

Report on Bachelor / Master Thesis

Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague

Student:	Martin Moldan
Advisor:	RNDr. Michal Červinka Ph.D. - IES
Title of the thesis:	Relationship of Economic Growth and Pollution in the Czech Republic

OVERALL ASSESSMENT (provided in English, Czech, or Slovak):

Please provide your assessment of each of the following four categories, summary and suggested questions for the discussion. The minimum length of the report is 300 words.

Summary of the thesis

The present bachelor thesis was aimed at assessing whether there is a relationship between various environmental pollutants and per capita income in the Czech Republic. In other words, to prove or disprove the theory of Environmental Kuznets Curve (EKC hypothesis) or an inverted U-shape relationship between GDP per capita and pollutant emissions or concentrations of NO_x and SO₂. According to the EKC hypothesis, for low levels of national income, concentrations of air pollutants increase with increasing GDP per capita, and that for higher levels of national income, concentration of air pollutants decrease with increasing GDP per capita. The EKC suggests that environmental degradation is something unavoidable at the first stage of economic growth and after a certain development is achieved, emissions decrease.

The thesis contains a short introductory section followed by a literature review of 6 pages. The third section introduces the pollutants that are being analysed in the thesis. The fourth section describes the dataset used in the study. The fifth section provides a description of the panel data across 14 regions in the Czech Republic and time dimension of the data spanning from 1995 to 2017, a general overview of methods for panel data analysis based on Wooldridge (2015) and model specification. Finally, section 6 discusses empirical results and statistical tests to determine the robustness of the analysis.

The environmental degradation can be measured by a number of different pollutants such as carbon dioxide (CO₂), sulfur dioxide (SO₂), nitrogen oxide (NO_x), particulates, deforestation etc. The author chose to focus on NO_x and SO₂. The author briefly explains that he does not include particulates or CO₂ in the model because of data issues – regional analysis is required, only concentration data is available by region and there is no concentration data on CO₂. Of note, the Czech Republic relies heavily on coal and lignite in its power generation, which produces a lot of CO₂ emissions. Czech Republic is also amongst the biggest polluters in Europe in terms of CO₂ emissions and key reason is the heavy reliance on coal and lignite in power generation. Therefore, I'd have thought that this is the most important pollutant to be covered in the analysis, although I do recognise that SO₂ is also likely to be an important pollutant since it is also produced by coal and lignite fired generation. While the author in section 3.2 discusses very briefly while he chooses to limit his analysis on NO_x and SO₂, I'd have appreciated a more thorough explanation and the choice based on which pollutants might be most significant for the Czech Republic.

I would also have liked to see discussion as to how local concentration of each pollutant is. If there were spill over effects from pollutants emitted in neighbouring countries that could invalidate results that looked at Czech incomes and Czech concentration. For this reason, even if CO₂ concentration data were available it is unlikely to have been a suitable variable for this analysis since my understanding is that CO₂ concentration is the result of global CO₂ emissions.

I would also have liked the author to provide a fuller discussion as to what is driving the relationship between income and pollution. The author refers to scale effects of economic growth increasing pollution outweigh efforts to reduce pollution and at higher incomes the effect reverses. Often, it requires a very targeted policy and attitudes to make sure that economic growth is compatible with an

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improving environment. It is also possible that policy decisions exogenous to the Czech Republic drive environmental policy in the Czech Republic. For example, the EU emissions trading scheme for CO₂ may be a driver of reductions in coal fired generation in the Czech Republic, which would reduce NO_x emissions. Similarly, rules regarding vehicle emissions adopted by the EC must be adopted by the Czech Republic. The point is that these factors are independent of Czech GDP per capita and will affect pollution. I would have liked to see a discussion of these external policy effects and how they may affect the choice of model and results.

The relationship between pollution and economic growth is quite complex as it depends on many factors such as the sectoral structure of a country, the country's endowments, the demand for environmental quality and policies in place.

Other comments:

- Figure 8 depicts the development of GDP per capita in the Czech Republic over the period 1995 to 2017. Nevertheless, it's not clear whether it's shown in real or nominal terms. I'd expect the author to use real terms.
- I'd have also welcomed had the author to discuss the biggest contributors of NO_x and SO₂ emissions in the Czech Republic, i.e. which sectors are causing the pollution.

The author concludes that emissions of both pollutants reached their peak after which they steadily declined. Nevertheless, it might have been also the fact that these pollutants were displaced by other pollutants as the GDP per capita increased. That is, what I missed is looking at the overall level of pollution in the Czech Republic over time and possibly a broader measure of pollution to be used in the model. In addition, it is quite possible that the Czech Republic effectively exports its pollution to other countries. For example, it could be the case that the Czech Republic has reduced its own steel manufacturing and relies on imports. The point is that with global trade a country could reduce its own pollution by shifting that pollution to another country. The effect could be to amplify the increase in pollution in the exporting country and to reduce the pollution in the importing country. It would have been interesting to see a discussion about these sorts of effects.

Furthermore, the specification of the model uses a policy variable (dummy variable) that takes values 0 if policy introduced before 1999 and 1 if in 1999 or after 1999 (p. 31). The policy variable is discussed in section 4.5 and represents the effectiveness of emission limits set in the law no. 309 from 1991 (Act No. 89/2012 Coll., §14 (3)). Nevertheless, this specification doesn't seem to really take account of the different policies that surely play a very important role in the reduction of emission concentrations. My expectation is that national, EU and global policies (such as the Kyoto Protocol) would have an impact on the emission concentrations and policies were introduced even before the Act No. 89/2012 Coll.

The specification of the model takes account of the share of mining in the economy, which is relevant. Nevertheless, I would expect that given the most important source of these emissions is the power sector, an important variable to introduce would be reliance on coal and lignite sources for power generation. That is, I'd expect that the emissions would decrease with commissioning of nuclear in the Czech Republic and the increase in renewable generation sources in the power generation mix, which is again likely to be driven by policies.

Contribution

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As noted above, there are several issues about pollution that I would like the author to have expanded on in the discussion of the underlying relationship between GDP and pollution and in the discussion of the choice of model. How local is the pollution effect, outside policy effects, export of pollution through trade, use of a broader measure of pollution etc.

Methods

No test for correlated explanatory variables. Some broader measure of pollution would have been good, e.g. some sort of composite variable in case there was substitution between pollutants.

Literature

Section 2 of 3 pages provides a literature review. The author also says that the EKC hypothesis has not been studied in the Czech Republic, and therefore the aim of the bachelor thesis is to bridge this gap. In fact, there have been some studies at least at universities, such as a Masters Thesis named Environmental Kuznets Curve – The Case Studies for the Czech Republic and Finland (2018), which can be found [here](#). It would be interesting to compare the results across the two studies.

Overall, I found the literature review clear and it covered a wide range of models used to investigate the EKC hypothesis.

Manuscript form

The thesis is well structured and well written and easy to read with very few grammatical mistakes.

Suggested questions:

- How can the analysis be made more robust and developed further? If pollution is not localised, should the analysis be expanded to Europe-wide study?
- The author concludes that emissions of both pollutants reached their peak after which they steadily declined. Nevertheless, it might have been also the fact that these pollutants were displaced by other pollutants as the GDP per capita increased. How would the author suggest testing for this and what could be done in the analysis to make sure there is not some sort of omitted variable bias?
- I'd have also welcomed had the author to discuss the biggest contributors of NO_x and SO₂ emissions in the Czech Republic, i.e. which sectors are causing the pollution and whether a change to these sectors did not have an impact on the level of pollution and therefore the reached conclusions.

SUMMARY OF POINTS AWARDED (for details, see below):

CATEGORY	POINTS
<i>Contribution (max. 30 points)</i>	20

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<i>Methods</i>	<i>(max. 30 points)</i>	20
<i>Literature</i>	<i>(max. 20 points)</i>	15
<i>Manuscript Form</i>	<i>(max. 20 points)</i>	18
TOTAL POINTS	<i>(max. 100 points)</i>	73
GRADE	(A – B – C – D – E – F)	B

NAME OF THE REFEREE: *Mgr. Petra Valíčková*

DATE OF EVALUATION: 31/05/2019



Referee Signature

EXPLANATION OF CATEGORIES AND SCALE:

CONTRIBUTION: *The author presents original ideas on the topic demonstrating critical thinking and ability to draw conclusions based on the knowledge of relevant theory and empirics. There is a distinct value added of the thesis.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
30	15	0

METHODS: *The tools used are relevant to the research question being investigated, and adequate to the author's level of studies. The thesis topic is comprehensively analyzed.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
30	15	0

LITERATURE REVIEW: *The thesis demonstrates author's full understanding and command of recent literature. The author quotes relevant literature in a proper way.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
20	10	0

MANUSCRIPT FORM: *The thesis is well structured. The student uses appropriate language and style, including academic format for graphs and tables. The text effectively refers to graphs and tables and disposes with a complete bibliography.*

<i>Strong</i>	<i>Average</i>	<i>Weak</i>
20	10	0

Overall grading:

TOTAL	GRADE
91 – 100	A
81 - 90	B
71 - 80	C
61 – 70	D
51 – 60	E
0 – 50	F