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THE ADOPTION OF NATIONAL GREEN PROCUREMENT PLANS FROM THE PERSPECTIVE OF CIRCULAR ECONOMY

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Abstract

The tendency of depletion of non-renewable resources and the environment's continuous degradation have been considered in the last centuries acceptable as side effects for achieving the economic growth and satisfying the human needs in the conditions of demographic growth following an upward trend. An adequate response to all these challenges is related to increasing the share of green GDP in total GDP, to green procurement and to the large-scale promotion of circular economy. At EU level, there are appropriate legislation and programs and packages aimed at implementing green procurement and the circular economy. There are also "prize-winner" countries that have adopted National Green Procurement Plans before they became mandatory, countries that have found it harder to adopt this type of plans, but also countries that have not adopted National Green Procurement Plans such as Estonia, Greece, Hungary, Luxembourg and Romania.

The article focuses on an analysis of the impact of national green procurement plans adoption on circular economy in the European Union member states for the period 2007-2018, with the help of an unrestricted VAR panel (PVAR), based on three hypotheses according to which the impact of these plans' adoption is positive on economic growth, CO2 emissions and circular economy. Data taken from Eurostat and processed using E-Views 9 econometric software allowed the validation of research hypotheses, confirming the positive impact of the adoption and implementation of green procurement national plans on some significant indicators characterizing the circular economy, which is likely to encourage the generalization of concerns regarding the adoption of coherent public policies in all Member States.

Keywords: green GDP, green procurement, circular economy, waste, recycling.

JEL Classification: F64, O13, Q28.

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Introduction

Accelerated exploitation of fossil resources given the limited nature of natural resources, demographic growth and the increased need for energy and food resources, continuous degradation of the environment and the triggering, not randomly, of phenomena such as: defrosting of the ice cap, frequent forest fires of unprecedented intensity or amplification of extreme weather phenomena, are just a few of the huge challenges that have raised serious questions about the traditional model of economic growth and have led to concerns about green GDP and circular economy. First published in 1993, in the system of national accounts at the OECD level, the concept of green GDP reflects the relationship between economic development and the conservation of natural resources and environment. According to the literature, GDP "refers to the aggregate market value of all final goods and services produced in a country in a given period of time, usually one year" (Avram, 2012). It is understandable that, as green GDP share in total GDP increases, green procurement also grows, respectively those "goods and services with a reduced impact on the environment throughout their entire lifecycle" (Neubauer et al., 2017). The goods purchased today on the principle of "lowest price" cannot be considered a correct choice if are not considered the subsequent expenses related to the decontamination and cleaning of the areas where they can be abandoned and to their collection and recycling.

The national green procurement plans began to be adopted based on the European Union's integrated policy on Environmental Life - Cycle Thinking (COM (2003) 0302 final), the first country to adopt a national green procurement plan being the Netherlands in 2003, followed by France in 2007 and Germany, Italy and Spain in 2008. Most countries have adopted national plans, gradually until 2017, with the exception of Estonia, Greece, Hungary, Luxembourg and Romania, which have not yet adopted these green procurement plans.

At European Union level, since 2004, green public procurement were regulated by Directive 2004/18 / EC, revised and completed in 2014 by Directive 2014/24 / EU. In 2014 were adopted as well Directive 2014/23 / EU on concession contracts and Directive 2014/25 / EU regarding the procurement of operators in the fields of water - sewer, energy, transport and postal services. All three Directives had the deadline for implementation in the national legislation on April 18, 2016. Starting from the Eco-Design Directive (2009/125 / EC), continuing with the Waste Framework Directive (2008/98 / EC) and the Landfill Directive (99/31 / EC), the European Commission adopted in 2015 the Circular Economy Package meant to increase the share of circular economy in the European Union through actions aimed at protecting natural resources and defending the EU member states economies from phenomena such as: depletion of ores, price volatility and dependence on sources of supply from outside the European Union.

Starting from the reality that concern for environmental issues is well defined and regulated at European Union level, while the involvement and determination of national authorities differs from one country to another, the accumulation of relevant, adequate and sufficient data for the period 2007-2018 allows analysis of the extent to which green procurement national plans gradual adoption by national authorities contributed to the growth and development of circular economy in the European Union. This article has addressed several issues, as follows: in section 1 we review the specialized literature, by highlighting the multiple research directions that had as central objective the ecological procurement process, the circular economy and the green GDP. In section 2 we present a case study on the impact of adopting national ecological procurement process on the circular economy,

detailing the research methodology, the econometric model used and the research results. At the end of the article are presented the conclusions that confirm the need to continue efforts to generalize the adoption of national plans for green procurement at the level of all the Member States of the European Union.

1. Review of the specialized literature

Even before 1993, the year of the emergence of the concept of green GDP in the system of national accounts, there were concerns for reducing pollution and for involving national authorities in adopting a more restrictive legislative framework. At the beginning, the specialized literature noted that an increase in the constraints generated by the regulation of ecological aspects causes the economic growth to slow down. Thus, comparative studies (Kendrick, 1981) highlighted the negative impact of environmental regulations on economic growth in Europe, which led to the conclusion that "government regulations seem to harm growth when viewed from this perspective" (Dornbusch and Fischer, 1997). As the authorities' concerns about increasing the share of green GDP in total GDP became more serious and the public policies focused in this direction turn more numerous, there were also studies that surprised the positive relationship between green GDP growth and nominal GDP growth (Hamilton, 1994; Wonget al., 2008; Testa et al., 2016; Cheng et al., 2018).

In the specialized literature, the issue of green procurement has been studied under its many facets. Thus, an important research direction was focused on the green supply chain management, with the help of which the organizational aspects that give consistency to the green procurement were identified (Zhu et al., 2005; Srivastava, 2007; Prajogo et al., 2008; Hsu et al., 2013). Recent studies have identified the influence of Digital Division on Big Data generation in the context of green supply chain (Gravili et al., 2018). Another equally important direction was aimed at sustainable public procurement through researches highlighting that the decisions to implement green public procurement have impact on the entire economic and social life, such as: employee satisfaction (Snell, 2006); government initiatives (Steurer et al., 2007); local administration (Preuss, 2009); public and private sectors (Walker and Branner, 2009) and in the academic environment as well (Fuentes-Bargues et al., 2018). Studies on green procurement in the private sector had also been identified, reflecting the interplay of good practices between the public and private sectors (Carter et al., 2000; Appolloni et al., 2014), but also the barriers that may intervene along the way (Giunipero et al., 2012) in the sense of limiting green procurement (Walker et al., 2008; Kaufmann et al., 2012).

A number of studies have emphasized the role of research-development activity as a driver of economic growth (Avram et al., 2015), while respecting the environment and intelligent growth (Edler and Georghiou, 2007). Other concerns of the specialists were aimed at studying the main risks of green procurement and the detailed analysis of its performances at the microeconomic and macroeconomic level (Rao et al., 2005; Green et al., 2012; Hassan, 2013; Zhu et al., 2013; Kuei et al., 2015; Theyel et al., 2015; Gonzales-Benito et al., 2016).

Another line of research, extensively studied, proved to be circular economy and recycling, defined as "sustainable design, maintenance, repairs, reuse, re-manufacturing, reconditioning and recycling" (Geissdorfer et al., 2017), which has highlighted the prominent role of governments and national and local authorities in implementing the principles of circular economy (Reike et al., 2018). Nor has the public's contribution to

supporting the circular economy been neglected, as the degree of knowledge that can change people's behavior for showing greater respect for the environment and generating ecological behavior is important (Brătianu, 2013; Junot, Paquet and Martin-Krumm, 2017).

2. Case Study: The Impact of Green Procurement Plans Adoption on Circular Economy

2.1. Research Methodology

The study presented in the paper is based on an unrestricted VAR panel (PVAR), which is best suited for the analysis of cross-sectional time series. PVAR is considered a versatile research tool because it allows analysis of the dynamic interaction between variables, "the main purpose of VAR type analysis is to evaluate the effects of various shocks on the system variables" (Enache, 2015). The data selected at the level of European Union 28, with the exception of Croatia, were taken from Eurostat for the period 2007-2018 and processed using the E-Views 9 econometric software.

The variables were chosen to best meet the research objective as follows:

- G.P.P. – respectively the introduction of national green procurement plans - it points out the moment when the National Action Plans for Green and Sustainable Procurement were adopted. Thus, for the countries that have not adopted the National Green Procurement Plans, the variable has the value 0 for the whole period 2007-2018. For the other countries, the value is 0 for the periods prior to the adoption of National Green Procurement Plans and becomes 1 from the year when those plans were adopted. In this way, the opportunity offered by the VAR methodology through the impulse - response function in studying the implications of public environmental policies and green procurement is capitalized. Considering the information presented in Table no.1, it turns out that during the whole period analyzed the GPP was considered 1 for the Netherlands and France and 0 for Estonia, Greece, Hungary, Luxembourg and Romania. For the other states, the value was initially considered 0 and became 1 from the year of the adoption for the first time of National Green Procurement Plan.

- G.D.P. – G.D.P. per capita at purchasing power parity - an indicator chosen to validate a very important hypothesis related to the adoption of green procurement procedures, respectively if the economic growth could be affected by this action, a fact that can justify the reluctance of some national authorities regarding the implementation of national green procurement plans, as is the case of Estonia, Greece, Luxembourg, Hungary and Romania.

Three important variables were selected for the circular economy, respectively:

- CO₂ - tons of carbon dioxide per capita - an indicator that measures the incidence of a very important polluting factor, widely debated in the literature.
- Recycled materials - the average volume of recycled materials, measured in kg per capita.
- Waste - the average volume of waste generated measured in kg per capita.

The controversies highlighted by the literature on the impact of environmental regulations on economic growth require a clear answer to determine whether the reluctance of national authorities that have not yet implemented the national green procurement plans is justified or not. At the same time, previous studies (Ying and Lijun, 2012) have shown that green

purchases lead to a decrease in the quantity of waste and to an increase in the amount of recycled materials.

Therefore, based on the above mentioned researches and in order to analyze the impact of national green procurement plans adoption on circular economy, three research hypotheses were formulated:

- H1 - The impact of National Green Procurement Plans adoption on economic growth, given the importance of circular economy for sustainable growth.
- H2 - The introduction of National Green Procurement Plans has a positive impact on CO₂ emissions. The relationship between green procurement and CO₂ emissions has been studied since 2010 (Abdallah et al., 2010), the present study bringing in addition a focus of the data as the Green Procurement Plans are adopted by the national authorities.
- H3 - The introduction of National Green Procurement Plans has a positive impact on the circular economy, reflected in both the recycled materials and the quantity of waste.

2.2. Econometric model

The model used for research is an unrestricted VAR panel that originates from the Cobb-Douglas production function, modified by Koke (2002), which considers production as dependent on input factors.

$$GDP_{1,t} = \alpha_2 + \Delta \sum_{j=1}^t \beta_{1,j} GDP_{1,t-j} + \Delta \sum_{j=1}^t \gamma_{1,j} GPP_{1,t-j} + \Delta \sum_{j=1}^t \delta_{1,j} CO_{2\ 1,t-j} + \Delta \sum_{k=1}^t \epsilon_{1,j} Recycle_{1,t-j} + \Delta \sum_{k=1}^t \theta_{1,j} Waste_{1,t-j} + u1_t \quad (1)$$

$$GPP_{1,t} = \alpha_2 + \Delta \sum_{j=1}^t \beta_{1,j} GPP_{1,t-j} + \Delta \sum_{j=1}^t \gamma_{1,j} GPP_{1,t-j} + \Delta \sum_{j=1}^t \delta_{1,j} CO_{2\ 1,t-j} + \Delta \sum_{k=1}^t \epsilon_{1,j} Recycle_{1,t-j} + \Delta \sum_{k=1}^t \theta_{1,j} Waste_{1,t-j} + u1_t \quad (2)$$

$$CO_{2\ 1,t} = \alpha_2 + \Delta \sum_{j=1}^t \beta_{1,j} CO_{2\ 1,t-j} + \Delta \sum_{j=1}^t \delta_{1,j} GDP_{1,t-j} + \Delta \sum_{j=1}^t \gamma_{1,j} GPP_{1,t-j} + \Delta \sum_{k=1}^t \epsilon_{1,j} Recycle_{1,t-j} + \Delta \sum_{k=1}^t \theta_{1,j} Waste_{1,t-j} + u1_t \quad (3)$$

$$Waste_{1,t} = \alpha_2 + \Delta \sum_{j=1}^t \beta_{1,j} Waste_{1,t-j} + \Delta \sum_{j=1}^t \gamma_{1,j} GPP_{1,t-j} + \Delta \sum_{j=1}^t \epsilon_{1,j} GDP_{1,t-j} + \Delta \sum_{j=1}^t \theta_{1,j} CO_{2\ 1,t-j} + \Delta \sum_{j=1}^t \delta_{1,j} Recycle_{1,t-j} + u1_t \quad (4)$$

where:

GDP – G.D.P. per capita;

GPP – Introduction of National Green Procurement Plans;

Waste – Waste in kg per capita;

Recycle – Recycled materials in kg per capita;

CO₂ – CO₂ tons per capita.

To validate the results, it is necessary to use the standard test recommended by Harvey, since 1990, to verify if the stability conditions, the optimal number of selected lags, the LM autocorrelation test and the heteroscedasticity test are met. The standard testing for the VAR methodology certifies, first of all, that the stability condition is met, as presented in Table no. 1. This test also validates the system of differential equations presented above.

Table no. 1: VAR stability condition

Lag specification: 1	
Square Root	Module
0.997913	0.997913
0.953489	0.953489
0.841918	0.841918
-0.131825 - 0.393449i	0.414946
-0.131825 + 0.393449i	0.414946
-0.359227	0.359227
0.335015	0.335015
0.048273 - 0.115931i	0.125580
0.048273 + 0.115931i	0.125580
-0.081323	0.081323
No square root lies outside the unit circle.	
VAR satisfies the stability condition.	

The testing of lags number confirms that the optimum number of selected lags is 1, which means the variables take effect one year after the date of National Green Procurement Plans introduction (Table no. 2).

Table no. 2: Selection of lags number

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1215.541	NA	12288242	30.51353	30.66241	30.57322
1	-855.2413	666.5549	2815.961*	22.13103*	23.02429*	22.48917*
2	-842.8599	21.35804	3888.879	22.44650	24.08414	23.10307
3	-824.4599	29.43990	4672.447	22.61150	24.99352	23.56652
4	-787.5200	54.48632*	3592.240	22.31300	25.43941	23.56647
5	-772.6690	20.04887	4912.880	22.56673	26.43752	24.11864
6	-742.1229	37.41899	4685.543	22.42807	27.04325	24.27843
7	-711.8106	33.34359	4688.564	22.29526	27.6548	24.44407
8	-690.5528	20.72628	6220.342	22.38882	28.49276	24.83607

* indicates lag order selected by the criterion

where:

LR – Sequential modified LR test statistic (each test at 5% level);

FPE – Final prediction error;

AIC – Akaike information criterion;

SC – Schwarz information criterion;

HQ – Hannan-Quinn information criterion.

The LM autocorrelation test presented in Table no. 3 confirms that no autocorrelation is necessary and, therefore, the VAR testing may continue with the heteroscedasticity test, as shown in Table no. 3 and Table no. 4.

Table no. 3: LM Autocorrelation test			Table no. 4: Heteroscedasticity test		
VAR Residual Serial Correlation LM Tests			VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)		
Lags	LM-Stat	Prob	Joint test:		
1	46.47578	0.0056	Chi-sq	df	Prob.
2	43.09525	0.0137	182.3289	135	0.0042
Probs from chi-square with 25 df.					

Validation of the VAR stability condition, followed by the selection of the number of lags, the autocorrelation test and the heteroscedasticity test, allows the variance decomposition as presented in Table no. 5.

Table no. 5: Variance Decomposition

Period	S.E.	CO ₂	GPP	RECYCLED MATERIALS	WASTE	L_GDP
1	0.552262	14.99834	0.047138	1.30E-06	0.092256	84.86227
2	0.768990	15.08884	0.168999	0.006491	0.071588	84.66408
3	0.927233	15.09181	0.575392	0.006768	0.061210	84.26482
4	1.054818	15.02169	1.167381	0.005907	0.052558	83.75247
5	1.162205	14.89477	1.870267	0.004950	0.045615	83.18440
6	1.254810	14.72545	2.629446	0.004181	0.039944	82.60098
7	1.335838	14.52542	3.406227	0.003658	0.035308	82.02939
8	1.407398	14.30393	4.174050	0.003372	0.031510	81.48714
9	1.470981	14.06820	4.915380	0.003290	0.028397	80.98473
10	1.527705	13.82379	5.619250	0.003377	0.025844	80.52774

where:

S.E. – Standard error;

L_GDP – Logarithmic data series of GDP.

It is important to note the impact of National Green Procurement Plans introduction on the economic growth even in the first year, but also the long horizon of response of the G.D.P. to the stimuli generated by the introduction of Green Procurement Plans.

2.3. Results and debates

Hypothesis H1 is confirmed in the sense that the impact of green procurement plans adoption on the economic growth is a positive and, at the same time, sustainable one as can be seen in Figure no. 1, which confirms the results of previous studies (Hamilton, 1994; Wong et al., 2008; Testa et al., 2016; Cheng et al., 2018), as opposed to the results of the comparative studies conducted by Kendrick in 1981.

Concerns of economic downturn due to the implementation of national plans for green procurement are unjustified. Authorities in Estonia, Greece, Hungary, Luxembourg and Romania will identify with the adoption of green procurement plans a source of sustainable growth.

It is important to note the impact of National Green Procurement Plans introduction on the economic growth even in the first year, but also the long horizon of response of the G.D.P. to the stimuli generated by the introduction of Green Procurement Plans.

It is true that countries that have not adopted national green procurement plans have nevertheless registered economic growth during the analyzed period; for example, in Romania, the level of economic growth is among the highest in the European Union during the period 2017 - 2018. However, this economic growth was based on consumption and it cannot be considered sustainable growth. Research results on the hypothesis H2 show that it is not validated and the introduction of national green procurement plans does not automatically lead to reduced CO2 emissions, being partially invalidated the conclusions of the study carried out by Abdallah in 2010. Implementation of green procurement can be considered a necessary but not sufficient condition for reducing CO2 emissions. For this scope, significant structural changes are required in industrial policy, in constructions, transports, protection of wooded areas but, most of all, the increase of the decision makers' interest in social responsibility is a must be. Figure no. 2 reflects the fact that, in the absence of other specific measures, after two years since the introduction of green procurement plans, CO2 emissions have registered a sustained increase.

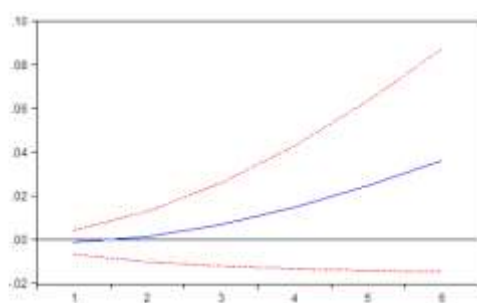


Figure no. 1: Impact of GPP on GDP

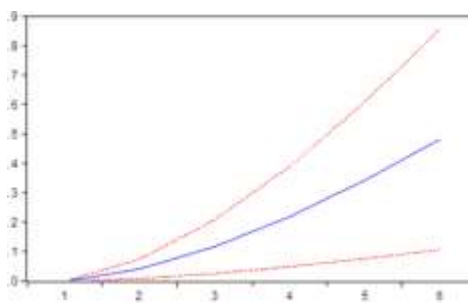


Figure no. 2: Impact of GPP on CO2

Hypothesis H3 is confirmed, the introduction of national green procurement plans contributes on one hand to reducing the quantity of waste per capita and on the other hand to increasing the quantity of recycled materials, which is a confirmation of the studies conducted by Ying and Lijun, in 2012. Green procurement contributes greatly to waste reduction as reflected in Figure no. 3.

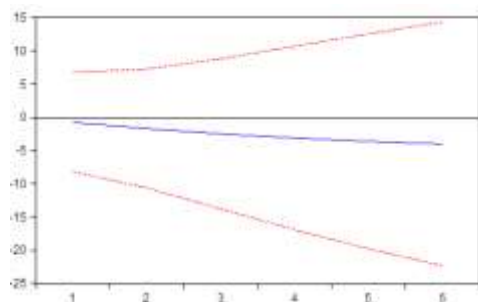


Figure no. 3: Impact of GPP on waste

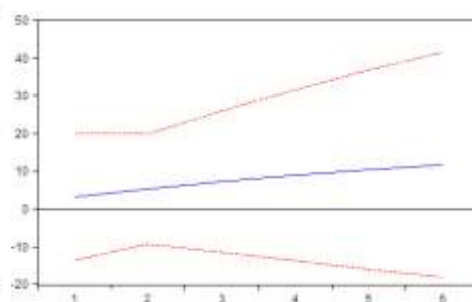


Figure no. 4: Impact of GPP on recycled materials

The national green procurement plans contain clear provisions and additional targets related to increasing the volume of recycled materials, as shown in Figure no. 4, which reflects the impact of GPP on the quantity of recycled materials per capita. It is obvious that the national plans contain higher targets regarding the level of recycled materials with each passing year, fact also reflected in Figure no. 4.

Conclusions

The results of this study confirm that the states which have adopted national green procurement plans have achieved both economic growth and reduction of the waste amount, as well as an increase of the quantity of recycled materials, whereas for the reduction of carbon dioxide emissions the introduction of these plans has proven to be a necessary but not sufficient condition, given this phenomenon's magnitude. Considering that among the causes that led to the non-adoption of these national plans are mentioned aspects of a legal nature and the "inertia" (Neubauer et al., 2017) of authorities with specific tasks in this area, some specific reactions from the civil society, the academics and the general public can represent solutions for raising awareness about the need to adopt the legal framework in the field and specially to boost the fight against inertia.

The results of this research confirm the positive impact of the national green procurement plans adoption on economic growth and on some indicators relevant for the characterization of circular economy. The fact that the countries which have adopted these national plans have registered a growth of the green GDP is all the more encouraging when it has not been done to the detriment of economic growth. This overcomes the fears of those who believe that an increasing concern for green procurement may contradict aspirations related to economic growth, labor market equilibrium or budget balance. Economic growth can lead to increased budgetary revenues and better use of labor force. In this regard, it is crucial for all EU Member States to adopt national green procurement plans, through appropriate public policies, and replace the "lowest price" criterion with the "best price throughout the product lifecycle" criterion. To achieve this, the authorities must acquire the theoretical and practical valences of the expressions "BPQR - Best Price Quality Ratio" and "MEAT - Most Economically Advantageous Tendering", without having any reluctance in terms of the negative impact of green procurement on economic growth.

The positive impact of national green procurement plans adoption is confirmed by the increase of recycled materials and decrease of the quantity of waste generated per capita, as

those contain responsibilities for the circular economy that increase year after year for both central authorities and municipal authorities in the countries where these plans had been adopted. Regarding the impact of national green procurement plans adoption on carbon emissions, our study practically rejects Hypothesis H2 since it is obvious that the introduction of these plans is a necessary but not sufficient condition for reducing carbon dioxide emissions. It is known that the most difficult moment for public policies is the one related to the introduction of a plan of measures on the public agenda. National Green Procurement Plans are already on the agenda of public authorities, but things cannot unravel on their own the critical mass being necessary to demonstrate the public's major interest in the circular economy, green procurement and green GDP growth.

The study presented in this paper can be further developed to capture the public policies needed to reduce CO₂ emissions by focusing the researches on industrial policy instruments, on restructurings in the field of construction and transport and on protecting and regenerating the forestry fund and increasing wooded areas.

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