accepted;
- The existence of auctions with decreasing bid of less than 5%;
- The existence of auctions in which the principal rejected to sign a contract with the winner;
- The existence of quotes requests for purchases of the same product for the amount exceeding 500 thousand rubles (breaking up the order), which violates the order of the Ministry of Economic Development #273 of 07 June 2011.

Table 1 shows the top-10 regions according to their rank in 2011 as well as the respective results for the years 2007–2010.

As can be inferred from the Innovations Absorptive Capacity Index of regions of Russia the regions

on the top of the ranking, namely Sverdlovskaya and Nizhegorodskaya oblasts, remain the same over the last 5 years. This result is determined largely by the high score in the Innovation Activity Sub-Index, reflecting the fact that many patents were registered in those regions as well as the high level of technology production and implementation. Moreover, both regions enjoy central geographical location and consequently well-designed infrastructure, which is reflected by the high score in the Regional Industrialization Sub-Index. In addition, worth highlighting is the progress made by the Magadanskaya Oblast over the time period under consideration. This result can be attributed to the dramatic increase in both the Business Activity Sub-Index and the Innovation Activity Sub-Index score made from 2009 to 2010, which reflects the rapid development of the region.

The bottom part of the ranking is unfortunately also very stable with the last 5 positions constantly filled by the regions of Russian South, namely Dagestan, Chechen Republic, Ingushetia, Karachay–Cherkess Republic and North Osetia–Alania. All 5 regions scored very poorly in all 4 sub-rankings, although it is worth mentioning that the scores obtained by Dagestan are 3–5 times higher than those obtained by Chechnya. The obtained results are actually not surprising as those regions are poorly developed, obtained highest scores in the corruption ranking, allow limited access of women to participation in the economic and business activities due to religious reasons, moreover, the regions suffered (and still suffer) from high-level of emigration to other regions of Russia and abroad.

On the whole the Innovation Absorptive Capacity Index of regions of Russia provides a rather clear picture of Innovation Absorptive Capacity and its distribution over the territory of Russia.

#### 4. FDI SPILLOVERS IN RUSSIA

The local TFP was modeled using the DEA (Data Envelopment Analysis) in the following way: the region is treated like a “black box” transforming the inputs it can use into the outputs that is the gross regional product. Thus the region can be viewed as a function transforming the human capital (the economically active population was taken as a proxy), electricity consumption and capital investment into the GRP. Consequently the GRP is a function of human capital, electricity and capital investments.

The FDI spillovers were modeled by undertaking the following procedures. First, the ratio of the volume of sales of FDI firms to the total industry sales in the region was calculated. Then the average value for all industries was taken. The sum of regional FDI variables with the FDI variables of the neighboring regions was taken and multiplied by the squared distance. The regions were treated as neighboring only if they possess common borders. The innovations absorptive capacity was introduced in the second section of the current paper.

The panel data regression of the following form was used:

$$TFP_{it} = \alpha + \beta_{it}^T INNOV_{it} + \beta_{it}^T HFDI_{it} + u_{it}$$

where TFP stands for total factor productivity, INNOV is the Innovation Absorptive Capacity Index and HFDI is the FDI spillover, where subscript *i* denotes the region and subscript *t* denotes the period,  $u_{it}$  is the disturbance term with 0 mean. The one-way (individual) Random Effect Model was estimated. The effects are considered to be random as the variation across regions is assumed to be random and not correlated with any other variables presented in the model.

Coefficients :

	Estimate	Std. Error	t-value	Pr(> t )
(Intercept)	0.4250613	0.0832936	5.1032	5.189e-07 ***
INNOV	-0.0078176	0.0011148	-7.0126	1.013e-11 ***
HFDI	0.7747339	0.1632257	4.7464	2.895e-06 ***

All the coefficients are shown to be significant; moreover the R-Squared, the coefficient of determination representing how close the regression is to its fitted line, is equal to 0.16, which is a good value for this type of models. In addition, it is worth

highlighting the very small p-value, therefore one can definitely conclude the hypothesis of neutrality of FDI and Innovations Absorptive Capacity towards the TFP. The obtained results provide support for the null hypothesis that is the existence of FDI spillover effects. The coefficient for the innovations absorptive capacity is negative, although, this result seems highly counterintuitive; the following reasoning provides an explanation. The effect of foreign direct investment on the TFP of the regions with low innovations activity is the highest exactly because of low innovations that is because of the high but not yet realized potential. Therefore FDI in this case act as the trigger for this potential. The following argument is also important: although Russia possesses highly developed human capital in terms of education and general approach to citizens' development, which is largely the heritage of Soviet period, as well as rather developed infrastructure also remaining from Soviet times, there is very limited knowledge regarding the management policies and the practical implementation of those assets in the present reality. Consequently, the FDI presence forces the development and transformation processes.

The obtained results suggest the following implications for the policymakers. Firstly, the policy should be aimed at attracting foreign direct investments, especially to the regions of highest potential, namely, those in which the innovations level is low. Therefore, encouraging foreign presence in such regions will be beneficial for the regional growth and respectively for the total country's economic growth. The policymakers' actions may include decreasing barriers of entry, beneficial fiscal policies, such as tax exemption and other incentives attractive for foreign investors. Moreover, it would be beneficial for the total economic development and growth to support and promote factors fostering innovations absorptive capacity.

#### 5. CONCLUSIONS

In the course of the present paper the research on FDI spillover effects in the regions of the Russian Federation was undertaken. Previous studies provided limited evidence on this issue. The conducted research suggests the following:

FDI spillovers do occur in the regions of Russia; moreover, the corresponding regression coefficient is statistically significant. Therefore, we can conclude that higher volumes of foreign direct investments should lead to higher productivity and, consequently, boosted economic growth;

The Innovations Absorptive capacity does affect the total factor productivity. However, the corresponding regression coefficient is negative, although, statistically significant. This fact implies that the regions with lower innovation activity levels that consequently possess higher innovation potential are the ones that benefit more from FDI.

Aside from the findings, the paper introduces the Innovations Absorptive Capacity Index for regions of the Russian Federation. The Index allows ranking the regions according to their respective innovations absorptive capacity and making meaningful assessments and comparisons.

The future research would provide valuable insights in the following directions: supplementing the Innovations Absorptive Capacity Index by the additional data and modifying it respectively; undertaking regression analysis of the data not only for the neighboring regions, but also for the inter-region associations, as many economic and business links are based not only on geographical proximity, but also on business interests. Likely, interesting results may be obtained taking into account the large volume of economic links built from and to Moscow. In addition, valuable insights can be provided by testing the data on inter-regional investments and respective spillover effects.

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