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## The Effect of Public Procurement and its Spillovers on Innovativeness of Enterprises in European Countries

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**Abstract:**

*Public procurement is an important policy instrument which supports innovation activity of enterprises. International links between economies and an increasing access to public procurement markets in European countries justify studying spatial effects of public procurement contracts on innovation activity of companies.*

*The aim of this paper is to assess these relationships using the spatial model.*

*The results show that public procurement contract is a very important innovation policy instrument, since it has the positive impact on innovations in a domestic economy and the negative effect in neighbouring countries.*

*Moreover, the need to meet requirements of public procurement contracts motivates enterprises, both in the own country and in the neighbouring countries, to undertake innovation activities.*

**Keywords:** *Public procurement, innovation, spatial spillovers.*

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## **1. Introduction**

Innovations play a crucial role in the economy as they are considered to be a key driver of economic growth. The governments promote innovation activities both in public and private sectors using different tools. One of the most efficient economic policy instrument applied to stimulate innovation activity of the private sector is public procurement. It has a great potential, since its share in total general government expenditures in EU countries in 2015 is almost 30%, while in the Netherlands 45%, in Slovakia 38%, and in Germany 34%. Similarly, there is also a high share of public procurement in GDP, in EU 14%, while in the Netherlands it equals 20%, in Finland 18%, and in Slovakia 17% (OECD, 2017).

In this article we examine the effect of public procurement on innovation activity of enterprises in European countries. We apply the spatial autoregressive model to study the impact of procurement contracts and the need to meet requirements for public procurement contracts on innovativeness of companies. It allows to verify of the significance of the public procurement effect on innovation not only in the country of the contract, but also in the neighbouring countries. This approach is supported by international links between economies and the increasing access to public procurement markets in European countries.

This paper is constructed as follows: the theoretical part includes the identification of research problem, in the methodological section, the data and methods are presented, the next section contains the results of econometric analyses and their comparison with previously published papers, the final section focuses on drawing conclusions and implications, and presenting limitations and possible avenues for future research.

## **2. Theoretical framework**

Public procurement may stimulate innovation activity in two ways. Firstly, it may be a product of 'regular' public procurement. Secondly, it may be an outcome of public procurement innovation (PPI), in which public sector places an order for the fulfilment of certain functions (through a new product). The main objective of PPI is not the development of new products, but the satisfaction of human needs or the solution to societal problems (Edquist and Zabala-Iturriagoitia, 2012; Saastamoinen *et al.*, 2018). Hence, PPI is considered to be the important innovation policy instrument (Aschhoff and Sofka, 2009).

The scientists undertake the research on the impact of public procurement on innovation using different methods and approaches. Rothwell and Zegveld (1981) find ) find that public procurement has a more significant effect on innovation than R&D subsidies. Guerzoni and Raiteri (2012) present similar results, but they notice that combination of these two instruments has the strongest effects on innovation. Aschhoff and Sofka (2009) compare the effectiveness of four innovation policy

instruments: public procurement, regulations, R&D subsidies, and basic research at universities. They provide evidence that public procurement and knowledge spillovers from universities cause innovation success equally. Uyarra *et al.* (2014) in turn identify barriers preventing firms from increasing their rate of innovations and conclude that the public sector is missing out on fully capturing innovation through procurement.

While the impact of public procurement as an instrument of innovation policy on the innovativeness of enterprises in the country is unequivocally positive, the impact of public procurements and the involvement of companies in their implementation on innovation activity of enterprises in neighbour countries is ambiguous. On the one hand, we can expect the positive impact resulting from the increase in competition between enterprises and their motivation to implement innovative solutions. On the other hand, we can anticipate the negative effect coming from the intra-governmental competition for involvement of companies in the implementation of public procurement.

The results of the interaction between these two effects are difficult to predict. Thus, we can formulate the research question: what is the final effect of public procurement on innovation activity of enterprises? To answer this question, we study the impact of public procurement on innovativeness of companies in European countries, considering its spatial dimension.

### 3. Data and method

Our study on the effect of public procurement on the innovativeness of enterprises in UE countries is based on data from the Eurostat database. These data are prepared on the basis of the Eurostat and OECD methodology, which is presented in the Oslo Manual (OECD, 2005). The data are collected in the Community Innovation Survey (CIS), carried out by the national statistical offices of EU member states and other European countries. The CIS provides a broad set of indicators of innovation activities, innovation spending, effects of innovation, public funding, innovation co-operation, sources of information for innovation, main obstacles on innovation activity, and methods of protecting intellectual property rights. The extensive piloting and pre-testing allows to verify the interpretability and validity of the CIS questionnaire before implementing it in different European countries (Laursen & Salter, 2006).

We conduct the research for 26 European countries: Austria, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Republic of Macedonia, Romania, Serbia, Slovakia, Slovenia, Sweden, and Turkey. The real problem in collecting data is missing information about public procurement contracts for several important large countries. Hopefully, the sample of countries, consisting of small and large countries from different European regions, is sufficient

for verifying the public procurement effect on innovativeness of enterprises. We use the results of the most recent survey, CIS 2014. Most statistics cover the 3-year reference period 2012-2014, but some use only one calendar year (i.e. 2012 or 2014). To fulfil the aim of the paper, we apply the spatial model. The spatial model is a comprehensive tool for studying the spatial patterns of the relationships between objects and variables. A general form of linear spatial econometric models is given by the following set of equations (Arbia, 2014):

$$y = \lambda Wy + X\beta_{(1)} + WX\beta_{(2)} + u \quad (1)$$

$$u = \rho Wu + \varepsilon \quad (2)$$

This model consists of two equations. The first one takes spatially lagged dependent variable  $y$  as one of the regressors and may also contain spatially lagged variables of some or all of the exogenous variables (the term  $WX$ ). The second equation describes the spatial model of the stochastic disturbances. In principle, there is no need for the three weight matrices in Equations (1) and (2) to be the same.

We use the model to find the relations between the implementation of public procurement and innovativeness of companies in the European countries. The innovativeness of companies is measured as the percentage of innovative enterprises in total number of enterprises (IE), and it is applied as the dependent variable. Innovative enterprises had innovation activities during the period 2012-2014, regardless of whether the activity resulted in the implementation of an innovation. During the reference period, innovation activities can be of three categories:

- successful, having resulted in the implementation of an innovation (although the innovation need not have been commercially successful);
- on-going, with work in progress that has not yet resulted in the implementation of an innovation;
- abandoned before the implementation of an innovation.

The public procurement variables measure its intensification. We employ two independent variables:

- percentage of enterprises with procurement contract for the domestic public sector in the total number of enterprises (PC);
- percentage of enterprises for which the need to meet requirements for public procurement contracts was a highly important factor in the total number of enterprises (RP).

The choice of PC and RP variables was made on the basis of the preliminary study, which indicated variables playing a crucial role in explaining innovativeness of enterprises. The spatial weights are calculated as the inverse distance between countries. Then the weight matrix is row standardized. In consequence, the spatially lagged variables are the mean values of them in neighbouring countries. They are the mean percentage of innovative enterprises, enterprises with procurement contract

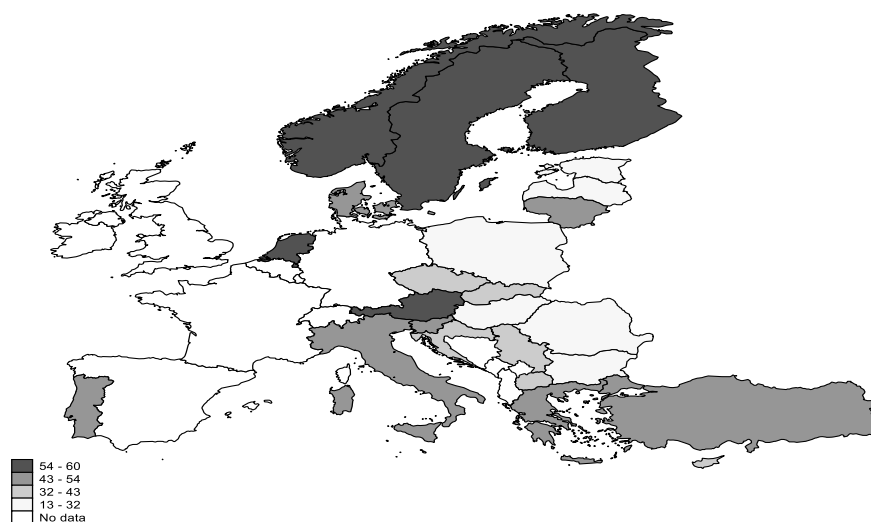
and enterprises that pay close attention to the terms of the procurement contract in neighbouring countries.

#### 4. Results and discussion

The spatial models estimated in this study describe the innovativeness of companies, which is measured as the percentage of innovative enterprises in the total number of enterprises. The level of this indicator for 26 European countries between 2012-2014 is presented in Figure 1. As previously stated, several large countries like Germany, France, United Kingdom and Spain are excluded from the study due to missing data for public procurement activity. The highest percentage of innovative enterprises is found in the Scandinavian countries (i.e. Norway, Sweden, Finland), Austria and Netherlands. These countries occupy the high positions in most of the innovation rankings created by various institutions, e.g. Global Innovation Index published by Cornell University, INSEAD, and the World Intellectual Property Organization (2015). The relatively high level of innovativeness of companies is usually reported for southern European countries (Portugal, Italy, Greece, Turkey), Denmark and Lithuania.

The position of the last country is surprising, as it belongs to the group of Central and Eastern European Countries (CEEC), which have the least innovative economies in Europe. The low level of innovativeness of these countries is the effect of their common communist history and economic delay resulting from this period. The lowest percentage of innovative companies is found in Poland, Hungary, Bulgaria, Romania, Latvia and Estonia.

*Figure 1. Percentage of innovative enterprises*

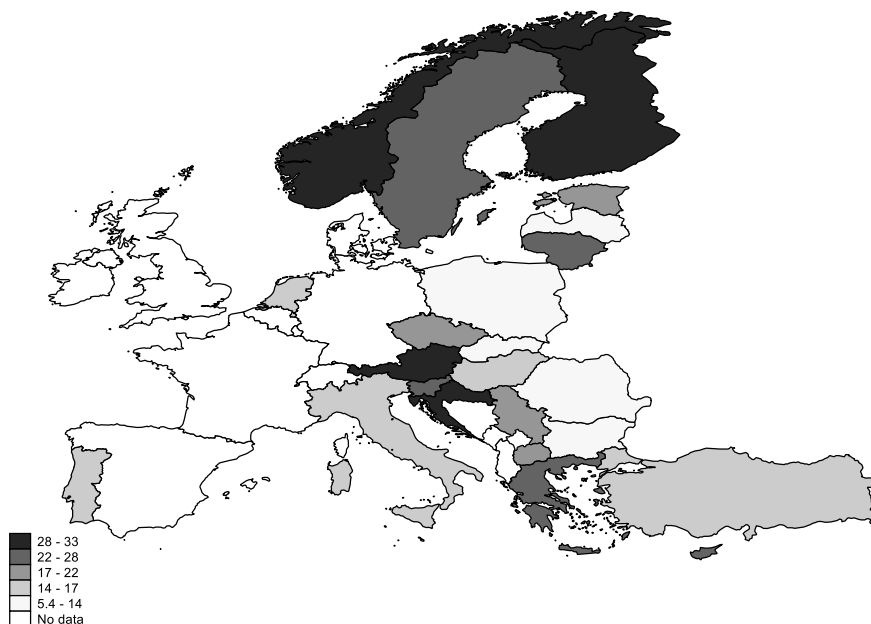


*Source: Map generated using STATA 15.*

We employ the public procurement variables in the spatial models as independent variables to verify their impact on innovativeness of companies. To visualise the level of these variables, the percentage of enterprises with the procurement contract for domestic public sector in the total number of enterprises and the percentage of enterprises for which the need to meet requirements for public procurement contracts was a highly important factor in the total number of enterprises are presented in Figure 2 and Figure 3. Figure 2 contains 25 countries (Denmark is excluded due to the lack of information) and Figure 3 contains 23 countries (without Czech Republic, Netherlands and Norway).

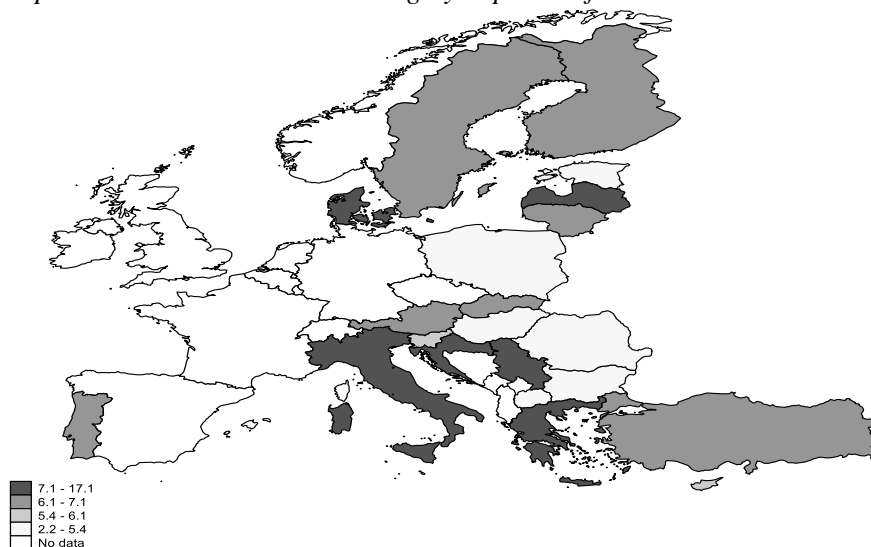
The highest engagement of enterprises in public procurement contracts is observed in Scandinavian countries, Austria, Croatia and Lithuania. Again, Lithuania is among the countries with the high activity in the analysed area. Greek, Serbian, Danish and Croatian companies pay close attention to meeting requirements for public procurement contracts. On the opposite side there are Poland, Bulgaria and Romania, where public procurements are less popular and firms are less determined to meet requirements for public procurement contracts.

**Figure 2.** *Percentage of enterprises with procurement contract for domestic public sector*



**Source:** *Map generated using STATA 15.*

**Figure 3.** Percentage of enterprises for which the need to meet requirements for public procurement contracts was a highly important factor



**Source:** Map generated using STATA 15.

The spatial models' parameters for IE variable are estimated using the generalized spatial two-stage least squares method. We apply the spatial matrix  $W$  with weights based on the inverse distance between countries. The matrix is row-standardized. The results are presented in Table 1.

**Table 1.** Estimates of model parameters for IE variable

Variables/spatial matrices	IE	
PC	0.822***	x
RP	x	4.125**
CONST	-115,18***	-128,02
W		
PC	-6.26**	x
RP	x	21,24*
IE	6.62***	x

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Source:** Author's calculations.

The results of model estimation indicate the strong positive effect of procurement contracts for domestic public sector on innovativeness of companies in European countries. Our findings are supported by Aschhoff and Sofka (2009), who indicate that public procurement has the positive and significant impact on innovation success (measured as sales with new-to-the-market products). We also confirm the positive effect of efforts to meet requirements for public procurement contracts on

innovations. Uyarra *et al.* (2014) identify the main barriers in public procurement process influencing suppliers' innovation abilities. These barriers include: the lack of interaction with procuring organisations, the use of over-specified tenders as opposed to outcome based specifications, low competences of procurers and a poor management of risk during the procurement process. Georghiou *et al.* (2014) additionally confirm that the barriers encountered by firms correspond to the deficiencies addressed by innovation policies but they do not address them sufficiently. This situation results from the lack of coverage, the lack of ownership by purchasers, the failure to address the whole cycle of acquisition and to address risk aversion.

The analysis of public procurement spillover provides new outcomes. The effect of public procurement contracts for domestic public sector on innovativeness of companies in neighbouring countries is negative. It means that the increasing intensity of public procurement for domestic sector has the positive effect on innovation in domestic economy but the negative impact on innovation in neighbouring countries. Thus, governments should extend the role of public procurement in stimulating innovation, as the neighbouring countries activities in this area may reduce the positive effects of their own actions. In turn, the efforts to meet requirements for public procurement contracts affect positively innovations in neighbouring countries. It may be the result of mutual motivation of enterprises, not only in national market, but also in foreign markets, to deliver more effective performance in the public procurement process.

## **5. Conclusions**

The aim of this article was to assess the effect of public procurement and its regional spillovers on innovativeness of enterprises in European countries. The previous studies verify the impact of public procurement and other policy instruments on innovation, and also indicate the barriers of innovation effects of public procurement. Additionally to previous works, we investigate the role of public procurement spillovers in innovativeness of companies in European countries.

We apply the spatial model to study the spillovers of public procurement contracts and efforts to meet their requirements. The results of the analyses confirm the positive effects of public procurements and attempts to meet their requirements on innovativeness of companies in national economy. At the same time we reveal the negative effect of public procurement contracts for domestic public sector on innovations in neighbouring countries. In the light of our research's findings the public procurement contract is a very important innovation policy instrument, as it has the positive impact on innovations in national economy and the negative effect in neighbouring countries. Thus, the governments should use public procurements to support enterprises in their innovation performance. Additionally, the need to meet requirements of public procurement contracts motivates enterprises, both in the own country and in the neighbouring countries, to undertake innovation activities.



This study, despite its data limitations, provides a contribution to further research. The next surveys might use more recent data supplemented by important large countries of western Europe. Therefore, future research should apply more detailed information about public procurement contracts to broaden knowledge about relationships between public procurements and innovations.

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