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## **Innovations and Export Performance of New EU Member States<sup>1</sup>**

### **Introduction**

Innovation is a crucial element of the modernization and development of the Central European countries and their convergence with the old EU-15 member states. The measures of innovative activity of companies can include spending on R&D as well as its effects, such as patents and share of new products in total sales. One of the key elements of innovation activity, which was already analyzed in the context of firm export performance in the old EU-15 member states, is research and development (R&D) activity. This activity is described as the process of systematic creative work that combines both basic and applied research aimed at extending the company's knowledge resources and their practical application. As a result R&D activity may lead to product and process innovations as well as the creation of intellectual property right related to patents and trademarks. Previous studies have studied mainly companies in developed countries, such as Germany or the United Kingdom, with a high level of innovation activity. These studies have mainly focused on product and process innovation while other forms of innovation received relatively little attention.

The main objective of this paper is to analyze the relationship between innovation of EU Central European firms and their export competitiveness. In particular, we empirically validate the main hypothesis concerning the positive relationship between innovation activities and exporting. In contrast to previous studies that use R&D spending as a measure of innovation we rather focus on

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innovation outcomes. Our detailed hypotheses postulate the existence of positive relationships between firm export performance and four different types of innovation activities: product, process, marketing and managerial innovations. We seek to determine which of the aforementioned types of innovation activity is of the greatest importance for exporting and whether it depends on firm size, the level of internationalization, the use of human capital and its sector of activity. Our study is based on the firm-level data for the period 2011–2014.

The results of our study can help in proposing a set of policy conclusions that can apply to Central European firms. The firms from those countries are lagging behind in terms of innovation activities and their presence in foreign markets is still limited compared to the firms from the old EU-15. This is particularly important in the light of changes in the allocation of the EU funds in the current Financial Perspective, i.e. increasing expenditure for innovative firms, aimed at increasing their presence in the global markets.

The structure of this paper is as follows. In Section 1 we provide the literature review of previous empirical studies on the innovation-exports nexus. In Section 2 we describe the analytical framework. In Section 3 we describe the dataset. In Section 4 we present our empirical results. The last section summarizes and concludes.

## **1. Literature review**

There is an extensive theoretical literature on the determinants of innovation and their consequences for productivity and exporting. In particular, a key hypothesis in this literature is that innovation is a driver of productivity improvement that in turn could stimulate exports. For example, Atkeson and Burstein (2007) and Constantini and Melitz (2008) have analyzed dynamic industry models to investigate linkages between firm-level productivity and the choices of both to export and to invest in R&D or adopt new technology. In these models, productivity distinguishes heterogeneous firms, and its evolution is endogenous and affected by innovation decisions at the firm level apart from a stochastic component.

There is also an extensive empirical literature that points to a positive impact of innovation as such on exports at the firm- or plant-level. This literature has identified two main types of innovation: product innovation and process innovation. Product innovation is a key factor for successful market entry in models of creative destruction and Schumpeterian growth while process innovation reduces costs of production and improves firm's market position. Both modes of innovation are expected to raise firm's productivity and propensity to export. The empirical evidence on the impact of other forms of innovations such as marketing and managerial innovations is scarce.

The majority of the existing studies rely on R&D expenditures as an indirect measure of innovations (Hirsch and Bijaoui 1985; Kumar and Siddharthan 1994; Braunerhjelm 1996; Basile 2001). Early empirical studies (e.g., Hirsch and Bijaoui 1985, and Schlegelmilch and Crook 1988) that looked into the effects of

innovations on exports used measures of innovation input and arrived at mixed conclusions (Ebling and Janz 1999).

There is also a limited number of studies that employ survey data with explicit information on the actual innovations (Wakelin 1998; Bernard and Jensen 1999; Roper and Love 2002; Lachenmaier and Wößmann 2006; Cassiman and Martínez-Ros 2007).<sup>2</sup> In particular, firm-level studies which used more direct measures of innovation output (i.e., actual innovations) are those of Wagner (1996) and Wakelin (1997, 1998).

In addition, there is also some evidence on a systematic determination of innovation. In particular, Ebling and Janz (1999) studied the impact of innovations on the extensive margin of exports in the service sector. Their results were based on probit models and pointed to a positive impact of innovations on exports, but not vice versa.

Van Beveren and Vandenbussche (2010) analyzed the relationship between firm-level innovation activities and firms' propensity to start exporting for Belgian firms. They measured innovation by innovative effort (R&D) as well as by innovative output. Their estimation results pointed to firms self-selecting into innovation in anticipation of their entry into export markets, rather than product and process innovation triggering entry into the export market. Hence, they suggested that governments could foster firm-level innovation through trade liberalization.

Cassiman and Martínez-Ros (2007) provided empirical support for the product innovation – productivity – export link in data on Spanish firms. They found little support for the reverse causality (i.e. exporting – process innovation – productivity growth). In the subsequent study for Spanish manufacturing firms Cassiman et al. (2010) argued that the positive association found between firm productivity and exports in the literature relates to the firm's innovation decisions. In particular, they provided evidence that product innovations are more important than process innovations as they affected firm productivity and induced small non-exporting firms to enter the export market. Also Caldera (2010) investigated the relationship between innovation and the export behavior of Spanish firms over the period 1991–2002. His empirical results suggested a positive effect of firm innovation on the probability of exporting. In particular, product upgrading appeared to have a larger effect on the firm export participation than the introduction of cost-saving innovations.

Filipescu et al. (2013) tried to advance understanding of the dynamics of firms operating abroad by considering the effects of innovation, i.e. R&D intensity, product and process innovations, on the breadth and depth of exports, and vice versa. Their study analyzed a panel data set of Spanish manufacturing firms during 1994–2005 using Tobit and logit regressions and the Granger test of causality to demonstrate a complex relationship. They found broad support for the notion that innovation and exports have a reciprocal causal relationship, although their

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<sup>2</sup> The problems associated with the use of survey data on innovations in econometric studies are discussed in Mairesse and Mohnen (2010).

findings showed a positive but nonsignificant associations between product innovation and exports and between export depth and process innovation. Furthermore, both export and innovation processes Granger-cause each other, demonstrating that there was a double causal relationship.

Becker and Egger (2013) studied the effects of new product versus process innovations on export propensity at the firm level in Germany. They hypothesized that product innovation should be relatively more important than process innovation. They investigated this hypothesis using an extensive panel data set with information about new innovations of either type. They determined the probability of launching new innovations and their impact on export propensity at the firm level through a double treatment approach to account for self-selection of firms into either type of innovation. Their results point to the importance of product innovation relative to process innovation for the decision to export. They concluded that process innovations increased a firm's probability to export only when they were combined with product innovations.

More recently, Gkypali et al. (2015) attempted to shed more light on the relationship between innovation and exports by setting a theoretical framework where a two-way causality was hypothesized to exist between these two firm activities. In addition, they highlighted the role of firm age as firms at different stages of their life cycle might face different prospects and constraints and thus develop different strategies to survive and grow. Such differential patterns may be even more intense due to the different knowledge and capabilities portfolio possessed by young and mature firms. Employing a sample of Greek manufacturing R&D active firms for the year 2010, they estimated a multi-group path analysis for young and mature firms. Even though empirical results did not support the existence of a two-way causality between innovation and export performance, when they accounted for the moderating role of age it became evident that the direction of causality differed between young and mature firms. Also they confirmed the indirect and direct effect of firms' R&D stock as an intermediate link within the innovation-export nexus.

Hence, the majority of empirical studies for the old EU-15 countries found support for the positive relationship between various types of innovations and exporting. In particular, these studies found that firms that introduced either process or product innovation had a higher probability to export than firms that did not innovate. However, product innovations seemed to be more important in determining the export performance of firms than process innovations.

In the context of the new EU member states (NMS) empirical evidence on the relationship between innovation and exporting is still rather scarce. The important exception is the study by Damjan et al. (2010) who explored the causal links between innovation and export activities of firms in Slovenia. Their empirical approach was to tackle both sides of this causality link using Slovenian microdata, including financial data, innovation survey data, industrial survey data, as well as information on trade flows, for the period 1996–2002. This extensive dataset allowed them to test the prediction that a firm's innovation enhances its probability of becoming an exporter, and the prediction that learning effects of

exporting would translate to a greater effort to innovate and thus to improvements in productivity. However, they found no evidence that either product or process innovations increased the probability that a firm becomes a first-time exporter. In particular, they found evidence that past exporting status increased the probability that medium and large firms would become process innovators. At the same time they found no impact of past exporting on product innovations but they found some evidence in favour of learning-by-exporting of Slovenian firms.

More recently, Cieřlik and Michałek (2016) tried to verify the hypothesis concerning the importance of innovations for firm involvement in export activities using BEEPS firm-level data for Poland. In particular, they studied empirically the relationship between R&D activity and the probability of exporting. They also analyzed the importance of different forms of innovation for the export performance. Their empirical results generally confirmed the positive role of R&D spending for exporting. However, their results obtained for various forms of innovations were ambiguous and should be treated with caution due to the very small sample size. In particular, they found that only marketing innovations were important for exporting.

Subsequently, Cieřlik et al. (2016) studied the relationship between various types of innovations and export performance of Polish firms over the period of 2008–2010 using the Polish CIS data. This data allowed them to control for human and physical capital endowment, firm size (employment size groups), the level of technological sophistication of a sector as well as the presence of foreign capital. However, they were not able to control for the level of productivity. They found that the probability of exporting by Polish firms was positively related to both product and process innovations, firm's size, the share of university graduates in employment and foreign ownership.

Similar results were also reported by Brodzicki and Ciołek (2016) in a direct survey panel of 470 Polish manufacturing industry firms. However, they found that only process and organizational innovations were important for the probability of exporting. Also Brodzicki (2016) investigated the relationship between the extent of innovation and the extent of internationalization in the cross-sectional sample of firms from Poland. He confirmed that productivity was a principal driver of firm exports and firm internationalization. He also provided some support for the causality going from innovation to internationalization.

It is important to note, however, that the results of the previous studies for particular new EU member states may not generalize to the whole group of the Central Eastern European countries. Therefore, in our paper we investigate empirically whether various innovative activities contribute to increased efficiency of firms from Central Eastern Europe and whether they improve their ability to compete and stay at international markets. In contrast to previous studies conducted for specific EU countries, our study is based on the comprehensive firm-level dataset collected by the World Bank. In our study we focus both on sources of innovations such as domestic R&D, the use of foreign technologies as well as the innovation outcomes. We proxy the use of foreign technology by the purchase of foreign licenses by domestic firms. In addition, we control for foreign ownership

of companies in the host country. We distinguish and examine the relative importance for exports of four types of innovation outcomes: product, process, marketing and managerial innovations. This allows us to identify the relative significance of specific types of innovation activities for exporting of Central European firms which is important for formulating some recommendations for economic policy and especially for policies to encourage innovation in these countries.

## 2. Analytical framework

The new strand in the trade theory argues that the level of firm productivity is critical for exporting. In particular, the Melitz (2003) model points at the existence of a positive relationship between firm productivity and export performance. In his model productivity differences among firms are exogenously given and each firm has to pay fixed costs of entry into domestic and foreign markets. The majority of empirical studies find support for the theoretical prediction of the Melitz model, i.e. that more productive firms self-select into foreign markets. The survey of early empirical evidence on the relationship between firm productivity and exporting was provided by Tybout (2003). The extensive summaries of more recent empirical evidence on this relationship in particular countries were offered by Wagner (2007, 2012). According to the first survey by Wagner (2007), a large number of studies using data from different countries report results showing that exporters and importers are more productive than non-exporters and non-importers. In particular, he argued that future exporters tend to be more productive than future non-exporters in the years before they enter the export market. Moreover, the empirical results for post-entry differences in performance between exporters and non-exporters point to faster productivity growth for the former group in only some studies. This picture was largely confirmed in the recent survey by Wagner (2012), i.e. his review provides extensive evidence in favor of the self-selection hypothesis.

In our paper we refer to the self-selection hypothesis. Our dependent variable indicating the export status of firm  $i$  is denoted by  $Y_i^*$ . Instead of observing the volume of exports, we observe only a binary variable  $Y_i$  indicating the sign of  $Y_i^*$ , i.e. whether the firm sells its output in the domestic market (local, regional or national) or it exports. Moreover, we assume that the variable  $Y_i^*$  follows  $Y_i^* = \mathbf{X}_i\boldsymbol{\Theta} + \varepsilon_i$ , where the error term  $\varepsilon_i$  is independent of  $\mathbf{X}_i$  which is a vector containing explanatory variables that affect exports with the first term equal to unity for all  $i$ ,  $\boldsymbol{\Theta}$  is the vector of parameters on these variables that needs to be estimated and  $\varepsilon_i$  is assumed to be normally distributed with a zero mean.

Our dependent variable follows a binary distribution and takes the value 1 when the firm exports and 0 otherwise:

$$Y_i = \begin{cases} 1 & \text{if } Y_i^* > 0 \\ 0 & \text{if } Y_i^* = 0 \end{cases} \quad (1)$$

We can obtain the distribution of  $Y_i$  given  $\mathbf{X}_i$ . Hence, the probability that a firm exports can be written as:

$$P(Y_i = 1 | \mathbf{X}_i) = \Phi(\mathbf{X}_i \boldsymbol{\theta}) \quad (2)$$

where  $\Phi(\cdot)$  denotes the standard normal cumulative distribution function (cdf).

To be able to successfully employ the probit model, it is important to know how to interpret the vector of estimated parameters on the explanatory variables  $\boldsymbol{\theta}$ . Consider a specific explanatory variable  $x_{ij}$ , which is an element of vector  $\mathbf{X}_i$ . The partial effect of  $x_{ij}$  on the probability of exporting can be written as:

$$\partial P(Y_i = 1 | \mathbf{X}_i) / \partial x_{ij} = \partial p(\mathbf{X}_i) / \partial x_{ij} \quad (3)$$

When multiplied by  $\Delta x_{ij}$ , equation (3) gives the approximate change in  $P(Y_i = 1 | \mathbf{X}_i)$  when  $x_{ij}$  increases by  $\Delta x_{ij}$ , holding all other variables constant.

### 3. Data description

Our study is based on “EBRD – World Bank Business Environment and Enterprise Performance Survey” (BEEPS) data collected by the World Bank and the European Bank for Reconstruction and Development in the post-communist countries located mainly in Europe and Central Asia (ECA). The main objective of the BEEPS survey was to obtain feedback from enterprises in the aforementioned countries on the state of the private sector. The survey examined the quality of the business environment. The survey questions concerned the identification of firm, sector of activity, legal and economic status, characteristics of managers and size of the firm, the infrastructure of services in the analyzed country, economic performance and key characteristics of reviewed firms, as well as stakeholders, e.g. employers organizations, employees organizations, local government, central government, ICT industry, SMEs, academics, etc.

Our sample includes only the period 2011–2014 for which the BEEPS V data was collected. Almost 60% of surveys in all countries were made in year 2013<sup>3</sup>. The BEEPS surveys covered both the manufacturing and services sectors and are representative of the variety of firms according to sector and location within each country. The number of firms operating in the service sector was relatively small compared to the manufacturing sector. Therefore, it was not possible to perform estimations separately for the manufacturing and service sectors. Moreover, particular industries within each sector can differ with respect to their capital intensity and export performance. Therefore, to control for heterogeneity across industries we used industry-specific effects in addition to individual firm characteristics in our estimating equations.

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<sup>3</sup> The numbers of observations (surveys) per year were as follows: 2884 in 2011, 1833 in 2012, 13 435 in 2013, and 4287 in 2014.

In all countries where a reliable sample frame was available, the sample was selected using stratified random sampling.<sup>4</sup> However, only a small proportion of firms was sampled every year. This means that the application of panel data analysis is not possible. Therefore, we used the standard probit procedure on the pooled cross-section dataset without controlling for individual firm effects but we control for country-specific and industry-specific effects. The list of countries in our sample is shown in Table A1 in the Appendix. It includes 11 new member states that joined the EU in three waves of the Eastern enlargement in 2004, 2007 and 2013.

Our dependent variable indicating the export status of the firm takes the form of a binary variable. It takes value zero if the firm sells its output only in the domestic market, and one otherwise, i.e. if it sells also some of its output abroad. In our study we selected a number of explanatory variables chosen from the survey, which should reflect the important characteristics of firms and the innovation efforts of analyzed firms. The description of all variables used in the empirical study is presented in the Table 1 while their summary statistics are reported in Table 2. The correlations between the explanatory variables are reported in Table 3.

**Table 1**  
**Variables used in the empirical analysis**

Export	Binary variable that takes the value 1 if the establishment is exporting and zero if not.
Lprod	Logarithm of productivity expressed as total amount of annual sales per full time employee.
Size	Logarithm of no. permanent, full-time employees of this firm at the end of the last fiscal year.
Uni	Percentage of full time employees who completed a university degree.
Fo	Binary variable indicating whether the percentage owned by private foreign individuals is larger than none.
Innov_product	Binary variable describing whether new products/services were introduced over last 3 years.
Innov_process	Binary variable describing whether new production/supply methods were introduced over last 3 years.
Innov_management	Binary variable describing whether new organizational/ management practices were introduced over last 3 years.
Innov_marketing	Binary variable describing whether new marketing methods were introduced over last 3 years.
R_D	Binary variable describing whether there was a spending on R&D over last 3 years.
Folicences	Binary variable describing whether the firm used technology licensed from foreign-owned company.

Source: own elaborations.

<sup>4</sup> The only exception was Albania. In the majority of cases the data includes about 250–350 observations per country. The details concerning the sampling methodology are explained in the Sampling Manual available at <http://www.enterprisesurveys.org/Methodology/>

**Table 2**  
**The summary statistics for NMS**

Variable	Obs	Mean	Std. Dev.	Min	Max
lprod	12 199	13.04625	2.57869	-3.4012	25.79845
innov_product	15 797	0.241881	0.428236	0	1
innov_process	15 796	0.197455	0.398091	0	1
innov_management	15 795	0.212409	0.409026	0	1
innov_marketing	15 778	0.230511	0.421173	0	1
R_D	15 753	0.105885	0.31504	-8	1
luni	15 121	2.349726	2.601046	-4.60517	4.60517
lsize	15 778	3.027125	1.253015	0	9.305651
fo	15 730	0.069231	0.253854	0	1
folicenses	15 694	0.145788	0.352905	0	1

Source: own calculations.

**Table 3**  
**The correlations between explanatory variables for NMS**

Variable	lprod	innov <sub>t</sub>	innov <sub>s</sub>	innov <sub>m</sub>	innov <sub>ng</sub>	R_D	luni	lsize	fo	folicenses
lprod	1									
innov_product	0.0378	1								
innov_process	0.0591	0.4905	1							
innov_management	0.0725	0.3768	0.4822	1						
innov_marketing	0.073	0.3744	0.4112	0.5716	1					
R_D	0.0184	0.3318	0.3324	0.3192	0.2997	1				
luni	0.1754	0.0475	0.0659	0.0722	0.0584	0.046	1			
lsize	0.0329	0.1276	0.144	0.16	0.1178	0.166	0.136	1		
fo	0.0502	0.072	0.0506	0.0766	0.0645	0.069	0.044	0.1872	1	
folicenses	-0.0433	0.1373	0.1132	0.1107	0.1104	0.137	0.025	0.1625	0.132	1

Source: own calculations.

## 4. Estimation results

In this section we present our estimation results. The estimation covers the period 2011–2014. The results of our estimations are presented in Table 4. First, in column (1) we report our benchmark results obtained from the specification in which we do not include individual sectoral and country effects. Then, in col-

umn (2) we give the results obtained from the specification with sectoral effects. Subsequently, in column (3) we report the results obtained from the specification with country effects. Finally, in column (4) we show the results obtained from the specification with both sectoral and country effects.

**Table 4**  
**Estimation results for NMS**

Variables	No effects	Sectoral effects	Country effects	Sectoral and country effects
	(1)	(2)	(3)	(4)
lprod	-0.00196 (0.0121)	0.0221* (0.0127)	0.0201 (0.0193)	0.0773*** (0.0211)
innov_product	0.145** (0.0630)	0.111* (0.0666)	0.114* (0.0647)	0.0798 (0.0691)
innov_process	0.267*** (0.0698)	0.182** (0.0738)	0.343*** (0.0717)	0.280*** (0.0765)
innov_managem	0.0322 (0.0710)	0.0984 (0.0748)	0.0716 (0.0726)	0.151* (0.0771)
innov_marketing	-0.221*** (0.0673)	-0.181** (0.0711)	-0.173** (0.0692)	-0.131* (0.0737)
R_D	0.474*** (0.0762)	0.396*** (0.0804)	0.369*** (0.0784)	0.274*** (0.0834)
luni	0.00900 (0.00902)	0.0200** (0.00970)	0.0255*** (0.00978)	0.0384*** (0.0107)
lsize	0.206*** (0.0217)	0.189*** (0.0235)	0.213*** (0.0224)	0.197*** (0.0244)
fo	0.611*** (0.0799)	0.602*** (0.0843)	0.549*** (0.0819)	0.516*** (0.0872)
folicenses	0.175** (0.0717)	0.140* (0.0761)	0.171** (0.0736)	0.127 (0.0789)
Constant	-1.237*** (0.157)	-1.104*** (0.168)	-1.805*** (0.260)	-2.109*** (0.287)
sectoral effects	no	yes	no	yes
country effects	no	no	yes	yes
Observations	2,794	2,794	2,794	2,794
Log likelihood	-1616	-1424	-1555	-1346
Pseudo R2	0.107	0.213	0.141	0.256

Standard errors in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Source: own calculations.

In column (1) of Table 4 we report the benchmark results on the relationship between innovation activities and export performance obtained from the specification in which we control for a number of individual firm characteristics but not for individual sectoral and country effects. The innovation activities of firms include the measures of product, process, management and marketing innovations as well as their R&D spending. The control variables include firm productivity,

firm size, firm ownership, the stock of human capital measured by the percentage of workers with the tertiary degrees, and the use of foreign licenses.

The estimated parameter on the productivity variable is statistically not significant. Out of four different forms of innovation outcomes, two of them are statistically significant and display expected positive sign – product innovations at 5 percent level of statistical significance and process innovations 1 percent level. One estimated parameter on marketing innovations displays unexpected negative sign and is statistically significant at 1 percent level. In addition, the estimated parameter on the R&D spending is also statistically significant at the 1 per cent level but displays expected positive sign. Moreover, the majority of our control variables are statistically significant and display expected signs. In particular, firm size, foreign ownership and the use of foreign technology are positively related to exporting and only the estimated parameter on the share of workers with tertiary degrees (*luni*) is statistically not significant.

In column (2) we report estimation results obtained from the specification in which we control for broad sectoral effects. The benchmark category was basic manufacturing. The majority of individual sectoral effects were statistically significant. For example, the other manufacturing and textiles sectors were more export oriented compared to the benchmark category while food, construction and wholesale were less export oriented. The inclusion of the sectoral effects had significant impact on statistical significance and signs of the estimated parameters of our measures of innovation activity as well as control variables.

The major difference is that the estimated parameter on productivity became positive and statistically significant, but only at 10 per cent level, which is in line with predictions of Melitz (2003) model. The statistical significance of all innovations variables have been reduced. In this estimation the significance of product innovations was reduced to 10 per cent level, while the significance of process and marketing innovations were reduced to 5 percent level. There were some changes in the case of control variables as well. In particular only the estimated parameter on the share of workers with tertiary degrees variable became positive and statistically significant at 5 per cent level, while the statistical significance of foreign licenses variable has been reduced from 5 to 10 percent level.

In column (3) we report estimation results obtained from the specification in which we control for country effects. The inclusion of country effects had a minor impact on estimators in comparison to the estimation with sectoral effects. The sign of the estimator of labor productivity variable became again statistically not significant. On the other hand the statistical significance of three variables increased. In particular, the statistical significance of process innovations increased from 5 to 1 percent and remained positive. Moreover, the statistical significance of the share of workers with tertiary degrees (*luni*) and foreign licenses variables increased as well.

In column (4) we report the estimation results obtained from the specification in which we control for both sectoral and country effects. These most representative results are somewhat different to those reported in the column (3). The major difference is that the estimated parameter on the product innovation variable became

statistically not significant, while the statistical significance of the management innovation variable became statistically significant at 10 percent level and revealed a positive sign. Moreover, the estimator of foreign licenses variable lost its statistical significance as well in this estimation, which we control for sectoral and country effects.

In conclusion we can state that process innovations are more important in comparison to product innovations in the analyzed group of new EU member states (NMS) as the value of the estimator and statistical significance are higher in the case of process innovations. In fact, the product innovations are statistically not significant in the last estimation. This result is not in line with a number of studies for other, more developed countries. Perhaps it reflects the situation in which a large share of exporters in NMS are foreign owned companies in which product innovations are mostly elaborated in the parent company. In the last estimation it was found that management innovations can positively affect exporting, while marketing innovations cannot. Moreover, the R&D expenditure, size of the firms, and the share of workers with tertiary degrees (*luni*) were found to be always positively related to exporting. Finally, the internationalization of firms through foreign capital participation was also important for export performance in all the estimations, while the use of foreign licenses was statistically less significant.

## Conclusions

In this paper we studied the relationship between various types of innovations and export performance of NMS firms. Our analytical framework referred to the most recent strand in the new trade theory literature based on the Melitz (2003) model that stresses the importance of firm productivity in entering the export markets. We treated innovations as a key element that can increase the level of productivity and focused our analysis on both product and process innovations as well as intellectual property creation. We also tried to control for the stocks of human capital proxied by the percentage of employees with tertiary education. In addition we analyzed the role of foreign capital participation in determining firm export performance. The empirical implementation of the theoretical framework was based on the probit model and the unique BEEPS V firm level data set covering the period 2011–2014.

Our estimation results indicate that the probability of exporting is frequently positively related to labor productivity, both product and process innovations, firm size, the share of university graduates in productive employment, foreign capital participation and the use of foreign licenses. In the case of NMS the process innovations appeared to be statistically more significant in comparison to product innovations. Management innovations turned out to be positive and statistically important determinant of exporting only when we control for country and sector specific effects, while marketing innovations revealed surprising negative sign in all estimations.

As regards possible conclusions for economic policy for the new EU countries, our findings suggest that policy instruments should be targeted towards specific innovations rather than innovation input. In particular, our results suggest that from the policy perspective the financial support for the development of new products

and processes should have a positive impact on exports of firms from the EU new member states. These results should be verified in future studies for particular NMS.

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## References

- Atkeson A., Burstein A., *Innovation, Firm Dynamics, and International Trade*, NBER Working Paper no. 13326, 2007.
- Aw B.Y., Roberts M.J., Xu D.Y., *R&D Investment, Exporting, and Productivity Dynamics*, NBER Working Paper, no. 14670, 2009.
- Baily M.N., Gersbach H., *Efficiency in Manufacturing and the Need for Global Competition*, “Brookings Papers on Economic Activity: Microeconomics” 1995, pp. 307–358.
- Basile R., *Export Behavior of Italian Manufacturing Firms over the Nineties: the Role of Innovation*, “Research Policy” 2001, no. 30, pp. 1185–1201.
- Becker S.O., Egger P.H., *Endogenous Product versus Process Innovation and a Firm’s Propensity to Export*, “Empirical Economics” 2013, no. 44, pp. 329–354.
- Bernard A., Jensen J.B., *Exceptional Export Performance: Cause, Effect, or Both?*, “Journal of International Economics” 1999, no. 47, pp. 1–25.
- Braunerhjelm P., *The Relation between Firm Specific Intangibles and Exports*, “Economic Letters” 1996, no. 53, pp. 213–219.
- Brodzicki T., *Innovation Intensity as a Driver of Firm’s Internationalization Intensity Evidence for Poland*, „Ekonomia, Rynek, Gospodarka, Społeczeństwo” 2016, no. 46, pp. 11–43.
- Brodzicki T., Ciołek D., *Determinanty działalności eksportowej polskich firm produkcyjnych*, „Gospodarka Narodowa” 2016, no. 2.
- Caldera A., *Innovation and Exporting: Evidence from Spanish Manufacturing Firms*, “Review of World Economy” 2010, no. 146, pp. 657–689.
- Cassiman B., Martínez-Ros E., *Innovation and Exports: Evidence from Spanish Manufacturing*, unpublished manuscript, IESE Business School Cohen, 2007.
- Cassiman B., Golovko E., Martínez-Ros E., *Innovation, Exports and Productivity*, “International Journal of Industrial Organization” 2010, no. 28, pp. 372–376.
- Cieślak A., Michałek J., *Innowacje a działalność eksportowa polskich przedsiębiorstw*, „International Business and Global Economy” 2016, no. 2(2), pp. 323–337.
- Cieślak A., Michałek J., Szczygielski K., *Innovations and Export Performance: Firm-level Evidence from Poland*, “Entrepreneurial Business and Economics Review” 2016, no. 4(4), pp. 11–28.
- Constantini J.A., Melitz M.J., *The Dynamics of Firm-level Adjustment to Trade Liberalization*, in: *The Organization of Firms in a Global Economy*, E. Helpman, D. Marin, T. Verdier (eds), Harvard University Press, Cambridge, MA, 2008.
- Damijan J., Kostevc C., Polanec S., *From Innovation to Exporting or Vice Versa?*, “The World Economy” 2010, no. 33(3), pp. 374–398.
- Damijan J.P., Kostevc C., *Learning-by-exporting: Continuous Productivity Improvements or Capacity Utilization Effects? Evidence from Slovenian Firms*, “Review of World Economics” 2006, no. 142(3), pp. 599–614.
- Filipescu D.A., Prashantham S., Criado A., Josep T., *Technological Innovation and Exports: Unpacking their Reciprocal Causality*, “Journal of International Marketing” 2013, no. (1), pp. 23–38.

- De Loecker J., *Do Exports Generate Higher Productivity? Evidence from Slovenia*, “Journal of International Economics” 2007, no. 73(1), pp. 69–98.
- Dollar D., *Technological Innovation, Capital Mobility, and the Product Cycle in North-South Trade*, “American Economic Review” 1986, no. 76, pp. 177–190.
- Ebling G., Janz N., *Export and Innovation Activities in the German Service Sector Empirical Evidence at the Firm Level*, “ZEW Discussion Paper” no. 99–53, Zentrum für Europäische Wirtschaftsforschung, Mannheim 1999.
- Entorf H., Krader W., Pohlmeier W., *Entscheidungen über Innovation, Beschäftigung und Außenhandel: Empirische Ergebnisse eines simultanen Probitansatzes*, in: *Empirische Wirtschaftsforschung*, H. Kräger (ed.), Campus 1988.
- European Firms in a Global Economy (EFIGE), *The Global Operations of European Firms*, The Second EFIGE Policy Report, Bruegel 2010.
- Foellmi R., Zweimüller J., *Mass Consumption, Exclusion, and Unemployment*, University of Zurich IEW Working Paper, 2006, no. 296.
- Gkypali A., Rafailidis A., Tsekouras K., “Eurasian Bus Review” 2015, no. 5.
- Grossman G.M., Helpman E., *Product Development and International Trade*, “Journal of Political Economy” 1989, no. 97, pp. 1261–1283.
- Grossman G.M., Helpman E., *Comparative Advantage and Long-run Growth*, “American Economic Review” 1990, no. 80, pp. 796–815.
- Grossman G.M., Helpman E., *Innovation and Growth in the Global Economy*, MIT Press, Cambridge, MA, 1991.
- Grossman G.M., Helpman E., Szeidl A., *Optimal Integration Strategies for the Multinational Firm*, “Journal of International Economics” 2006, no. 70, pp. 216–238.
- Hirsch S., Bijaoui I., *R&D Intensity and Export Performance: A Micro View*, “Weltwirtschaftliches Archiv” 1985, no. 121, pp. 138–151.
- Hopenhayn H.A., *Entry, Exit, and Firm Dynamics in Long run Equilibrium*, “Econometrica” 1992, no. 60, pp. 1127–1150.
- Jensen R., Thursby M., *A Decision Theoretic Model of Innovation, Technology Transfer, and Trade*, “Review of Economic Studies” 1987, no. 54, pp. 631–647.
- Jovanovic B., *Selection and the Evolution of Industry*, “Econometrica” 1982, no. 50, pp. 649–670.
- KPMG, *Dojrzałość innowacyjna przedsiębiorstw w Polsce*, 2014, <http://www.kpmg.com/PL/pl/IssuesAndInsights/ArticlesPublications/Documents/2014/Dojrzalosc-innowacyjna-przedsiębiorstw-w-Polsce-KPMG-2014.pdf>
- Kumar N., Siddharthan N.S., *Technology, Firm Size and Export Behavior in Developing Countries: the Case of Indian Enterprise*, “Journal of Development Studies” 1994, no. 32, pp. 288–309.
- Lachenmaier S., Wößmann L.W., *Does Innovation Cause Exports? Evidence from Exogenous Innovation Impulses and Obstacles using German Micro Data*, “Oxford Economic Papers” 2006, no. 58, pp. 317–350.
- Mairesse J., Mohnen P., *Using Innovation Surveys for Econometric Analysis*, in: Hall B.H., Rosenberg N., *Economics of Innovations*, vol. 2, chapter 26, North-Holland, Amsterdam, 2010.
- Martin S., *Endogenous Firm Efficiency in a Cournot Principal-agent Model*, “Journal of Economic Theory” 1993, no. 59, pp. 445–450.
- Melitz M.J., *The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity*, “Econometrica” 2003, no. 71, pp. 1695–1725.

- Michałek J.J., Śledziewska K., *Analiza handlu międzygałęziowego pomiędzy Polską a Unią Europejską*, in: *Od liberalizacji do integracji Polski z Unią Europejską. Mechanizmy i skutki gospodarcze*, pp. 43–61, Wydawnictwo Naukowe PWN, Warszawa 2003.
- OECD Directorate for Science, *Technology and Industry*, Economic Analysis and Statistics Division, ISIC Rev. 3, Technology Intensity Definition, 7 July, 2011.
- Roper S., Love J.H., *Innovation and Export Performance: Evidence from the UK and German Manufacturing Plants*, *Research Policy* 2002, no. 31, pp. 1087–1102.
- Schlegelmilch B.B., Crook J.N., *Firm-level Determinants of Export Intensity*, “Managerial Decision Economics” 1988, no. 9, pp. 291–300.
- Segerstrom P.S., Anant T.C.A., Dinopoulos E., *A Schumpeterian Model of the Product Life Cycle*, “American Economic Review” 1990, no. 80, pp. 1077–1091.
- Spencer B.J., Brander J.A., *International R&D Rivalry and Industrial Strategy*, “Review of Economic Studies” 1983, no. 50(4), pp. 707–722.
- Tybout J., *Plant-and Firm-level Evidence on the 'New' Trade Theories*, in: E. Kwan Choi, J. Harrigan (eds), *Handbook of International Trade*, Basil-Blackwell, Oxford 2003.
- Van Beveren I., Vandenbussche H., *Product and Process Innovation and Firms' Decision to Export*, “Journal of Economic Policy Reform” 2010, no. 13(1), pp. 3–24.
- Wagner J., *Export Performance, Human Capital, and Product Innovation in Germany: a Micro View*, “Jahrbuch für Wirtschaftswissenschaften” 1996, no. 47, pp. 40–45.
- Wagner J., *Exports and Productivity: A Survey of the Evidence from Firm-level Data*, “The World Economy” 2007, no. 30(1), pp. 60–82.
- Wagner J., *International Trade and Firm Performance: a Survey of Empirical Studies Since 2006*, “Review of World Economics” 2012, no. 148(2), pp. 235–267.
- Wakelin K., *Trade and Innovation. Theory and Evidence*, Edward Elgar, Cheltenham 1997.
- Wakelin K., *Innovation and Export Behaviour at the Firm Level*, “Research Policy” 1998, no. 26(7–8), pp. 829–41.

## Appendix

Table A1

The list of analyzed countries and the number of observations on labor productivity

Country	Summary of labor productivity		
	Mean	Std. Dev.	Frequency
Poland	12.53481	1.886507	390
Romania	11.60442	1.477842	476
Estonia	10.88395	1.058498	243
Czech Rep.	14.34824	1.445675	215
Hungary	16.63346	1.384401	193
Latvia	9.789768	1.467226	270
Lithuania	11.36614	1.178445	223
Slovak Rep.	10.75806	1.515367	172
Slovenia	11.64111	1.286459	243
Bulgaria	10.61182	1.10446	273
Croatia	12.98574	0.843683	322

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### Streszczenie

Artykuł analizuje zależność pomiędzy różnymi formami innowacji a eksportem krajów Europy Środkowo-Wschodniej należących do Unii Europejskiej. Analiza nawiązuje do modelu handlu międzynarodowego, który podkreśla znaczenie wydajności dla przedsiębiorstw wchodzących na rynki eksportowe. Autorzy traktują innowacje jako kluczowy czynnik określający poziom wydajności w przedsiębiorstwach i jej wzrost. Miernikami aktywności innowacyjnej przedsiębiorstw mogą być wydatki na badania i rozwój (B+R) oraz ich efekty, obejmujące różne formy innowacji: produktowych, procesowych (technologicznych), marketingowych, organizacyjnych i menedżerskich. Autorzy próbują określić znaczenie tych czterech form innowacji dla działalności eksportowej przedsiębiorstw. Analiza empiryczna opiera się na modelach probitowych, zastosowanych do zbioru danych mikroekonomicznych BEEPS V obejmującego okres 2011–2014. Wstępne wyniki wskazują, że prawdopodobieństwo podjęcia działalności eksportowej przez firmę zależy od innowacji produktowych, natomiast innowacje marketingowe i menedżerskie nie wydają się mieć istotnego wpływu. Następnie autorzy badają wpływ innowacji na działalność eksportową przedsiębiorstw z uwzględnieniem zmiennych kontrolnych, takich jak: wydajność pracy, wielkość przedsiębiorstwa, udział pracowników produkcyjnych z wykształceniem wyższym, udział kapitału zagranicznego i wykorzystanie licencji zagranicznych.

**Słowa kluczowe:** działalność eksportowa, innowacje, przedsiębiorstwa, Europa Środkowo-Wschodnia

**JEL:** F14, O32, P33

## INNOVATIONS AND EXPORT PERFORMANCE OF NEW EU MEMBER STATES

### Summary

The paper analyzes the relationship between different forms of innovations and export performance of firms located in Central Eastern European countries, the new member states (NMS) of the European Union (EU). The analytical framework refers to the new trade theory literature based on the model that stresses the importance of firm productivity in entering the export markets. The authors treat innovations as a key factor that determines firm's productivity. The measures of innovative activity of companies can include both spending on R&D as well as its effects, such as different forms of innovation: product, process, marketing, organizational and managerial. The authors try to assess the significance of these four forms of innovations for exports. The empirical analysis is based on the probit models, applied to the BEEPS V firm level data set covering the period 2011–2014. The preliminary results indicate that the probability of exporting is positively related to both product and process innovations, while the marketing and managerial innovations do not seem to affect export performance of firms. Next, the authors analyze the importance of innovations controlling for labor productivity, firm size, the share of university graduates in productive employment, foreign capital participation, and the use of foreign licenses.

**Key words:** export activity, innovations, firm heterogeneity, Central Eastern Europe

**JEL:** F14, O32, P33

## **ИННОВАЦИИ И ЭКСПОРТ СТРАН – НОВЫХ ЧЛЕНОВ ЕВРОСОЮЗА**

### **Резюме**

В статье проводится анализ зависимости между разными формами инноваций и экспортом стран Центрально-Восточной Европы – членов Евросоюза. Авторы используют модель международной торговли, в которой подчеркивается значение эффективности производства предприятий, выходящих на экспортные рынки. Инновации рассматриваются в качестве ключевого фактора, определяющего уровень производительности на предприятиях и ее рост. Мерилами инновационной активности предприятий могут быть расходы на исследования и разработки (ИР) и их эффекты, охватывающие разные формы инноваций: касающихся продуктов, процессов (технологии), маркетинга, организации и менеджмента. Авторы пытаются определить значение этих четырех форм инноваций для экспортной деятельности предприятий. Эмпирический анализ опирается на пробит-моделях, примененных для сбора микроэкономических данных BEEPS V за период с 2011 по 2014 гг. Предварительные результаты показывают, что вероятность начала экспортной деятельности зависит от инноваций, касающихся продукта, в то время как инновации, касающиеся маркетинга и менеджмента, не имеют, пожалуй, существенного значения. Затем авторы исследуют влияние инноваций на экспортную деятельность предприятий с учетом контрольных переменных, таких как: производительность труда, размер предприятия, доля работников с высшим образованием, доля зарубежного капитала и использование иностранных лицензий.

**Ключевые слова:** деятельность в области экспорта, инновации, предприятия, Центрально-Восточная Европа

**JEL:** F14, O32, P33