ECONOMIC GROWTH AND AIR POLLUTION IN THE CZECH REPUBLIC: DECOUPLING CURVES

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-Abstract-

The decoupling curve, together with the Environmental Kuznets Curve, has been recognized as one of the important indicators showing relations between economic growth and environmental degradation/pollution. Many both theoretical and empirical studies have been published on it. Our paper brings models which investigate relations between the economic growth per capita and selected indicators of air pollution in the Czech Republic. The analysis tried to go before the year 1990, despite the difficulties when dealing with different macroeconomic indicators published during the socialist period and those introduced after the transition to a market economy. The results might be somehow surprising for those dealing only with data generated after the year 1990: it is possible to discover the turning points for some of the airborne pollutants already in the 1980s.

Key Words: Economic development, Air pollution, GDP

JEL Classification: Q5

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1. INTRODUCTION

Decoupling of the trends of economic growth and pollution, together with the Environmental Kuznets Curve, is one of the highly understandable indicators of relations between economic development (of a country, region, etc.) and the level of adverse impacts of human activities on the environment. Numerous empirical studies indicate that at the beginning of economic development the trend of environmental degradation more or less follows the trend of economic growth (see for instance Arrow et al., 1995, p. 520). From some level of economic

development, economic growth continues, but environmental degradation absolutely or relatively declines.

The paper brings results of applications of the decoupling model on selected indicators of air pollution (CO_2, SO_X, CO, NO_X, and PAHs) in the Czech Republic. While Czech studies mostly deal only with developments after the radical social and political changes after the year 1989 (see Scasny et al., 2003; Bruha & Scasny, 2006; Kovanda & Hak, 2007; Kovanda et al., 2008; Scasny & Tsuchimoto, 2011), this paper tries to overarch the year 1989. It wants to contribute to the discussion whether the positive trends (visible as a decrease in pollution and modelled as decoupling) can only be explained as the results of a functioning market economic system and a democratic political system or whether it is, at least partly, a phenomenon of industrialization.

2. THE METHODOLOGY

Standard line chart graphical models of the decoupling curves were developed for the selected air pollutants in the Czech Republic in 1972-2008. The time horizon was different for different pollutants due to the data availability. The most difficult methodological problem was resolving the issue of measuring the economic activity of the country before and after 1989. While after 1989 the country has switched to standard economic indicators like GDP, different indicators, such as national income and social product, were published during the socialist period.

There is still no study resolving the problem of different key Czech macroeconomic indicators generated before and after 1989, which would publish the time series of the data where the values before and after 1989 would be measured with one consolidated indicator. Here, this problem has been resolved with the use of two vertical axes, which allows a consequent "tailoring" the two time series in one graphic. It is not a standard modelling of the decoupling curve, but it still allows elaborating interesting comparisons and conclusions.

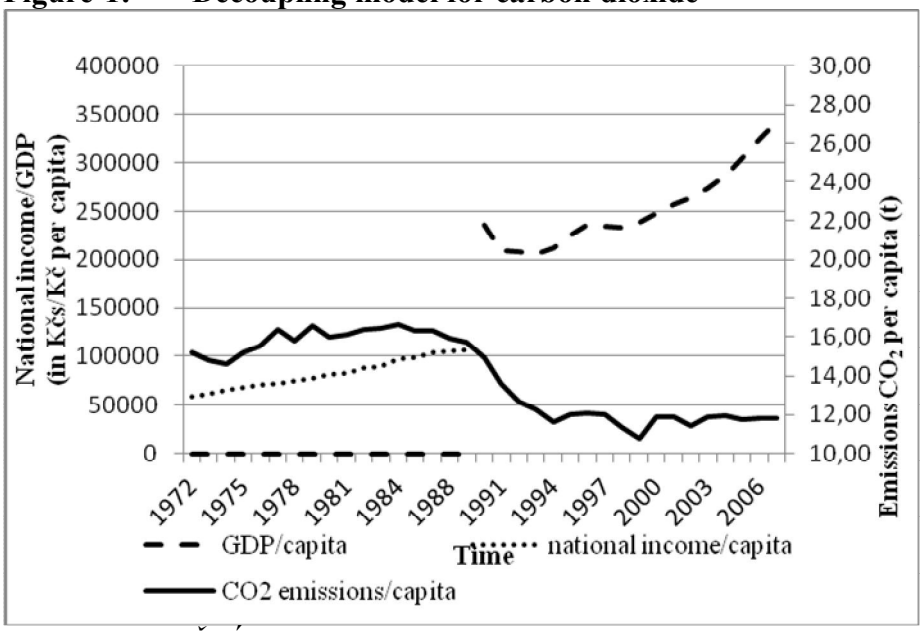
3. MODELLING THE DECOUPLING CURVES FOR THE CZECH REPUBLIC

This section brings the results of decoupling curve modelling for the pollution caused by carbon dioxide (CO_2), sulphur oxides (SO_X), carbon monoxide (CO), nitrogen oxides (NO_X), and polycyclic aromatic hydrocarbons (PAHs) in the Czech Republic.

3.1 Carbon Dioxide

Carbon dioxide is a well known gas which contributes, together with several other gases, to the global climate change.

Figure-1: Decoupling model for carbon dioxide



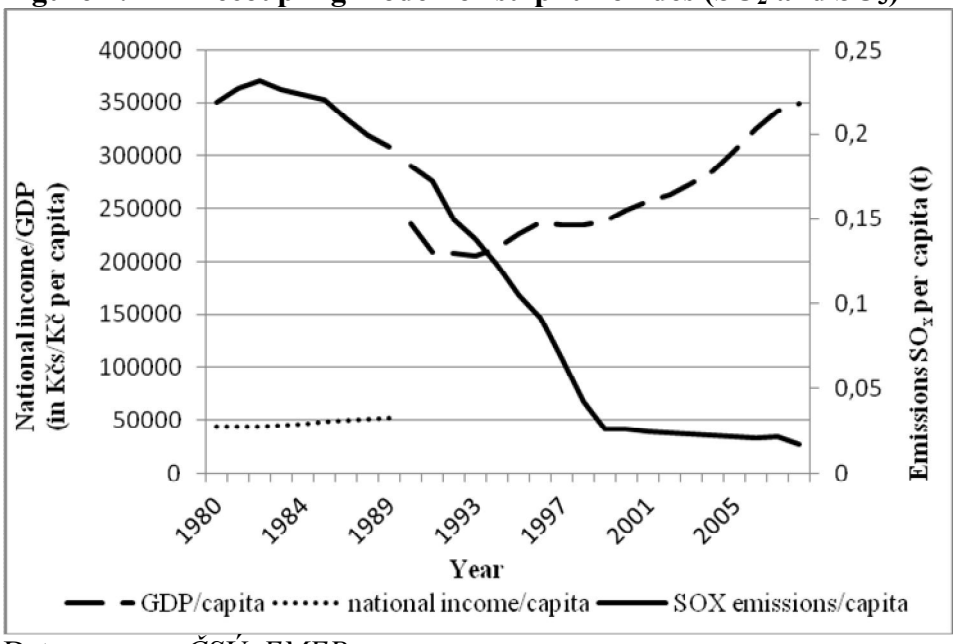
Data sources: *ČSÚ, OECD Country Statistical Profiles 2009 and 2010*

As one can see in Figure 1, the turning point for the CO_2 emissions in the Czech Republic is approximately in 1984. It is also visible that the increase in the CO_2 emissions, comparable to the increase in the national product, was relatively low. In the time period of 1972-1989 the increase in the national product was 66.5% and the total increase in the CO_2 emissions was (only) 3.5%.

3.2 Sulphur Oxides

Sulphur oxides, namely the SO_2 emissions, were one of the most important environmental factors causing huge damage, especially to health, forestry, agriculture and buildings in the region until the 1990s.

Figure 2: Decoupling model for sulphur oxides (SO_2 and SO_3)



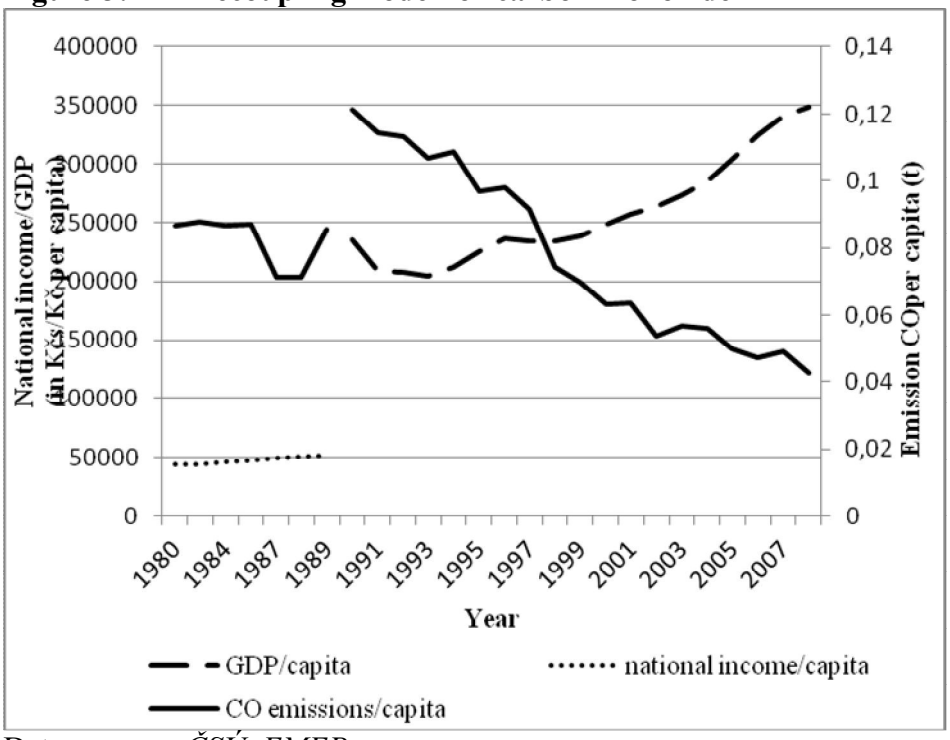
Data sources: *ČSÚ, EMEP*

Although there was a change in the SO_x monitoring methodology in 1990, the data corrections are minimal and the trend is well visible in Figure 2. The turning point is observed already in 1982.

3.3 Carbon Monoxide

Carbon monoxide is a toxic combustible gas generated by combusting carbon fuels, including smoking. It contributes to generating ground ozone and causes health problems to town citizens (IRZ, 2005). It also belongs to the group of so-called greenhouse gases.

Figure 3: Decoupling model for carbon monoxide



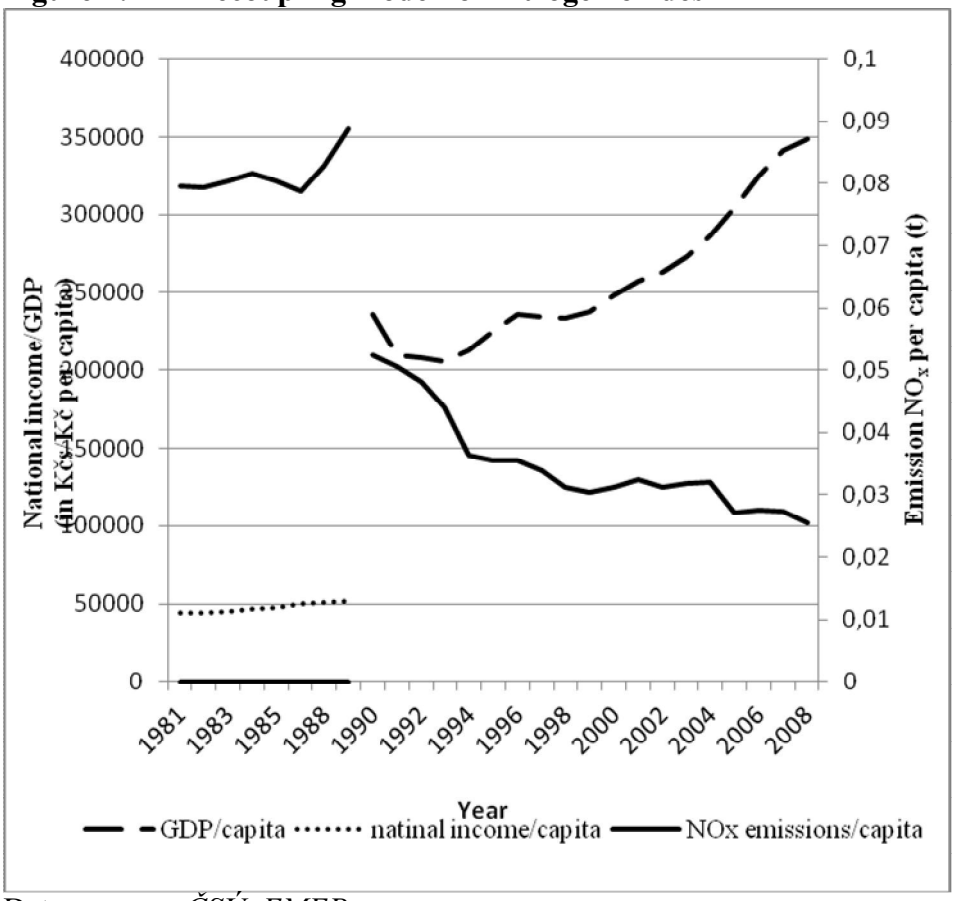
Data sources: *ČSÚ, EMEP*

Due to the change in the monitoring methodology, the comparison of the periods before and after 1990 is not easy. Figure 3 shows quite a stable situation of the CO emissions before 1990 and a unique decrease after 1990.

3.4 Nitrogen Oxides

NOx are generated especially when burning fossil fuels and biomass. Increased concentrations damage plants and, together with sulphur oxides, they are components of acid rains. NO_2 contributes to creating ground ozone and NO belongs among greenhouse gases (IRZ, 2005).

Figure 4: Decoupling model for nitrogen oxides



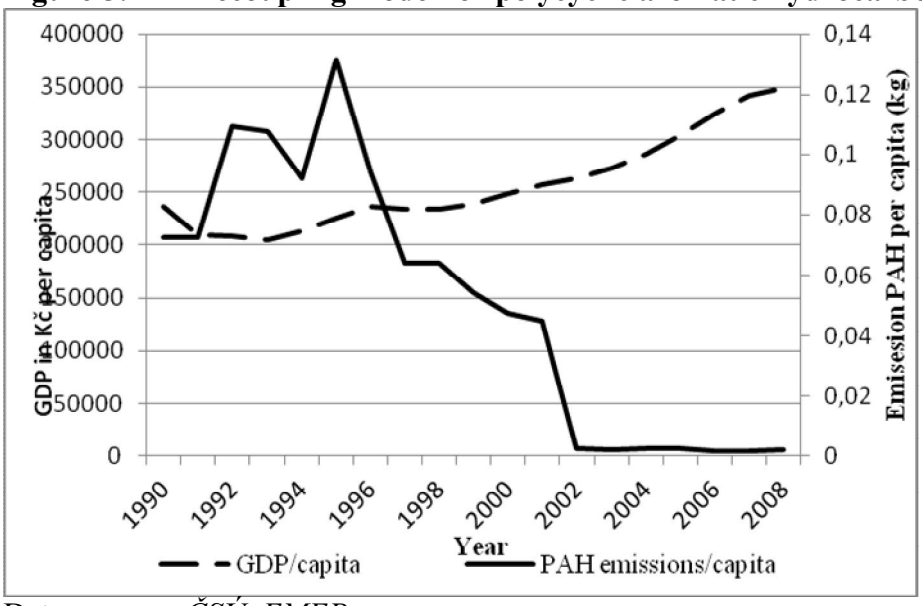
Data sources: *ČSÚ, EMEP*

Figure 4 illustrates a significant change in the approach to the environmental situation after 1990. Despite an increase in motoring, there is a significant decrease in the NO_x emissions after 1990.

3.5 Polycyclic Aromatic Hydrocarbons

PAH emissions are generated by incomplete combustion. They are accumulated in the environment and endanger human health via the food chain (IRZ, 2009, p. 2).

Figure 5: Decoupling model for polycyclic aromatic hydrocarbons



Data sources: *ČSÚ, EMEP*

Figure 5 shows the increasing trend until the turning point in 1996. Since 2002 the emissions of PAH have been very small and insignificant.

4. CONCLUSIONS

The analysis has shown that the decoupling of the trends of economic growth and air pollution in the Czech Republic has already happened for all of the five significant pollutants for which data time series are available. The turning points for CO_2, SO_X, CO and NO_X are observable already before the year 1990 at a level of 44-51 thousand Czechoslovak Crowns of national income per capita. The turning point for PAH was discovered in the time period after the 1989 Revolution at a level of 225 thousand (new) Czech Crowns per capita. Due to the structural economic changes and measures undertaken within environmental policy, the situation has changed significantly to a better environmental situation. The Czech Republic belongs to the EU countries that meet all of the 2010 emission ceilings set in the EU NEC Directive (EEA, 2012).

BIBLIOGRAPHY

Arrow, K., B. Bolin, R. Costanza, P. Dasgupta C. Folke, C. S. Holling, B. O. Jansson, S. Levin, K. G. Meller, C. Perrings, and D. Pimentel (1995), "Economic Growth, Carrying Capacity, and the Environment," Science 268:520-1.

Bruha, J., Scasny, M. (2006). Economic Analysis of Driving Forces of Environmental Burden during the Transition Process: EKC hypothesis testing in the Czech Republic. Paper presented at the the 3rd Annual Congress of Association of Environmental and Resource Economics AERE, Kyoto, 4-7 July, 2006.

Bruha, J., Scasny, M., Machalek, P. (2005), Decomposition Analysis of Air Pollution Reduction in the Czech Republic: Focused on Driving Forces of Environmental Pressure Changes during the transition. In: Ritschelová, I. (eds.), Environmental Accounting and Sustainable Development Indicators. Proceedings. International Conference, Prague 25-27 September 2005. ISBN: 80-7044-676-5. pp. 277-287.

Kovanda, J., Hak, T. (2007): What are the possibilities for graphical presentation of decoupling? An example of economy-wide material flow indicators in the Czech Republic, Ecological Indicators 7 : 123–132

Kovanda, J., Hak, T., Janacek, J. (2008): Economy-wide material flow indicators in the Czech Republic: trends, decoupling analysis and uncertainties, Int. J. Environment and Pollution, 35, No. 1

Scasny, M., Kovanda, J., Hak, T. (2003): Material flow accounts, balances and derived indicators for the Czech Republic during the 1990s: results and recommendations for methodological improvements, Ecological Economics 45 : 41-57

Scasny M., Tsuchimoto, F. (2011): Decomposition analysis of air pollutants in Czech Republic, Paper presented at European Association of Environmental and Resource Economists, 18th Annual Conference, 29 June - 2 July 2011, Rome, on-line: http://www.webmeets.com/ EAERE/2011/m/viewpaper.asp?pid=787, [Accessed 15.03.2012].

Details about the data sources:

ČSÚ: Statistical Yearbooks 1977-2010, databáze ČSÚ, on-line: http://www.czso.cz/csu/redakce.nsf/i/statisticke_rocenky_ceske_republiky [Accessed 20.12.2011].

EEA (2012). Air pollutant emission limits exceeded in twelve EU Member States, European Environmental Agency, on-line: http://webcache.googleusercontent.com/search? q=cache:1MkFisP3AhsJ: www.eea.europa. eu/highlights/air-pollutant-emission-limits-exceeded/, [Accessed 15.03.2012].

EMEP (2010): European Monitoring and Evaluation Programme - Centre on Emission Inventories and Projections: Convention on Long-range Transboundary Air Pollution, UNECE, databáze oficiálních údajů o emisích jednotlivých zemí, on-line: http://www.ceip.at/emission-data-webdab/emissions-as-reported-by-parties/, [Accessed 20.12.2011]

IRZ (2005): Integrovaný registr znečišťování: Informace o látkách zařazených do Integrovaného registru znečišťování: oxidy dusíku, oxidy síry, oxid uhelnatý, oxid uhličitý, polycyklické aromatické uhlovodíky, Praha. on-line: http://www.irz.cz/obsah/ohlasovane-latky, [Accessed 20.12.2011]

OECD: Country statistical profiles 2009/2010, on-line: http://stats.oecd.org/Index.aspx?DatasetCode=CSP2009;, [Accessed 20.12.2011].