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INVESTIGATING THE RELATION BETWEEN INNOVATION AND FDI IN THE EU MEMBER STATES

Empirical studies

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Abstract

In the world of knowledge economy and competitiveness in which we live today, the economic growth is built on innovation. Our interest in the present paper is to find if innovation is a factor that shaped the attractiveness of EU location for foreign investors during the economic crisis. In this respect, we use the Pearson correlation coefficient. We find weak correlation between innovation and FDI stocks at the EU level during 2006-2013, with a higher and significant correlation between the two variables in the new EU countries until 2009. We do not find significant correlations in the old member states, probably because the group of member states is too heterogeneous. Also, we obtain significant positive correlation only in 11 countries out of 28, without identifying any preference related to the EU adhesion moment.

1. Introduction

We live in the world of a knowledge economy, where the economic growth is built on innovation. The importance granted to innovation is not only a regional or national matter, but an European and even global one.

EU puts innovation at the roots of its sustainable growth. The importance of innovation at the EU level is emphasized by the creation of Directorate-General (DG) for Research and Innovation (RI). This means the EU places RI on the same level of importance as the Agricultural Policy or the Economic and Financial Affairs. Moreover, the EU has a RI policy that aims to implement (European Commission, 2015).

Also, innovation is one of the targets of the Europe 2020 strategy. The EU is aiming to have 3% of its GDP invested in research and development until 2020, as a method for enhancing growth and creating jobs.

Innovation proved to be an efficient tool for overcoming the crisis. In the "Innovation Union – Competitiveness Report 2013", the then Commissioner for Research, Innovation and Science, Máire Geoghegan-Quinn, stated that investing in innovation proved to be an efficient tool for recovery after the economic crisis. Countries that invested in innovation and reformed their innovation system managed to obtain better results than the countries that were not concerned with this issue, to improve their productivity and create jobs (European Commission, 2014a). The Innovation Union is one of the seven initiatives of Europe 2020 strategy meant to transform Europe into a region where innovation is promoted both in the private and in the public sector and to represent a way of working for the public institutions.

Innovation affects each sector. The mere definition of innovation according to the EU extends this notion to almost all activities: "Innovation refers to the creation of new or significantly improved products, processes, marketing and organisation that add value to markets, governments and society." (European Commission, 2013, p.4).

Innovation is no more an issue economies can ignore (Atkinson, 2013). This is why the author advocates for a strategy focused on removing the obstacles to innovation and supporting the systems needed for providing innovation.

Innovation represents a long-term interest for the international organizations. The World Economic Forum developed a report meant to support entrepreneurs through facilitating the access to innovation (World Economic Report, 2014). In this way, less developed countries have the chance to catch up, while the most developed ones could continue to improve their innovation programmes. Also, United Nations Economic Commission for Europe (UNECE, 2015) provides Innovation Performance Reviews for countries, in order to draw public policy measures for stimulating innovation.

Innovation is the future of the EU. "Europe's future is connected to its power to innovate" (European Commission, 2013, p.2).

In this paper, we are interested if innovation is a factor that shapes the attractiveness of an EU location for foreign investors. In this respect, the rest of the paper is divided as follows: in the first part we investigate the literature for identifying the relationship between innovation and competitiveness and between innovation and FDI. We firstly assess the relation between competitiveness and innovation because in the view of some authors, FDI inflows and outflows can be perceived as indicators of an internationally competitive country (Mitschke, 2008). In the second part we present our methodology for assessing the relationship between innovation and FDI at the EU level and we discuss the results. In the last part we draw several conclusions.

2. Literature review

2.1. Innovation and competitiveness

The relation between competitiveness and innovation is clearly expressed in the long-term objective established for 2020 by DG RI. The EU is aiming to "Make Europe a better place to live and work, by developing and implementing R&I policy to improve Europe's competitiveness, boost its growth, create jobs, and tackle the main current and future societal challenges." (European Commission, DG RI, 2015, http://ec.europa.eu/research/index.cfm?pg=dg).

Also, the relationship between innovation and competitiveness can be seen in the multitude of definitions for competitiveness. Theorists have not reached to a widely accepted definition for the notion of competitiveness (Smit, 2010; Criste et al., 2008). It still seems that innovation is could be found at the roots at this concept, according to several definitions.

For example, Buckley et al. (1988) consider that competitiveness is based on three dimensions: the competitive performance, the competitive potential and the competitive process. At least in the competitive potential there are several variables that could point to innovation, such as the technological development or the skills of the labour force.

Fagerberg (1988) builds its competitiveness definition on two pillars: the capacity to compete especially in terms of technology and the delivery capacity.

Momaya (1998) also takes into account three facets of competitiveness: the competitive assets, where he includes technology or human resources, the competitive processes where research and development synergies are included and finally the

competitive performance, which is related to productivity, quality or effectiveness both of human resources and technology. Variables expressing innovation could be found at each level.
The competitiveness framework developed by Kharlamova and Vertelieva (2013) is of such nature that the two authors consider that countries are in a situation where the need for innovation is continuous and the low level of technological development must be overcame.
Moreover, Fu (2007) considers that "technological capabilities are a key component of competitiveness at national, regional or firm levels" (p. 3).
Also, several empirical studies points to a direct relationship between innovation and competitiveness.
Iosif (2014) considers that innovation is directly related to competitiveness due to its strong impact on productivity. In a research at the EU level testing for the relationship between competitiveness and the variables expressing innovation according to the Innovation Union Scoreboard 2014, the author finds, through multiple regressions, that human resources, intellectual assets and finance and support have a positive and significant impact on countries' competitiveness.
Davo et al. (2011) test the connection between technological innovation and competitiveness at the EU-15 level using cluster analysis in the 1998-2008 period. The authors prove that countries performing better in technological innovation will achieve higher levels of competitiveness.
Furman et al. (2002) introduce the concept of national innovative capacity representing the ability of a country "to produce and commercialize a flow of new-to-the world technologies over the long term" (p. 900). The authors argue that focusing on expanding the national innovative capacity is able to enhance a country to increase its high-technology exports.
But we also find significant studies that point to the importance of competitiveness for attracting FDI, as in Castro (2000), Rugman and Verbeke (2001), Dunning and Zhang (2008), Popovici and Calin (2012a).

2.2 Innovation as a determinant for FDI

Most of the studies are searching for the impact of FDI on innovation and technology regardless the geographic location of the country: in China (Cheung and Lin, 2004; Fu, 2007) or Taiwan (Lin and Lin, 2010), Mexico (Peters, 2009), India (Mondal and Pant, 2014) or in Kenya and Nigeria (Ola-David and Oyelaran-Oyeyinka, 2012).
Fu (2007) investigates the impact of FDI on innovation. Using a panel dataset over the 1998-2004 period, the author demonstrates that FDI in China lead to the increase of its regional innovation capabilities but only to the extent of an important local absorptive capacity. Peters (2009) find a quite similar result for the effects of FDI on innovation in Mexico, accusing the low level of competitiveness of Mexican firms for their lack of engagement in producing and processing innovation. The same is true for the firms in the manufacturing sectors from Kenya and Nigeria, according to Ola-David and Oyelaran-Oyeyinka (2012). Mondal and Pant (2014) demonstrate that the presence of foreign firms in India is more desirable for enhancing efficiency than buying foreign technology. This still depends on the absorptive capacity of the firms and on the degree of the environment's competitiveness. However, Cheung and Lin (2004) find positive effects of foreign firms on innovation, which is expressed as the Chinese patent applications. Lin and Lin (2010) reach a similar result for firms in Taiwan.
FDI is attracted by a large set of determinants (see, for example, Magai, 2012). The wide diversity of FDI determinants led to additions to existing FDI theories or to the development of new ones (Popovici and Calin, 2014b).
We are interested weather foreign investors are searching for locations with high innovative levels. Theoretically, efficiency or strategic asset seeking FDI would prefer such host locations. These types of FDI require special attention as they are able to enhance competitiveness of countries by searching the hi-tech sectors, which is the main interest of the EU, according to its sustainable growth strategies. At the same time, these types of FDI are searching for locations which can provide high innovation. For example, efficiency-seeking FDI are interested in location advantages such as infrastructure, technological development and institutions providing support for development (Rugman and Verbeke, 2001). Strategic asset-seeking FDI are attracted by a location rich in technological assets or macro-innovative, entrepreneurial and educational capabilities (Dunning, 2004).
Lansbury et al. (1996) tests if the innovation capacity, expressed as the number of patents, is significant for attracting FDI. The authors find a positive and significant relationship between innovation and FDI flows over the period 1991-1993.
Guimon (2007) concludes that, in order to attract FDI intensive in research and development, the host country innovation policy must be coordinated with the interest of the inward investment promotion policy. The conclusion is drawn after analysing the cases of Spain and Ireland. Among the innovation policy determinants that can be used to attract FDI, the author emphasizes the role of financial and fiscal incentives for R&D activities, the development of the human capital and of the research infrastructure or the regime of property rights. A similar conclusion is obtained in Popovici and Calin (2014a), as regards the new EU member states.

Other studies have also emphasized the role of governments and public policies in positively affecting determinants that attract FDI (Paul et al., 2014; Popovici and Calin, 2012b; Bevan et al., 2004; Dunning, 2004).
We find the theoretical foundation for innovative locations being attractive for FDI. We are interested now if this relationship is true for the EU member states.

3. Methodology and results

In order to find if the innovation level in the EU countries represent a factor for attracting FDI, we use the Pearson coefficient for establishing the existent correlations. For assessing FDI, we use the FDI stocks per capita expressed in US dollars, as provided by UNCTAD. We use the per capita value instead of the nominal value for removing any distortions that could make our results unbiased and for having comparable values.
For assessing the innovation level, we use the Innovation index provided by the EU in its Innovation Union Scoreboard (European Union, 2014c). This is a composite index, based on eight dimensions that are grouped into three types. The first type is that of ***Enablers***, that is composed by three dimensions: Human resources, Open, excellent and attractive research systems and Finance and support. The second type is that of ***Firm activities***, also formed by three dimensions: Firm investments, Linkages and entrepreneurship and Intellectual assets. Finally, the last type is the ***Outputs*** one that contains two dimensions: Innovators and Economic effects. In their turn, each of the eight dimensions is formed by specific and measurable indicators.
We also want to test two new innovation indicators, the Innovation Output Indicator and the Knowledge-intensity of the economy, provided in the European Commission's (2014b) report "Research and Innovation performance. Innovation Union progress at country level in the EU" from 2014. We have data for these two indicators only for 2012, as they were launched by the European Commission in 2013. The Innovation Output Indicator is useful due to its composition meant to measure the extent to which innovation is implemented in the market. In this respect, four dimensions are assessed: the number of patents as a way for expressing the growth due to technology, the number of jobs in knowledge intensive sectors, the volume of trade in mid or high-tech commodities as an expression for the competitiveness of goods and services that are highly innovative and the number of jobs in innovative and fast-growing firms.
The second indicator is the Knowledge-intensity of the economy, composed by eight structural change indicators divided into five dimensions: research and development, skills, sectoral specialisation, international specialisation and the internationalisation dimension.
We assess the correlations during the crisis period, namely between the 2006-2013 period. We calculate the Pearson coefficient for both the entire EU in the mentioned period and for each country. Also, we split the sample of 28 countries according to their accession to the EU into the newest EU (NEU) countries and oldest EU (OEU) countries. The group of the NEU countries is formed by 13 countries, while the OEU group comprises 15 countries. In this way, we can assess for which group of countries innovation is more important as a determinant of FDI. Finally, based on the results obtained, we group the countries by the importance of innovation as a determinant of FDI.
A positive result of the Pearson coefficient will indicate a positive relationship between innovation and FDI. Therefore, we can assume that innovation represent a determinant for FDI, which is in line with our expectations. A negative result will indicate a lack of correlation between the two variables. Also, the value of Pearson coefficient will also show the strength of the correlation. A value closer to 1 will indicate a stronger positive relationship, while a result closer to 0 will indicate a lack of correlation. Furthermore, a value of over 0.8 is meaning a very strong positive correlation, values between 0.6-0.79 a strong correlation, values between 0.4-0.59 a moderate correlation, while values between 0.2-0.39 weak correlation and under 0.2 a very weak correlation.
The results for the whole EU are presented in Table 1. We obtain positive and significant relationship between the innovation index and the FDI stocks per capita in all the analyzed years, except for 2010. More precisely, the results are statistically significant at 10% except for the year 2011. We find a weak correlation between innovation and FDI at the EU level. In 2006 we obtain the highest value of the correlation, of 0.4, which indicates a moderate correlation. It seems that the crisis had a strong impact as regards the importance of innovation as a determinant for FDI because, interestingly, the correlations results are increasingly weaker starting with 2006 until 2010. It is very possible that during this period, another determinants to gain greater importance for foreign investors, such as the risk of the country, the macroeconomic conditions or even the capacity to implement structural reforms, as already seen in the literature. Starting with 2012, the correlation stars to increase gradually and, as regards its strength, it is around the level registered in 2007.
For the NEU countries, innovation seems to have a greater impact for attracting FDI than for the EU as a whole (Table 2). We still find significant results only during 2006-2009. Our Pearson coefficient is statistically significant at 5% for the first four analyzed years. As the crisis was felt later in the

Central and Eastern European countries, we can observe that the significance of the correlation between the two coefficients lasts until the beginnings of the crisis in this region. Afterwards, the intensity of the correlations decreases and loses its statistical significance. The relationship is not restored even in the last years of our analysis. As the big part of the investments in this region are not efficient or strategic asset–seeking, but more market and resource-seeking, we can consider that foreign investors are more interested in the macroeconomic wealth of these countries, namely in having their economic structure on solid bases, such as reformed economic sectors or less corrupt institutions in order to make less risky investments. Also, we cannot consider that the opportunities of doing business are so important for these countries that the foreign investors to overlook a weak economic structure. Hewko remarks that the transition countries offered the possibility of some important privatizations, which were more attractive for the foreign investors than a "perfect" legal system (Hewko, 2002). This is not the case anymore.

Interestingly, the FDI in the OEU countries are not depending on the level of innovation (Table 3). We do not find statistically significant results for our variables in none of the analyzed years. One explanation – and probably the most suitable – is that this group of countries is very heterogeneous. Another valid explanation is that, given the fact that these countries already reached and provide a certain level of innovation, foreign investors are more interested in other variables, such as the easy access to innovation, the cost of the innovative products and processes and so on.

In order to clarify this issue, we also test for correlations between FDI and Innovation Output Indicator, respectively Knowledge-intensity of the economy. The two indicators are available only for 2012. The first indicator points to the output of the innovation on the market. We find a moderate correlation between FDI and this variable at the EU level, but a lack of statistical significance when tested on the NEU and OEU countries (Table 4). This means that the group of countries is quite heterogeneous, and that there are countries in each group in which the two variables are correlated, but the division between the old and the new EU member states has no relevance in studying this case.

FDI are more correlated with the indicator of Knowledge-intensity of the economy, showing that foreign investors are interested to invest in sectors where innovation gains an increasingly important role. Yet, there is no difference between the NEU and OEU countries, as the strength of the correlations is almost similar for the two groups. We should pay attention to the fact that the last dimension of the Knowledge-intensity of the economy – the internationalisation one – is formed by taking into account the changes in the inward and outward FDI stocks as percentage of GDP.

We also calculate the correlation coefficients for each country during 2006-2013. In Table 5 we present only the statistical significant results. We obtain significant correlation only in 12 countries out of 28. In six countries we find very strong positive correlation and Lithuania is in the top, with the highest Pearson coefficient. In this group of countries, four of them are old EU member states. The second group is formed by five countries, out of which three are new EU member states. This means that the economies that joined the EU later are starting to be interesting for foreign investors as long as they focus on innovation. Contrary to our expectation, Greece is the only country in which we find strong negative correlation between innovation and FDI stocks per capita. Still, taking into account the fact that our time period is focused on the crisis years and that Greece was the most affected, we can assume based on the results that innovation did not matter at all for foreign investors. Therefore, even if Greece had a small increase in innovation during these years, the economic turbulences materialized in the highest degree of risk in the whole Europe had a greater impact on investors.

4. Conclusions

We obtain weak correlation between innovation and FDI stocks at the EU level during 2006-2013. Moreover, in 2011, innovation does not present interest for foreign investors any more at the EU level. Instead, we find a moderate correlation between FDI and Innovation Output Indicator, respectively Knowledge-intensity of the economy at the EU level in 2012.

It is very possible that during this period, characterised by the economic and financial crisis, the interest of investors moved on a careful assessment of the risk of the countries, the macroeconomic conditions or even the capacity to implement structural reforms. Moreover, as seen in the literature, it is possible that the absorption capacity for innovation in these countries decreased.

We find a higher and significant correlation between innovation and FDI in the NEU countries until 2009, which reinforces our previous assumption that during the hardest years of crisis, foreign investor were more interested in the macroeconomic wealth of these countries. The opportunities of doing business in the NEU countries do not surpass the risk of investments in these locations.

We do not find significant correlations between FDI and innovation in the OEU countries, probably because the group of member states is too heterogeneous.

When calculating the correlation coefficient for each of the countries during 2006-2009, we obtain significant positive correlation only in 11 countries out of 28. There is no preference as regards the age of EU membership, since there are 5 NEU countries and 6 OEU countries where we find significant correlations between the two variables.

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Table 1. Pearson correlation coefficients for the whole EU during 2006-2013

	2006	2007	2008	2009	2010	2011	2012	2013
Pearson	0.40024	0.381054	0.36975	0.355417	0.320038	0.292743	0.377874	0.38927
p value	0.03484	0.045466	0.05283	0.063457	0.096902	0.130652	0.047463	0.040651

Source: author's own calculations

Table 2. Pearson correlation coefficients for the NEU countries during 2006-2013

	2006	2007	2008	2009	2010	2011	2012	2013
Pearson	0.55433	0.603884	0.692929	0.609428	0.422002	0.349098	0.330699	0.384685
p value	0.049324	0.028872	0.008649	0.027034	0.150898	0.2425	0.269904	0.194432

Source: author's own calculations

Table 3. Pearson correlation coefficients for the OEU countries during 2006-2013

	2006	2007	2008	2009	2010	2011	2012	2013
Pearson	0.227399	0.234147	0.221047	0.222505	0.166716	0.141445	0.23722	0.268394
p value	0.415242	0.401037	0.428632	0.425424	0.552649	0.615198	0.394648	0.333614

Source: author's own calculations

Table 4. Correlations' results between FDI stocks/capita and Innovation Output Indicator and Knowledge-intensity of the economy in 2012

Correlation between FDI and:		Innovation Output Indicator	Knowledge-intensity of the economy
EU	Pearson	0.431855	0.592523
	p-value	0.021762	0.000893
NEU	Pearson	0.384515	0.594648
	p-value	0.194558	0.032089
OEU	Pearson	0.326628	0.591774
	p-value	0.23479	0.02015

Source: author's own calculations

Table 5. Pearson correlation coefficients at country level during 2006-2013

Country	Pearson	p value	Strength of correlation
Lithuania	0.884149	0.003562	Very strong positive correlation
Ireland	0.878604	0.004076	
Germany	0.869724	0.005004	
Spain	0.834402	0.00999	
Estonia	0.807566	0.015358	
Sweden	0.801324	0.016806	
Latvia	0.793585	0.018745	Strong positive correlation
Slovakia	0.703137	0.051725	
Austria	0.672912	0.067434	
United Kingdom	0.658665	0.075746	
Bulgaria	0.625109	0.097468	
Greece	-0.76077	0.028638	Strong negative correlation

Source: author's own calculations