Legal and Economic Instruments of Environmental Protection in the Area of Air Protection - Example of Selected Regions of the Czech Republic and Impacts on Entrepreneurs

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Abstract: The environment regulates act No. 17/1992 Coll., on the Environment, which applies in the Czech Republic, everything that creates natural conditions for the existence of organisms, including humans, and is a prerequisite for their further development. Its components are mainly air, water, rocks, soil, organisms, ecosystems and energy. This law is based on the premise, that mankind and other organisms are an integral part of nature, recalling the natural interdependence of mankind and other organisms, while respecting the right of mankind to reshape nature in accordance with the principle of sustainable development, aware of his responsibility for maintaining a favorable environment future generations and emphasizing the right to a favorable environment as one of the fundamental rights of mankind. This paper assesses whether the government spending programs have an impact on air protection as a significant component of nature. The author uses methods of statistical analysis and legal analysis. The result of the article is that there is a relationship between spending programs for businesses and reducing emissions around industrial plants. Economic instruments of environmental protection therefore have the benefit of reducing air pollution.

Key-Words: environment, air, efficiency, public spending programs, regression analysis

1 Introduction

Air is one of the most important components of the environment for man to do without. Breathing air and everything it contains reaches the interior of the human body and directly affects human health. That is the reason why air quality it is given the great attention both at the national and European level and internationally. Air protection means preventing and reducing air pollution. This is important for the limit of the risks to human health caused by air pollution, reducing the burden on the environment by substances introduced into the air and damaging ecosystems and creating the conditions for the regeneration of environmental components affected by air pollution (Abdullah, Khalid, 2012). The level of ambient air pollution is mainly due to the discharge of pollutants from various sources as a result of human activity (local fireplaces, transport, industry and energy, agriculture) and natural processes may also influence it (van der Kamp, 2017). The pollutants are transmitted in the atmosphere and can thus affect air quality both in the immediate vicinity of the source of pollution itself and in more remote areas. The basic legal norm regulating the assessment and management of air quality and operation of air pollution sources is Act No. 201/2012 Coll., On air protection, as amended.

The Ministry of the Environment also participates in the protection of the Earth's ozone layer from substances that cause its damage (for examples freons). The result is measurement of the ozone layer, dangerous ultraviolet radiation penetrates the Earth's surface, which can cause dangerous diseases (Arndt, Carmichael, Streets, Bhatti, 1997). Reducing emissions of these substances is one of the world's most successful environmental projects.

2 Problem Solution

The paper evaluates the effectiveness of public spending programs for companies in the field of air protection. European Union (EU) countries have problems with government deficits. It is therefore necessary to carefully consider where public funds go. In other words, both the EU and the Czech Republic put great emphasis on maximizing the effective use of public funds. The pressure of the

EU Commission on the effectiveness of public policies is also apparent. Increasingly, there are researches on the impact of support programs in companies.

Expenditure on air protection brings significant economic burden to entrepreneurs. Given that this fulfills one important function of the state, environmental protection, the state and the EU subsidizes measures taken by companies.

Czech Hydrometeorological Institute want to collect and generally make available measured data from important networks monitoring substances polluting the ambient air. This enables efficient general use of costly data. In particular, the aggregate territorial assessment of the air pollution load and the analysis of the time development of the state of air pollution in the national territory are unthinkable without a concentrated and systematic archiving of all available data on air pollution (Peng, 2019). Evaluation of air quality in relation to air pollution limits. Pollutants that must be monitored and evaluated due to demonstrably harmful effects on the health of the population are set by the national legislation (Act No. 201/2012 Coll., On air protection), the limit values. In addition, the legislation sets emission limits for the protection of ecosystems and vegetation (Braniš, Hůnová, 2009). The emission limits for the protection of human health are set for the following pollutants: sulfur dioxide, PM10 and PM2.5 fraction particles, nitrogen dioxide, lead, carbon monoxide, benzene, cadmium, arsenic, nickel, benzo (a) pyrene (polycyclic aromatic hydrocarbon contamination indicator), tropospheric ozone (Atkinson, et al, 2001). The limit values for the protection of the vegetation ecosystems are set for the pollutants: sulfur dioxide, nitrogen oxides, tropospheric ozone. European legislation, or Directive 2008/50 / EC, distinguishes limit target values (Tang, 2016). The limit value (formerly called the limit value in Czech legislation) is defined as a level established on the basis of scientific knowledge in order to prevent or prevent harmful effects on human health or the environment as a whole or to be reduced within a specified time it must not be exceeded afterwards (Beeson, 2010). Furthermore, the Directive defines the target value (formerly called the target value) in the legislation as a level set to prevent or prevent harmful effects on human health or the environment as a whole or their reduction, which should be achieved, if possible, within the time limit set (Tian, 2016). The binding condition of this limit is given by the concentration if possible. Therefore, the target value is not strictly required, as is the case of the limit value, where failure to comply with them threatens Member States to breach the EU Treaty. Decree No. 330/2012 Coll., on the method of assessing and evaluating the level of pollution, the extent of informing the public about the pollution level and in smog situations. Adoption of the new Act repealed the previous Act No. 86/2002 Coll., on air protection and its implementing regulations, among them also Government Order No. 42/2011 Coll., Amending Government Order No. 597/2006 Coll., Monitoring and evaluation of air quality. The Act No. 201/2012 Coll., On air protection, sets immission limits for selected pollutants without further differentiation to immission and target immission limits (Žujić, Radak, Filipović, Marković, 2009). The limit values and the permissible frequency of their exceedance are set out in Annex 1 to this Act. The limit values are binding for air protection authorities in the exercise of their powers under this Act. In order to assess the level of pollution, the Ministry ensures the assessment of the level of pollution and the comparison of the resulting level of pollution with these limit values. If the zone or agglomeration exceeds the limit value set in points1 - (limit values declared for human health protection for SO2, NO2, 5, Pb abenzene), (limit values declared for the protection of a vegetation ecosystems for SO2 and NOx) and 3 (limit values declared for the protection of human health for As, Cd, Ni abenzo (a) pyrene) - the Ministry take action in cooperation with air quality improvement program by the zone or agglomeration authority (Luo, 2019).

The air protection is carried out in such a way that the state, through the Czech Hydrometeorological Institute, operates a network of measuring stations focused on carbon dioxide, heavy metals and other pollutants (Airnow, 2019). If these substances exceed the prescribed standards, there is a breach of legal regulations and sanctioning of state authorities. Air pollution from industrial production is one of the important elements outside the operation of cars. The paper examines the relationship between the amount of public funds spent (used for filters, environmental technologies, etc.) and pollution data from measuring stations through methods of analysis and statistical methods (regression analysis).

Table 1. Temporal distribution of drawdown of funds under the Environment Program for Entrepreneurs for emission reduction measures and the Common Air Quality Index (CAQI)

End of projects	*Number*	*Allocation*	*CAQI*
2010	*3*	*18,1*	*75*
2011	*31*	*70,1*	*72*
2012	*57*	*186,2*	*70*
2013	*84*	*582,2*	*68*
2014	*87*	*1561,3*	*66*
2015	*89*	*1672,2*	*63*
2016	*91*	*1998,2*	*58*
2017	*93*	*2010,2*	*56*
2018	*95*	*2525,0*	*55*

Source: CHI (2019), Own preparation

As Table 1 shows, the Air Quality Index (CAQI) is used by the government agencies to inform the public about how polluted air is or is polluted (Bishoi, 2009). As CAQI grows, the risk to public health increases. The main objective of CAQI was to have an index that would encourage a broad comparison across the EU without replacing local indices, for examples indices in individual countries, which are based on a different construction. According to the doctrine, the main aim of CAQI is not to warn people of the possible adverse health effects of poor air quality, but to attract their attention to urban air pollution and its main source (traffic) and help them reduce their exposure. CAQI is a number on a scale of 1 to 100, where low value means good air quality and high value means poor air quality. The scale is that a value of 0 to 25 means a very low level of air pollution, a value of 25-50 a low level of contamination, a value of 0-75 a mean value of contamination, 75-100 means a considerable value of contamination. The index includes data from measuring stations that monitor mainly harmful oxides of nitrogen and carbon and other human organism. Data from measuring stations of the Czech Hydrometeorological Institute are taken into account in those locations and towns where projects financed from the Operational Program Environment were implemented. It is examined whether the amount of public funds for environmental protection measures for entrepreneurs had an impact on the amount of CAQI. Data were taken from measuring stations in the vicinity of these industrial plants where the measures were implemented (eg desulphurization filters, environmental operations, etc.). The largest number of investments was in the Ústí and Moravian-Silesian regions.

3 Results and Discussions

In this part of the paper, we will study the relationship between the quantity of public money (investment) - spending programs for companies in the field of air protection and number of Index concerning Air Pollution (Gujarati, 2004) In others dependant variable in the analysis is if the public spending in the field is effective. Independent variable is numbers of complaints (Jurčík, 2013).
In the beginning, an empirical analysis of dependant variable and chosen independent variable is conducted. The first step is to model quantity of public money given to industrially companies on air protection and influence on Index concerning air pollution as a function of 1 regression using OLS method in Gretl software.

Number of CAQI = function

We suppose that there will be a positive relationship between variables.

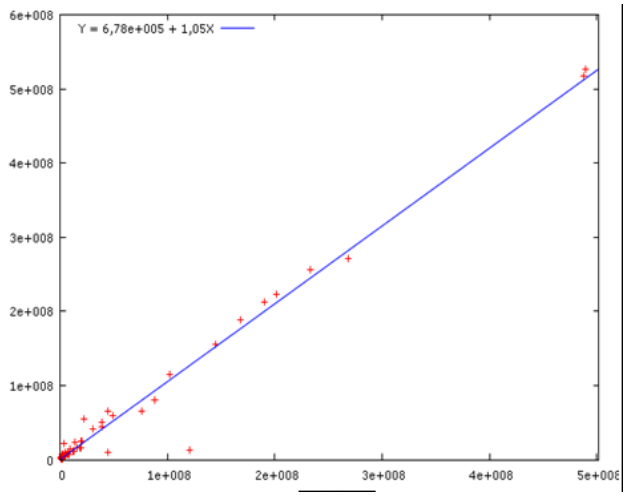

Fig.1: Relationship between the quantity of public funds invested in air protection projects and CAQI number - The Common Air Quality Index (CHI, 2019). *Source: own preparation*

Figure 1 shows linear relationship between variables. From the picture it is quite clear that linear relationship is suitable for this model (axis X is quantity of public investment, Y is number of CAQI Index).
Using OLS method there is recognized relationship between variables:

Table 2. Model 1 (linear): Dependent variable: public funds invested in air protection projects and CAQI number (The Common Air Quality Index) (OLS, using observations 1-120)

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Const	733272	1.69385e+06	0,433	0.6668	
Number of reports	0.929964	0.0239076	66,85	1.20e-095	***

Mean dependent var	52994577	S.D. dependent var	1.02e+09
Sum squared resid	3.21e+17	S.E. of regression	16455485
R-squared	0.974378	Adjusted R-squared	0.976056
F(1, 98)	4469.337	P-value(F)	1.21e-97
Log-likelihood	−2165.209	Akaike criterion	4331.417
Schwarz criterion	4335.892	Hannan-Quinn	4442.681

Source: own preparation

From table 1 it can be seen that the higher is number of reports from financial units, the higher is the portion (number) of criminal offences. But from the p-value of the constant can be claim, that constant is not significant (p-value is higher than 0.05). For this reason model is modified into the model without constant. Result can be seen bellow.

Table 3. Model 2 (linear without constant): Dependent variable: public funds invested in air protection projects and CAQI number (The Common Air Quality Index) (liOLS, using observations 1-120)

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Number of reports	0.932543	0.0122949	85.85	1.32e-102	***

Mean dependent var	52996577	S.D. dependent var	1.02e+08
Sum squared resid	3.20e+18	S.E. of regression	16399719
R-squared	0.979737	Adjusted R-squared	0.979735
F(1, 98)	5752.935	P-value(F)	1.3e-102
Log-likelihood	−2163.306	Akaike criterion	4328.608
Schwarz criterion	4331.395	Hannan-Quinn	4329.738

Source: Own preparation

From table 3 it is clear that between these two models the better one is the model 2 –linear model without constant. It has lower value of information criteria and higher value of adjusted R^2. Also the variables is significant (p-value is much lower than 0.05).

Relationship between variables

From the previous table can be say, than the relationship between public funds invested in air protection projects and CAQI number (The Common Air Quality Index) initiated with the impact on the recovery of illegally acquired:

Public funds invested in air protection projects = 0.9345 * CAQI number.

Meaning that public funds invested in the air protection projects (public money) are initiated in 93 % based on CAQI number (see definition of this index for population).

Classical assumptions

The estimation created through regression produced a linear relationship between the variables. However, performing a regression does not automatically give a reliable relationship between variables. Seven classical assumptions of well specified model must be fulfilled. The model must be tested on all classical assumptions. Firstly, it will be test on correct specification. Because model is linear it can be tested by Lagrange Multiplier (LM) test of linearity (Wooldridge, 2009, Jurčík, 2014).

Table 4. LM test

LM test: results	p-value
Polynomic form	0.531718
Logarithmic form	0.68871

Source: Own preparation

From the both results of LM tests it is obvious that function form of the model is OK and model is linear - logarithmic (both p-values are higher than 0.05, H_0: that the relationship is linear fail to be rejected. Model is linear (Gujarati, 2004). Another used test was Ramsey's RESET test for detection of omitted variable in the model or incorrect specification of the model. It's with p-value was 0.775 from which it is clear that null hypotheses that model is correctly specified failed to be rejected and model is correctly specified. More ways to verify correct model specification are adjusted coefficient of determination (R^2_{adj}) and Information criteria. Results of those tests were presented in the Model 2 (table 2), where can be seen that 97.96 % of variability was explained by regression model to the total variability which is great success.

Classical assumption number 1, which says that regression model is linear in parameters, it is correctly specified and it has an additive error term was confirmed. Another classical assumption is correlation. Existence of serial correlation implies that the error term from one time period depends on error term from other time periods. But because data are cross sectional, correlation cannot appear in the model. By the classical assumption number V error term has constant variance which is requirement for homoskedasticity of the error term. Homoskedasticity was tested using White test. Test resulted with p-value 0.860629. P-values is greater than alpha (0.05), not rejection of the null hypothesis, there is no heteroskedasticity in the model. Errors are homoskedastic. Assumption number V is fulfilled. Classical assumption VI refers about multicollinearity which can be detected by Variance Inflation Factors, VIF(βj). But because in our model only one independent variable stayed, there can be no multicollinearity. Normal distribution of stochastic error is classical assumption VII. There are many ways to verify normality of the error term. One of commonly used statistical test is Chi-square test of goodness of fit. Its p-value was higher than 0.05, failure of H_0 rejection. Classical assumption number seven was fulfilled.

4 Conclusion

This contribution demonstrates that public funds on air protection were spent efficiently. This was due, in the author's opinion, to the fact that the funds were spent directly on greener means and technologies in the production programs (Liang, 2014). Of course, it would be better if these resources were increased. This implies the possibilities of the state budget and its priorities. At present, it is rather a priority to address another aspect of nature conservation. This is water retention in the landscape and more efficient water management. Therefore, real increases in air protection cannot be expected, especially when public policies in this area are moving in other directions. In this area, we can mention efforts to promote environmentally friendly propulsion of passenger cars.

The aim of this study was to answer the question whether the portion of public investment (public funds invested in air protection projects in the period 2010-2018 had a positive impact on the number CAQI Index (The Common Air Quality Index) and whether costs on the air protection are justifiable. The answer is positive.

The impact of public investment into the production of enterprises (into air protection) – the effectiveness of public investment is 93 %. We can say that this investment has good influence on air condition.

These relationships were also tested. All tests, which were used, concluded that classical assumptions of well specified model were fulfilled.

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