

ALINA GEORGETA AILINCĂ¹
GABRIELA PICIU²

AIR POLLUTION IN THE CONTEXT OF THE CIRCULAR ECONOMY IN SIRET-PRUT-NISTRU EUROREGION

***Abstract.** As compared with other current societal, economic and political issues, environmental issues have long been neglected. In the context of the need for major changes, the circular economy can be a solution for changing the economic paradigm as well as a response to the reduction of air pollution. Health in the context of lucrative human activities is still second, but the solution could easily come through the transition to the circular model by providing clean air.*

The European Union has set itself the goal of achieving specific levels of air quality improvement, by reducing risks to the environment and human health since the 1970s, integrating more and more environmental protection requirements into European policies.

Thus, the present article tackles the sensitive issue of the air quality by revising the latest EU legislation in the matter, also linking it to a brief analysis of the air pollution in Siret-Prut-Nistru Eurozone (the part that belongs to the Republic of Moldova), and its connection with a series of economic and the health status of the population indicators in the period 2008-2017.

Key words: euroregion, air pollution, economic and social implications.

JEL: Q01, Q53

1. Introduction

The transition to a circular economy requires fundamental changes in production and consumption systems, far outweighing resource efficiency and recycling of waste. In the concept of circular economy, preserving the central role of products, preserving their value as much time as possible, places them at the center of the transition process. The current actions of stimulating and monitoring the transition focus primarily on materials, which is not surprising, as the circular economy's vision has evolved as a solution to the waste problem and current policies and business tools focus on waste or materials. Environmental issues such as biodiversity loss, water, air, soil pollution, both exhaustion and excessive use of resources and land are increasingly threatening society, and economic challenges such as supply risk, problematic structures deregulated markets and weak incentive structures lead to an increase in financial and economic instability.

¹ Scientific Researcher III, Ph.D., “Victor Slăvescu” Centre for Financial and Monetary Research, Bucharest, alina.glod@gmail.com.

² Scientific Researcher II, Ph.D., “Victor Slăvescu” Centre for Financial and Monetary Research, Bucharest, gabriela_piciu@yahoo.

Air pollution and its impact on human health, ecosystems and biodiversity should be further reduced, with the long-term goal of not exceeding critical quantities and levels. To do this, efforts need to be stepped up in the field of air quality and to define relevant strategic objectives and actions for the post-2020 period.

In the Siret-Prut-Nistru Euroregion of Republic of Moldova (SPNERM), although the linear economy is deeply rooted, emerging trends indicate that the role of products in society is changing.

Moving to a circular economy requires a better understanding of the links between products, the underlying business model, infrastructure and societal governance that determine their lifecycle.

Monitoring and analysis conducted to identify key mechanisms and trends will be crucial in this respect. Generalizations must be avoided, however, because there is no universal solution for better product design for circular use.

2. The latest legislation of EU about clean air

In order to improve air quality, in latest decades, the EU was struggling to enforce requirements for environmental protection in energy, transport and industrial sectors. Thus, three main pillars of legislation (European Commission, 2018 and EEA, 2018) for clean air were projected: – Ambient air quality standards protecting environment and human health (EU, 2004 and EU, 2008), – Emission and energy efficiency standards for key sources of air pollution, – National emission reduction targets established in the National Emission Ceilings (NEC) Directive (EU, 2016).

Also, the European Commission adopted in 2013 a Clean Air Policy Package, including a Clean Air Programme for Europe (CAPE), (European Commission, 2013), aims to ensure full compliance with actual legislation until 2020. Also, the targets were set to further improve Europe's air quality, in order that by 2030 the number of premature deaths is reduced by half in report to the year 2005. Also, the CAPE was projected to track progress towards the Ambient Air Quality Directives objectives. In 2017, European Commission, regarding Ambient Air Quality Directives, started a two year process (until the 2019 ending) monitoring and assessment methods fitness for the period 2008–2018 but also and the extent to which have been facilitated action to prevent or reduce adverse impacts by the above directives.

In 2016, new directive for the limitation of the specific pollutants emissions of the medium combustion plants (EU, 2015) regulated pollutant emissions from fuels combustion with thermal input equal to or greater than 1 MWth and less than 50 MWth.

In 2018, for regional, national and local actors, the Commission adopted a communication with a more practical guidance – “A Europe that protects: Clean air for all”. Member States are also supported by EU to meet their targets of clean air especially in urban areas by EU Urban Agenda and Urban Innovative Actions.

In addition, European Commission prioritises a strong Energy Union and committed also to accomplish the Paris Agreement on Decarbonisation targets, including by promoting electric cars.

The Republic of Moldova aims to integrate into the European Union by fulfilling the obligations stipulated in the Moldova-EU Association Agreement. In this respect, harmonization of environmental legislation is one of the main priorities and efforts are focused on the transposition of the *acquis communautaire* and directives on air quality, water, nature protection and biodiversity, waste, climate change, chemicals, mining, fishing etc.

3. Methodology

The article proposes a theoretical and a practical approach linking the air pollution to some economical and social indicators. At present, there are limited analyzes of the effects of air pollution, and in the Siret-Prut-Nistru Euroregion the empirical and applicative analyzes are still expected to be conducted. Thus, this article proposes a relatively simple but effective econometric approach to a better understanding of economic reality at the Siret-Prut-Nistru Euroregion of Republic of Moldova concening clean air. The approach is built on panel data with all the Moldova Siret-Prut-Nistru Euroregion districts or “rayons”.

The database used is that of National Bureau of Statistics of the Republic of Moldova for the period 2008–2017. Also, for the analysis of the air pollution with CO₂ and SO₂ we used the statistical data from the period 2005–2014.

4. Results and commentaries

On the researches of National Bureau of Statistics of the Republic of Moldova for the period 2007–2017, we made an econometric analysis with some relevance to the air pollution. The results obtained are given below.

From the correlation matrix, the fertility rate is relatively fair (as expected) related to the regional air pollution indicator and the same thing we can say about genral population morbidity. Urban green spaces indicators do not correlate as how we expected with the air pollution indicator. This is due to the unsatisfactory evolution in the urban area of green space management.

If we consider that the increase and implicitly the increased value of industrial production causes air pollution, we can consider the evolution of the two indicators PSE and VIP as natural as possible.

Table 1

The correlation matrix regarding pollutant substances evacuation into air, total fertility rate, general population morbidity, the green spaces in urban area and value of industrial production on SPNERM

	<i>PSE</i> (Tones)	<i>TFR</i> (Anbc)	<i>GPM</i> (pers. per 100000 pers.)	<i>GSUA</i> (Thousand m ²)	<i>VIP</i> (Mil. lei)
PSE (Tones)	1				
TFR (Anbc)	-0.474	1			
GPM (pers. per 100000 pers.)	0.462	-0.197	1		
GSUA (Thousand m ²)	0.896	-0.510	0.501	1	
VIP (Mil. lei)	0.887	-0.519	0.512	0.962	1

Source: data from National Bureau of Statistics of the Republic of Moldova, authors' processing.

Notation: *PSE* – Evacuation of polluting substances in the atmospheric air by stationary sources of economic agents (Tones), *TFR* – Total Fertility Rate (Average number of born children of a woman on her entire fertile life), *GPM* – General Population Morbidity per 100000 pers (cases per 100000), *GSUA* – Green Spaces in Urban Area (Thousand square meters), *VIP* – Value of Industrial Production (Mil. Lei).

On the base of the above correlation matrix we can see that two elements can be considered causes and the other two effects. Thus, in Table 2 we can see that total fertility rate and general population morbidity in Siret-Prut-Nistru Euroregion of Republic of Moldova has a rather weak R Square and Adjusted R Square (of 0.3664 and respectively 0.3627), but the p-value for the two indicators is well below 0.05, meaning that the model is well specified allowing for us to reject the null hypothesis H₀. Only for TFR the coefficient is different significantly from 0, and the negative sign means that there is an inverse link between the pollution indicator and the total fertility rate analyzed.

Also on the base of the above correlation matrix (see Table 3) we can see that the alleged determinants of air pollution – the value of industrial production and the green spaces situation in urban areas have a small coefficients, not so different from 0. At the same time, the value of the determination coefficient (R²) 0.8109 is more than satisfactory and R² adjusted 0.8097 at the level of 340 observations suggests a relatively strong correlation between the variables in the model. Thus, in Table 3 we can see that the p-value for the two indicators is well below 0.05, meaning that the model is well specified allowing for us to reject the null hypothesis H₀ and to considered that the influence on PSE comes mainly from these factors. Only for GSUA the coefficient is rather different from 0, but the positive sign can mislead us. This is due to the relatively stagnant situation of green space management at urban level, so it is not surprising why air pollution is evolving in the same way as the development of urban green areas.

Table 2

The summary results of regression equation regarding pollutant substances evacuation into air and total fertility rate and general population morbidity, on SPNERM

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.6053							
R Square	0.3664							
Adjusted R Square	0.3627							
Standard Error	484.8164							
Observations	340							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	2	45812703	22906352	97.45435478	4.00025E-34			
Residual	337	79210831	235046.98					
Total	339	125023534						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1093.015378	266.09465	4.1076187	5.02294E-05	569.5996851	1616.4311	569.59969	1616.4311
TFR (Anbc)	-1304.152042	144.72693	-9.0111224	1.55212E-17	-1588.83399	-1019.4701	-1588.834	-1019.4701
GPM (pers. at 100000 pers.)	0.017664572	0.0020349	8.6808995	1.71087E-16	0.013661909	0.0216672	0.0136619	0.0216672

Source: Data from National Bureau of Statistics of the Republic of Moldova, authors' processing. Preserving above notations.

Moldova is a very vulnerable country to climate change. This becomes more dangerous if the Republic of Moldova is an agricultural country. One of the objectives agreed and declared in the field of climate change is to reduce the total emissions of greenhouse gases by 2020 by at least 25% compared to the base year 1990, by implementing economic mechanisms aimed at mitigating climate change, in accordance with the principles and the provisions of the United Nations Framework Convention on Climate Change. To solve this problem, the implementation of GD 1009/2014 in the Strategy for adaptation to climate change by 2020 is vital. Air quality is low in the Republic of Moldova. Although 6 air quality directives have been established, little progress has been made so far.

The Republic of Moldova emitted about 13.95 Mt CO₂ equivalent in 2015, which represents less than 0.04% of the total global emissions. According to the Two Biennial Report of the Republic of Moldova, the GHG emissions after 2015 have remained constant. The Republic of Moldova is committed to achieving by 2030 the unconditional target of 64–67% reduction of GHG emissions compared to the level of 1990 (reference year). The commitment to reduce greenhouse gas emissions could conditionally increase up to 78%, in the case of providing low-cost financial resources, technology transfer and multilateral technical cooperation, access to all of them being appropriate to the challenges of change.

Table 3

The summary results of regression equation regarding pollutant substances evacuation into air and the green spaces in urban area and value of industrial production on SPNERM

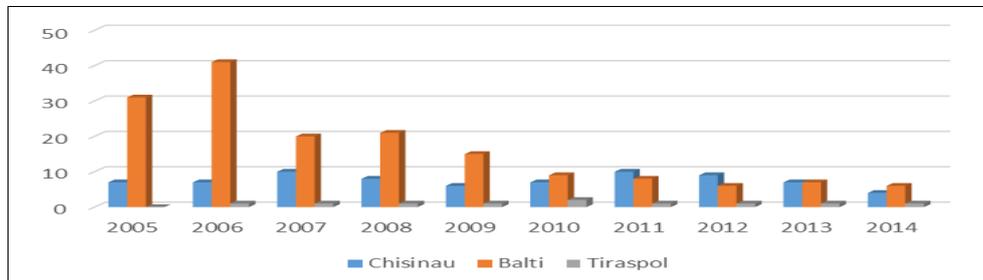
SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.9005065							
R Square	0.8109119							
Adjusted R Square	0.8097897							
Standard Error	264.85799							
Observations	340							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	2	101383068	50691534	722.61885	1.312E-122			
Residual	337	23640467	70149.753					
Total	339	125023534						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	274.32036	15.111716	18.152827	7.621E-52	244.5951886	304.045532	244.59519	304.04553
GSUA (Thousand m ²)	0.5282537	0.0807553	6.5414106	2.264E-10	0.369405737	0.68710174	0.3694057	0.6871017
VIP (Mil. lei)	0.0558219	0.0141212	3.9530447	9.405E-05	0.028045034	0.08359883	0.028045	0.0835988

Source: Data from National Bureau of Statistics of the Republic of Moldova, authors' processing preserving above notations.

In terms of SO₂ pollution it has decreased over the years, the main sources are thermal power stations and small and medium boilers for coal burning in urban areas, the highest annual average concentration being recorded in 2006 in Balți – 41 µg / m³ (Figure 1).

Moldovan cities in the Siret – Prut – Nistru Euroregion are facing a serious problem in the area of air quality monitoring. According to the data collected, the following substances are present in the air: sulfur dioxide, carbon monoxide, nitrogen dioxide, soluble sulphates, nitrogen oxide, phenol, formaldehyde. Using the current monitoring system will not allow us to control the implementation of transposed EU air quality directives. Also, the current data are not comparable at regional / European level.

Air quality is determined by air emissions from stationary sources and mobile sources (road traffic), predominantly in large cities, as well as long-distance transport of air pollutants.



Source: Data from National Bureau of Statistics of the Republic of Moldova

Figure 1. Average annual SO₂ concentration for the cities of Chişinău, Bălţi, Tiraspol

5. Conclusions

The circular economy, viewed in the context of sustainable development and, as one of the basic tools for achieving sustainable development, also as a means of efficiency of resources and energy, the application of cleaner technologies, with low carbon emissions and reduced pollution, and minimization of environmental risks.

The transition to a circular economy will create major economic opportunities. The “circularity” of the economy is a new growth engine, a generator of decent jobs and a vital strategy to eradicate poverty. This process can turn many challenges into economic opportunities and prevent the negative impact on the environment. Also, the circular economy will greatly increase economic growth and the number of jobs in the environmental sector that require specific environmental skills.

This process involves the modification of sustainable production and consumption patterns, and the change can be made through regulations, taxation, legal decisions and requests from the public, etc. In terms of sustainable production and consumption, in order to achieve the EU objectives, it is necessary to increase business responsibility and raise awareness of civil society, as Moldova continues to take the first steps in this area.

Integrating climate change and climate change adaptation issues into sectoral development policies and sustainable practices that need to be implemented at national and local level are essential to reduce pressures on policies and activities of other sectors on the environment and to achieve the following policy objectives, environment and climate.

References

1. European Commission (2013) – “The Clean Air Programme for Europe” (http://ec.europa.eu/environment/air/clean_air/index.htm).
2. European Commission (2018) – “Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the

- Regions — 'A Europe that protects: Clean air for all' "(COM(2018) 330 final) (http://ec.europa.eu/environment/air/pdf/clean_air_for_all.pdf).
3. European Environment Agency (EEA) (2018) – "EEA Report No 12/2018, Air quality in Europe — 2018 report", Publications Office of the European Union, Luxembourg, 2018.
 4. EU (2004) – "Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air" (OJ L 23, 26.1.2005, pp. 3–16).
 5. EU (2008) – "Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe" (OJ L 152, 11.6.2008, p. 1–44).
 6. EU (2016) – Directive 2016/2284/EC of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC (OJ L 344, 17.12.2016, p. 1–31).
 7. UN (2013) – "*Minamata Convention on Mercury*", United Nations, UN Environment (http://www.mercuryconvention.org/Portals/11/documents/Booklets/Minamata%20Convention%20on%20Mercury_booklet_English.pdf).