OECONOMIA
COPERNICANA

2017 VOLUME 8 ISSUE 4, DECEMBER

p-ISSN 2083-1277, e-ISSN 2353-1827
www.oeconomia.pl

ORIGINAL PAPER

Citation: Zygmunt, A. (2017). Innovation activities of Polish firms. Multivariate analysis of the moderate innovator countries. *Oeconomia Copernicana*, *8*(4), 505–521. doi: 10.24136/oc.v8i4.31

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Received: 28 March 2017; Revised: November 3 2017; Accepted: 17 November 2017

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Innovation activities of Polish firms. Multivariate analysis of the moderate innovator countries

JEL Classification: *O30; O52; R11*

Keywords: *innovation activities; firm; the European Union; moderate innovator countries*

Abstract
Research background: The uncertainty in the environment and rapid changes have impact on firms, regions and countries. The necessity to adapt to new conditions requires a stimulation of actions aimed at enhancing competitiveness and economic growth. In this respect, the European Union strategy called Europe 2020 should be mentioned. Regarding the role of firms' innovation activities in economic growth of regions and countries, substantial importance was attached to how innovation activities of Polish firms differ from those from the other EU countries with a level of innovation similar to Poland. Here, a particular emphasis was put on moderate innovator countries.
Purpose of the article: The aim of this paper is to investigate Polish firms' innovation activities against those by other moderate innovator countries.
Methodology: In the study a multivariate analysis and zero unitarization methods were applied. These methods allowed for a division of moderate innovator countries into four groups and for a multivariate analysis of firms' innovation activities in Poland and other EU countries with a level of innovation similar to Poland. The study was based on data from the European Innovation Scoreboard 2016 relating to dimensions of firm activities: firm investments, linkage & entrepreneurship and intellectual assets. The study referred to the period 2008–2015.
Findings & Value added: This paper contributes to the existing literature by providing new insight on understanding the issues related to firms' innovation activities. The analysis has

revealed several conclusions. One of them indicated the highest distance of Polish firms to those from the other moderate innovator countries, in terms of SMEs innovating in-house, innovative SMEs collaborating with others and public-private co-publications. The findings have practical and policy implications. It is assumed that the obtained results may be useful for firms, regions and countries in adaptation to uncertainty in the environment and, therefore, in maintaining competitive advantage capacity.

Introduction

The dynamic environment impacts on countries, regions and firms. In circumstances of rapid changes and uncertainty in the environment, competitiveness contributes to economic growth. For this reason, stimulation of actions aimed at enhancing competitiveness is crucial. Such actions are noticeable in the European Union strategy Europe 2020. Here, special attention is paid to smart, sustainable and inclusive growth with a strong emphasis on creation of the conditions for a more competitive economy (European Commission, 2016, p. 4).

As has been widely argued, an important driver of competitiveness is innovation. Innovation stimulates economic growth of countries and regions (see: e.g. Acs *et al*., 2016, pp. 527–535; Kondratiuk-Nierodzińska, 2016, pp. 451–471; Furková & Chocholatá, 2017, pp. 9–24) and is crucial for firms' performance (see: e.g. Naranjo-Valencia *et al*., 2016, pp. 30–41). The ability of innovation to foster competiveness of countries, regions and firms is emphasized especially by endogenous growth theory and knowledge spillovers theory. Against this background, regions should support firms to stimulate innovation and develop cooperative relationships for faster diffusion of knowledge spillovers. This argument is built on the acknowledgment of a simultaneous relationship between innovation and regions, and firms as a key to economic growth (see, e.g., Huggins & Williams, 2011, pp. 909–910). Such a relationship highlights the importance of firms' innovation processes. Based on this reasoning, a particular emphasis should be put on firms' innovation activities as the core to build a competitive advantage of firms, regions and countries. Considering the importance of the issue, research attention has focused essentially on the indicators of firms' innovation activities within a country and the influence of country and political institutions' activities in question (see: e.g. Żelazny & Pietrucha, 2017, pp. 43–62; Balcerzak & Pietrzak, 2016, pp. 66–81; Amoroso, 2017, pp. 93–120).

Concerning the above, it is very important to explore how innovation activities of firms differ among countries. Therefore, this paper focuses on the multivariate analysis of Polish firms' innovation activities and other

European Union countries. Hence, the aim of this paper is to investigate Polish firms' innovation activities against those from other moderate innovator countries. The study specially addresses moderate innovator countries to understand how innovation activities of Polish firms differ in relation to firms from the EU countries distinguished by a level of innovation similar to Poland.

The study was carried out under theoretical and empirical analysis of the problem based on a related literature review and data gathered from the European Innovation Scoreboard (EIS), which provides information about innovation performance in the European Union member states. The time period is 2008–2015.

The paper is organized as follows: The first part presents a brief overview of the literature on the innovation activities of firms. The second part discusses how information from the European Innovation Scoreboard is used to examine innovation activities of Polish firms in comparison to those from other moderate innovator countries. This part also presents the methods used for analysis. The next part provides the results, and the last part concludes the paper.

This paper contributes to the existing literature by providing new insight on understanding of the issues related to firms' innovation activities. To understand the differences in firms' innovation activities between countries from the moderate innovators group, a multivariate analysis and zero unitarization method were applied. The application of these methods enabled a division of the EU countries with a level of innovation similar to Poland, according to the level of indicators of firms' innovation activities. It is very important in the context of firms', regions' and countries' adaptation to the dynamic environment and the needs of regional policy to support competitiveness enhancement.

Theoretical background and hypothesis development

Since the early to the current state of literature on innovation, a strong emphasis has been put on innovation activities as an important determinant of firms' survival (see: e.g. Naranjo-Valencia *et al*., 2016, pp. 30–41). Without doubt, contemporary firms operate in a dynamic environment. The high impact of rapid changes on firms' performance and uncertainty in the environment make it necessary to adapt to new conditions. Hence, keeping up with changes seems necessary to maintain competitive advantage capacity. From this point of view, innovation activities "become mandatory, a life-and-death matter for the firm" (Baumol, 2002, p. 1).

The dynamism in the environment changes spans the interest in innovation activities from the firms level to regional and national levels. In this respect, firms' innovation activities play a critical role in economic growth of regions and countries. Thus, innovation activities of firms become an important driver of innovation and competitiveness. This issue is particularly salient and highlighted in endogenous growth theory and knowledge spillovers theory. The above approaches emphasize, among others, the high rank of regional conditions for innovation activities. In this regard, according to a number of theoretical and empirical studies, cooperation between regions and firms is essential for economic growth (see: e.g. Tödtling & Grillitsch, 2015, pp. 1741–1758; Huggins & Williams, 2011, pp. 909–910). Hence, achieved cooperation will increase the growth effects of firms, regions and countries. Thus, regions should build backgrounds for stimulating firms' innovation activities and develop regional innovation ecosystems (see: e.g. Acs *et al*., 2016, pp. 527–535; Huggins & Williams, 2011, pp. 909–910; Zygmunt A., 2017, pp. 1455–1464).

Regarding the role of firms' innovation activities in economic growth of regions and countries, substantial importance is attached to indicators associated with innovation performance of firms. In this context, in the past decades a number of studies dealt with key indicators of firms' innovation (see: e.g. Krstić *et al*., 2016, pp. 142–152; Brodzicki, 2017, pp. 91–109; Ali Taha *et al*., 2016, pp. 7–17). Based on these studies, firms' innovation activities can be explained by a variety of indicators. Among others, a wide body of empirical literature assesses the role of firms' capabilities in enhancing innovation performance (see: e.g. Ali Taha *et al*., 2016, pp. 7–17; Brodzicki, 2017, pp. 91–109). In particular, firms' capabilities concern the ability to "continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders" (Lawson & Samson, 2001, p. 384). Thus, according to this line of argumentation, firms' intangibles, such as employees' skills and innovativeness, support culture, leadership practices, development of individual knowledge and processes and tools for managing ideas, are crucial for innovation activities. Another strand of literature highlights the importance of innovation systems and networks in enhancing firms' innovation activities. Following this, what is essential for firms' innovation performance is not only the strengthening of R&D capacities, but also the network between "the actors that are involved in generating innovations" (Asheim *et al*., 2016, p. 5). Therefore, the network between such actors as, among others, universities, research organizations, institutional environment and firms, enhances not only firms' innovation abilities, but also innovation capacities of regions (Cooke *et al*., 2000, pp. 1–183). Hence, under the circumstances of dynam-

ic environment, national and regional innovation systems play an essential role in contributing to shaping conditions for networking and interactions between the actors (Asheim *et al*., 2016, pp. 1–19; Zygmunt J., 2017, pp. 226–236; Oganisjana *et al*., 2015, pp. 186–197). Regarding recent studies, special attention is attached especially to knowledge spillovers and knowledge bases as the core to shift innovation performance of firms (see: e.g. Tödtling & Grillitsch, 2015, pp. 1741–1758). In this respect, firms' innovation activities can be fostered by such indicators as social networks, labour mobility, institutional embeddedness of the actors and different dimensions of proximity (Grillitsch & Nilsson, 2015, p. 301; Oganisjana *et al*., 2015, pp. 186–197). The ability of firms to enhance innovation activities depends also on sectoral specializations that shape knowledge and related networks of firms (see, e.g., Tödtling & Grillitsch, 2015, pp. 1741–1758).

The above indicators of firms' innovation activities are increasingly considered by the European Union to be important sources of enhancing competitiveness of firms, regions and countries. Hence, it is currently a major policy goal to shape conditions for innovation performance and it is noticeable in the place-based approach. This approach emphasizes the rank of combination of endogenous and exogenous indicators of regional development in building competitive advantage of firms, regions and countries (Barca, 2009, pp. 1–244). Particular attention is also given to the diversity of social, economic and territorial conditions of regions as an important component of policy-making to support firms to stimulate innovation.

An increasing rank of firms' innovation activities in enhancing economic growth of regions and countries, in combination with their specific and unique capabilities, requires undertaking studies on how innovation activities of firms differ between the EU countries with a similar level of innovation. Thus, the following hypothesis was posed: although Poland belongs to the group of EU countries with a similar level of innovation, Polish firms' innovation activities differ from those from other moderate innovator counties.

Research methodology

The data employed for the study were extracted from the last report of the European Innovation Scoreboard (European Commission, 2016) and refer to the period 2008–2015. This report provides information connected with different aspects of the European Union member states' innovation performance, with division into three main types of composite indicators (ena-

blers, firm activities, outputs) with twenty fife specific indicators. Despite the fact that some studies criticize the use and the choice of indicators (see, e.g., Grupp & Schubert, 2010, pp. 67–78), the EIS provides data which allow a comparable analysis between the EU countries. In relation to the investigation of firms' innovation activities, the study uses data from the European Innovation Scoreboard relating to indicators of firms' activities. According to the EIS, indicators of firms' activities are grouped into three dimensions, such as: firm investments, linkage & entrepreneurship and intellectual assets. These dimensions and their nine specific indicators are consistent with endogenous growth theory and knowledge spillovers theory. Special attention is also paid in the EIS to small and medium-sized enterprises (SMEs), which represent 99% of firms in the European Union (European Commission, 2017).

Empirical analysis uses data with respect to the EU countries with a level of innovation similar to Poland. According to the European Innovation Scoreboard, Poland belongs to the moderate innovators group. Against other groups of countries, referred to as modest innovators, strong innovators and innovation leaders, moderate innovators are distinguished by innovation performance below that of the EU average (European Commission, 2016). This group contains such countries as: Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, and Spain. The descriptive statistics of diagnostic variables, comprising mean, standard deviation, minimum and maximum, are presented in Table 1.

All diagnostic variables are characterized by sufficient variability (coefficient of variation is higher than 0.1).

In order to empirically analyse how innovation activities of Polish firms differ from those from other moderate innovator countries, a multivariate analysis and zero unitarization method were applied. The usability of the combination of the multivariate analysis and zero unitarization method indicates the ability to analyse the differences between the European Union countries (Balcerzak, 2015, pp. 190–205) and "enables comparing the values of synthetic index for all years" (Balcerzak, 2015, p. 191). In the undertaken study the application of multivariate analysis enabled a multivariate analysis of firms' innovation activities in Poland and other EU countries with a level of innovation similar to Poland, while zero unitarization method allowed normalization of diagnostic variables. Thus, four classes of the moderate innovator countries were distinguished: (i) countries with a very high level of indicators of firms' innovation activities, (ii) countries with a high level of indicators of firms' innovation activities, (iii) countries with an average level of indicators of firms' innovation activities, (iv) countries

with a low level of indicators of firms' innovation activities. Such grouping was conducted for each of the EIS innovation dimensions related to firm activities (firm investments, linkage & entrepreneurship and intellectual assets). The study concerned the period 2008–2015.

Firstly, the study required normalization of diagnostic variables. In this respect, on the basis of the assumption of zero unitarization method, a constant reference point (the range of the normalized variable) was calculated, according to the following formula (Kukuła & Bogocz, 2014, p. 7):

$$R(X_{jt}) = \max_{it} x_{ijt} - \min_{it} x_{ijt} \tag{1}$$

Because all diagnostic variables are stimulants, for normalization of diagnostic variables, the following formula was used (Kukuła & Bogocz, 2014, p. 7):

$$z_{ijt} = \frac{x_{ijt} - \min_{it} x_{ijt}}{\max_{it} x_{ijt} - \min_{it} x_{ijt}} \tag{2}$$

where $z_{ijt} \in [0,1]$; $(i = 1,2, \dots, n)$; $(j = 1,2, \dots, m)$; $(t = 1,2, \dots, l)$

Next, a synthetic measure was calculated using the formula (Balcerzak, 2015, p. 196):

$$SM_{it} = \frac{1}{m} \sum_{j=1}^{m} z_{ijt} \tag{3}$$

where $z_{ijt} \in [0,1]$; $SM_{it} \in [0,1]$; $(i = 1,2, \dots, n)$; $(j = 1,2, \dots, m)$; $(t = 1,2, \dots, l)$

On the ground of the synthetic measure and assumptions for grouping the EU countries proposed by Balcerzak (2015, p. 196), a division of moderate innovator countries into four groups was made:

(i) countries with a very high level of indicators of firms' innovation activities:

$$SM_{it} \geq \overline{SM_{\iota t}} + S(SM_{it}) \tag{4}$$

where $(i = 1,2, \dots, n)$; $(t = 1,2, \dots, l)$

(ii) countries with a high level of indicators of firms' innovation activities:

$$\overline{SM_{it}} \leq SM_{it} < \overline{SM_{it}} + S(SM_{it}) \tag{5}$$

where $(i = 1,2, \dots, n)$; $(t = 1,2, \dots, l)$

(iii) countries with an average level of indicators of firms' innovation activities:

$$\overline{SM_{it}} - S(SM_{it}) \leq SM_{it} < \overline{SM_{it}} \tag{6}$$

where $(i = 1,2, \dots, n)$; $(t = 1,2, \dots, l)$

(iv) countries with a low level of indicators of firms' innovation activities:

$$SM_{it} < \overline{SM_{it}} - S(SM_{it}) \tag{7}$$

where $(i = 1,2, \dots, n)$; $(t = 1,2, \dots, l)$

Where (Balcerzak, 2015, p. 196):

$$\overline{SM_{it}} = \frac{1}{n}\sum_{j=1}^{n} SM_{it} \tag{8}$$

where $(i = 1,2, \dots, n)$; $(t = 1,2, \dots, l)$

$$S(SM_{it}) = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(SM_{it} - \overline{SM_{it}})^2} \tag{9}$$

where $(i = 1,2, \dots, n)$; $(t = 1,2, \dots, l)$

The above procedure allowed for investigating how innovation activities of Polish firms differ from those from other moderate innovator countries.

Findings

The results of multivariate analysis of firms' innovation activities in moderate innovator countries are provided in Tables 2 to 4 (in the Annex). In line with the obtained results, innovation activities of Polish firms differed in the period 2008–2015 from those from other EU countries with a level of innovation similar to Poland. Considering the dimension of firm investments, the results imply that among moderate innovator countries, Polish firms were distinguished by a relatively low level of business R&D expenditure and non-R&D innovation expenditure (Table 2). This situation was especially seen in the period 2008–2010, when investments of Polish firms rank among countries with a low level of business R&D expenditure and non-R&D innovation expenditure (similar to Greece and Lithuania). In principle, with respect to firm investments, Polish firms differed significantly from especially such moderate innovator countries as: Estonia, the Czech Republic, Portugal, Italy and Spain. However, since 2011 the distance between Poland and countries with higher business R&D expenditure and non-R&D innovation expenditure has decreased. The results indicate that during the period 2011–2015 Polish firms increased the level of investment. Against the background of firms from other moderate innovator countries, investments of Polish firms ranked into the average group (in 2011, 2013–2014) and the high group of countries (in 2012, 2015). It proves that Polish firms constantly improved the level of business R&D expenditure and non-R&D innovation expenditure.

Regarding the linkage & entrepreneurship dimension, the obtained results highlight a relatively high distance between Polish firms and those from other countries with a level of innovation similar to Poland (Table 3). Among moderate innovator countries, Polish firms ranked in the last place in terms of SMEs innovating in-house, innovative SMEs collaborating with others and public-private co-publications. Such a situation concerns the period 2008–2015 and should be treated as negative, especially in the context of enhancing competitiveness of firms, regions and country. The results imply the highest diversity of linkage & entrepreneurship dimension between Polish firms and firms from Estonia, Cyprus and the Czech Republic –countries with the highest indicators for SMEs innovating in-house, innovative SMEs collaborating with others and public-private co-publications. On the other hand, similar to Poland, a low level of linkage & entrepreneurship indicators distinguished firms from such countries as Lithuania and Malta.

Concerning the intellectual assets dimension, the results indicate the location of Polish firms among those from the average group of other moder-

ate innovator countries (Table 4). According to the obtained results, in terms of PCT patent applications, PCT patent applications in societal challenges, community trademarks and community designs, Polish firms highlighted high similarity particularly with firms from the Czech Republic and Cyprus. It should be emphasized that within the group of EU countries with a level of innovation similar to Poland, Polish firms were also distinguished by low distance to the group of EU countries with a low level of intellectual assets (such as Slovakia, Greece, Lithuania). This situation should be treated as negative in relation to building a competitive advantage of firms, regions and countries. Based on the results, the high distance between Polish firms and those from other moderate innovator countries appeared with respect to Italy, Estonia and Spain.

Conclusions

This study analysed Polish firms' innovation activities against those from the EU countries with a level of innovation similar to Poland. The results of grouping the countries into four groups reveal that in terms of innovation activities, Polish firms differed (in 2008–2015) from those from other moderate innovator countries. In this respect, the empirical evidence indicates that innovation activities of Polish firms differed the most in terms of the linkage & entrepreneurship dimension. With respect to the other innovation activities dimensions, Polish firms were distinguished by the lowest level of SMEs innovating in-house, innovative SMEs collaborating with others and public-private co-publications. This situation, in relation to the relatively low level of intellectual assets, may influence limited abilities of firms to adapt to dynamic environment and, in consequences, also regions' and countries' abilities to enhance competitiveness. Furthermore, besides reducing the distance between Polish firms' and firms from moderate innovator countries with a high and the very high level of business R&D expenditure and non-R&D innovation expenditure, Polish firms' investments require further improvement.

These findings have practical and policy implications. First, the findings call for a regional and country policy to further support the enhancement of firms' competitiveness, especially in regard to SMEs innovating in-house, innovative SMEs collaborating with others and public-private co-publications. Such actions should focus, among others, on shaping conditions for networking and interactions between the actors and supporting labour mobility and institutional embeddedness of the actors. Second, an important implication for firms refers to the necessity to intensify actions to

strengthen firms' capabilities of adaptation to rapid changes and uncertainty in the environment. In this respect, strengthening the network between universities, research organizations and institutional environment is also essential.

This study is not without limitations. The multitude of indicators of firms' innovation activities resulted in presenting selected approaches in theoretical background. This paper draws also on indicators of firms' innovation activities and data from the European Innovation Scoreboard. It would be interesting to investigate whether the obtained results also hold in other spatial contexts (with special attention to regions).

The complexity of firms' innovation activities requires further studies. In terms of future research, it seems important to focus on other indicators of firms' innovation activities as well as on the investigation of the causes of differences between Polish firms' innovation activities and other EU countries with a level of innovation similar to Poland.

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Annex

Table 1. Descriptive statistics of diagnostic variables

Variables			Mean	St. dev.	Min	Max
Firm investments	x_{1t}	Business R&D expenditure	0.49	0.27	0.08	0.99
	x_{2t}	Non-R&D innovation expenditure	0.98	0.51	0.45	2.31
Linkages & entrepreneurship	x_{3t}	SMEs innovating in-house	25.41	8.59	11.73	39.44
	x_{4t}	Innovative SMEs collaborating with others	9.93	5.37	4.42	22.76
	x_{5t}	Public-private co-publications	14.40	7.37	3.19	24.89
Intellectual assets	x_{6t}	PCT patent applications	0.91	0.56	0.32	2.13
	x_{7t}	PCT patent applications in societal challenges	0.26	0.17	0.04	0.57
	x_{8t}	Community trademarks	6.33	6.40	0.91	23.73
	x_{9t}	Community designs	2.94	2.89	0.33	11.08

Source: own calculations based on data from the European Innovation Scoreboard 2016 (European Commission, 2016).

Table 2. The results of multivariate analysis of firms' innovation activity in Moderate Innovator countries – Firm investments dimension (in the period 2008–2015)

2008			2009			2010			2011			2012			2013			2014			2015		
No.	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**
Very High			Very High			Very High			Very High			Very High			Very High			Very High			Very High		
1	EE	0,8015	1	EE	0,8516	1	EE	0,9015	1	EE	1,0000	1	EE	1,0000	1	EE	0,7526	1	EE	0,6432	1	EE	0,7644
2	CZ	0,5593	High			High			2	CZ	0,7064	High			High			2	CZ	0,6178	2	CZ	0,6690
High			2	PT	0,5645	2	PT	0,5723	High			2	CZ	0,5006	2	CZ	0,5057	High			High		
3	ES	0,4632	3	CZ	0,5593	3	CZ	0,5441	3	HU	0,5376	3	CY	0,4843	3	CY	0,5000	3	CY	0,5000	3	HU	0,5893
4	PT	0,4326	4	ES	0,4922	4	ES	0,4621	4	PT	0,5207	4	MT	0,3670	Average			4	HU	0,4732	4	MT	0,5606
5	IT	0,3791	5	IT	0,4255	5	HU	0,4558	5	CY	0,4843	5	PL	0,3578	4	LT	0,4241	5	LT	0,4351	5	PL	0,4648
Average			6	HU	0,3675	6	IT	0,4357	6	IT	0,4674	Average			5	MT	0,4138	6	MT	0,4325	Average		
6	HU	0,3257	Average			Average			Average			6	HU	0,3491	6	PL	0,3654	7	IT	0,4196	6	LT	0,4225
7	MT	0,2961	7	MT	0,3007	7	MT	0,2794	7	MT	0,4540	7	PT	0,3040	7	IT	0,3526	Average			7	IT	0,4122
8	CY	0,2788	8	HR	0,2890	8	CY	0,2788	8	ES	0,4296	8	IT	0,2682	8	HU	0,3364	8	PL	0,4104	8	HR	0,4020
9	SK	0,2379	9	CY	0,2788	9	SK	0,2551	9	PL	0,3785	9	HR	0,2510	9	PT	0,3231	9	PT	0,3476	9	PT	0,3620
10	HR	0,2237	10	SK	0,2577	10	HR	0,2440	10	HR	0,3313	10	ES	0,2199	10	ES	0,2672	10	ES	0,3125	10	EL	0,3226
Low			Low			Low			Low			11	LT	0,1752	Low			Low			11	SK	0,3152
11	EL	0,1365	11	PL	0,1504	11	PL	0,1480	11	SK	0,2256	12	EL	0,1630	11	SK	0,2183	11	HR	0,2637	12	ES	0,2740
12	PL	0,1311	12	EL	0,1429	12	EL	0,1396	12	LT	0,2206	SK		0,1627	12	EL	0,2146	12	SK	0,2634	Low		
13	LT	0,1193	13	LT	0,0945	13	LT	0,0997	13	EL	0,2119	13			13	HR	0,2073	13	EL	0,2412	13	CY	0,1074

Legend: HR – Croatia, CY – Cyprus, CZ – the Czech Republic, EE – Estonia, EL – Greece, HU – Hungary, IT – Italy, LT – Lithuania, MT – Malta, PL – Poland, PT – Portugal, SK – Slovakia, ES – Spain.

Source: own calculations based on data from the European Innovation Scoreboard 2016 (European Commission, 2016).

Table 3. The results of multivariate analysis of firms' innovation activity in Moderate Innovator countries – Linkage & entrepreneurship dimension (in the period 2008–2015)

2008			2009			2010			2011			2012			2013			2014			2015		
No.	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**
Very High			Very High			Very High			Very High			Very High			Very High			Very High			Very High		
1	EE	0,8591	1	EE	0,8591	1	CY	0,8848	1	CY	0,9738	1	CY	0,8597	1	CY	0,9218	1	CY	0,8438	1	EE	0,6308
2	CY	0,7241	2	CY	0,7241	2	EE	0,8488	2	EE	0,8599	2	EE	0,7677	High			2	EE	0,6653	2	CY	0,6254
3	CZ	0,6515	3	CZ	0,6515	High			High			High			2	EE	0,6557	High			3	CZ	0,6215
High			High			3	CZ	0,6515	3	HR	0,6134	3	HR	0,6134	3	IT	0,5963	3	IT	0,5995	4	IT	0,6129
4	EL	0,5651	4	EL	0,5651	4	IT	0,6123	4	CZ	0,6066	4	CZ	0,6063	4	HR	0,5844	4	CZ	0,5421	High		
5	HR	0,5406	5	HR	0,5406	5	HR	0,5581	5	IT	0,5699	5	IT	0,5532	5	CZ	0,5673	5	EL	0,5317	5	EL	0,5743
Average			Average			6	EL	0,5543	6	EL	0,5166	6	PT	0,5178	6	EL	0,5491	6	HR	0,4557	6	PT	0,4633
6	IT	0,5989	6	IT	0,5989	Average			7	PT	0,5006	7	EL	0,5173	7	ES	0,4455	7	ES	0,4444	Average		
7	PT	0,4179	7	PT	0,4179	7	PT	0,4149	Average			Average			Average			8	PT	0,4279	7	HU	0,3880
8	ES	0,3973	8	ES	0,3973	8	ES	0,3898	8	HU	0,3464	8	ES	0,3434	8	PT	0,4302	Average			8	ES	0,3557
9	HU	0,3374	9	HU	0,3374	9	HU	0,3334	9	ES	0,3208	9	HU	0,2795	9	HU	0,3472	9	HU	0,3859	9	HR	0,3543
10	SK	0,2457	10	SK	0,2457	10	SK	0,2386	10	LT	0,1918	10	LT	0,1906	10	SK	0,3187	Low			10	MT	0,2811
Low			Low			11	LT	0,2283	Low			Low			Low			10	SK	0,2862	11	SK	0,2414
11	LT	0,1923	11	LT	0,1923	Low			11	SK	0,1751	11	SK	0,1437	11	LT	0,1593	11	MT	0,1752	Low		
12	MT	0,1720	12	MT	0,1720	12	MT	0,1702	12	MT	0,1428	12	MT	0,1049	12	MT	0,1550	12	LT	0,1521	12	LT	0,1487
13	PL	0,1387	13	PL	0,1387	13	PL	0,1387	13	PL	0,0369	13	PL	0,0369	13	PL	0,0000	13	PL	0,0208	13	PL	0,0304

Legend: Like in Table 2.

Source: own calculations based on data from the European Innovation Scoreboard 2016 (European Commission, 2016).

Table 4. The results of multivariate analysis of firms' innovation activity in Moderate Innovator countries – Intellectual assets dimension (in the period 2008–2015)

2008			2009			2010			2011			2012			2013			2014			2015		
No.	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**	**No.**	**Co.**	**SM**
Very High			Very High			Very High			Very High			Very High			Very High			Very High			Very High		
1	IT	0,8011	1	IT	0,8256	1	IT	0,8021	1	IT	0,7738	1	IT	0,7603	1	EE	0,6215	1	IT	0,5810	1	MT	0,6546
2	ES	0,5572	2	ES	0,5538	2	EE	0,6067	2	EE	0,7150	2	EE	0,7220	2	IT	0,5735	2	MT	0,5536	2	IT	0,5804
High			High			High			3	ES	0,5813	3	ES	0,6137	3	MT	0,5532	3	ES	0,4963	3	ES	0,4774
3	CY	0,4886	3	EE	0,4855	3	ES	0,5533	High			High			4	ES	0,4965	High			High		
4	HU	0,4006	4	MT	0,4206	4	MT	0,4704	4	CY	0,4420	4	HU	0,4088	High			4	HU	0,3371	4	HU	0,2618
5	HR	0,3522	5	HU	0,3633	5	HU	0,4630	5	HU	0,3832	5	MT	0,3872	5	HU	0,3516	5	EE	0,2856	5	EE	0,2552
Average			6	PT	0,3438	Average			6	PT	0,3654	6	PT	0,3833	Average			Average			Average		
6	PT	0,3366	Average			6	PT	0,3474	Average			Average			6	PT	0,2548	6	CY	0,2465	6	CZ	0,2150
7	MT	0,3334	7	HR	0,3151	7	CZ	0,3280	7	CZ	0,3264	7	CZ	0,3681	7	CY	0,2462	7	CZ	0,2438	7	CY	0,1943
8	EE	0,3208	8	CZ	0,2976	8	CY	0,3094	8	MT	0,3179	8	CY	0,3566	8	CZ	0,2146	8	PT	0,2120	8	PT	0,1923
9	CZ	0,2841	9	CY	0,2618	9	PL	0,2266	9	PL	0,2592	9	PL	0,3050	9	PL	0,1444	9	HR	0,1847	9	PL	0,1367
10	PL	0,2124	10	PL	0,1941	10	HR	0,1659	10	LT	0,1872	10	HR	0,1695	10	HR	0,1375	10	PL	0,1598	Low		
Low			Low			Low			Low			Low			11	LT	0,1121	11	EL	0,1194	10	HR	0,0932
11	SK	0,1173	11	SK	0,1141	11	EL	0,1121	11	HR	0,1244	11	SK	0,1429	Low			Low			11	LT	0,0690
12	EL	0,1068	12	EL	0,0908	12	SK	0,1114	12	SK	0,0921	12	LT	0,1358	12	SK	0,0963	12	LT	0,1130	12	EL	0,0629
13	LT	0,0835	13	LT	0,0515	13	LT	0,0806	13	EL	0,0848	13	EL	0,1081	13	EL	0,0765	13	SK	0,0928	13	SK	0,0538

Legend: Like in Table 2.

Source: own calculations based on data from the European Innovation Scoreboard 2016 (European Commission, 2016).