

European Integration and Transboundary transfer of air pollution: Analyzing the case of nitrogen oxides.

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Abstract: The recent expansion of the EU, in May 2004, included ten new members eight of which used to belong to the so-called "former eastern block". The post WWII environmental policy followed in this region has been radically different from the tendencies followed in Western Europe. While in both regions the industrial development has been the main goal, the lack of conservation regulations at the Eastern European countries has resulted in a rather harmful industrialization, regarding natural resources and environmental quality. In the meanwhile, Europe experienced the severe consequences of the transboundary transfer of air pollution with sensitive ecosystems of the continent being devastated. The European Monitoring and Evaluation Program has published data regarding the transboundary transfer of nitrogen oxides throughout the European continent in the course of over 15 years. The present study utilises these data, focusing on the contribution of the new member-states to the environmental pressure faced by the older member states and vice versa, in order to analyse the situation and discuss the present and future environmental policy concerning air pollution.

Key-Words: Transboundary, Air Pollution, Nitrogen Oxides, Europe, Integration, EMEP

1 Introduction

Since May 2004, ten more countries have joined the European Union, in its greatest expansion historically. Eight out of the ten new members used to belong to the so called "former eastern block", with a post WWII history significantly different than that of the Central and Western Europe. These countries, being politically and financially isolated during the last decades, have been left behind in the implementation of any environmental protection policies.

While during the post WWII period the struggle to improve the economic indicator was rising, Europe experienced the threatening consequences of the transboundary transfer of dangerous air pollutants. Up to that time problems caused by the rising production of acidifying and eutrophying gaseous pollutants have been identified but it has been thought that their effects were only local around the area into which they were produced. In contradiction to that belief numerous lakes and hectares of forests in Scandinavia were found to be exposed in very high acidity, which was not produced in the nearby area [1,2]. Acid compounds that have been emitted in central

Europe degraded forest and aquatic ecosystems of the Scandinavian Peninsula [3].

The recognition of the problem of transboundary transfer of certain air pollutants throughout the European continent led in 1979 to the initiation of "The Convention of Long-Range Transboundary Air Pollution" (CLRTAP) [4] which had set a clear framework not only for the environmental and health consequences but also for the internationally cooperative approach needed for their abatement. The Convention was signed by the European Community, while 34 governments established the European Monitoring and Evaluating Programme (EMEP) [5,6] for the promotion of scientific research and intensive monitoring of the Transboundary Air Pollution Transfer (TAPT) effect, funded by the Organization for Economic Cooperation and Development (OECD) [7].

Although the first actions taken for the control of the TAPT effect were focused on the mitigation of the sulphur dioxide emissions, the increase of road transport as well as the lack of any abatement measures resulted also in the dangerous increase of the nitrogen oxides production. While in Western Europe it was mostly the extensive growth of the

private vehicles fleet that was causing the problem [8,9], in the centrally planned economies it was the extreme industrial specialization, which heavily demanded cargo overland transfer for raw materials and products. The United Nations Economic Commission for Europe (UNECE) implemented the 1st Nitrogen Protocol in year 1988, asking the signatory parties to keep their nitrogen oxide emissions below the 1987 levels until the year 1994.

Although the "first generation" protocols contributed a lot in the emissions control, still the monitoring procedures were reporting high acidity in several ecosystems. This fact put forward the need for a different approach, as scientific research should answer the question of how much acidity were the ecosystems able to receive and still maintain their balance [10]. Data from all the participating countries were collected in order to sort out solutions for minimizing the environmental damage with the lowest economic cost [11]. Taking into account the transboundary transport of air pollution as well as the ecosystems limits, each country was examined individually and advised to lower its emissions at an adequate level. The latest evolution of the legal and policy framework for the abatement of acidification and eutrophication is set in the EU by the emission ceiling directives (e.g. Directive 2001/80/EC).

2 A Brief Spatial Analysis of the Integrated EU Area

The integrated European area consists of the old EU members as well as the new countries, eight of which are located in the central and north-east Europe. The present study is based on defining a hypothetical border line between the old and the new member states. In this way we are examining the air pollutants exchanged towards each direction.

Beginning with a north towards south analysis one may notice (figure 1) that the neighbouring countries in the Baltic sea region are Estonia, Latvia, Lithuania and Poland from the new member states and Finland, Sweden and Germany from the old member states. It is obvious that while Finland is closer to Estonia and Latvia, Sweden interacts mostly with Lithuania and Poland. The latter is also heavily influenced from Germany. However, SW Poland together with the SE part of Germany (former German Democratic Republic – GDR) and the Czech Republic (western part of the former Czechoslovakia) were forming the area which was well known as the “Black Triangle”. The heavy

industrialisation of this region in combination with the early exploitation of its high quality brown coal resulted in the utilisation of poor quality fuels with a high sulphur content. Serious damages have been reported in the ecosystems of this region [12] and these were directly correlated to the high concentrations and deposition of airborne sulphur compounds and acidity [13]. It has been the aftermath of the dramatic increase of the sulphur dioxide emissions in this region by a factor of ten in the 1960-1985 period [14]. Moving to the South, the former Czechoslovakia, Hungary and Slovenia are surrounding the eastern Austria. Finally northern Italy neighbours with Slovenia.



Fig. 1: Map of Europe

One may notice that from the present study are excluded several countries along Western Europe as well as countries which are at the East of the new member states. As regards to the western European countries like United Kingdom, Netherlands, Belgium, Luxembourg, France, Spain and Portugal, the distance from the hypothetical border line is significantly large resulting in minor air pollution transfer to the new members and vice versa.

Same as above is the situation considering the eastern European countries of Belarus, Moldova, Ukraine and the western part of Russian Federation. Moreover these countries are not member states of the EU therefore there is little interest in complying with EU-wide environmental policies. While Romania and Bulgaria are not EU members either, they are in the final stage of completing the entry process so there is a particularly increased interest for their interaction

with Greece as the closer neighbouring old member state at the southern Balkan Peninsula. However, this issue has been extensively studied in a previous work of the authors [15].

3 Transfer of Oxidised Nitrogen Air Pollutants

Oxidised nitrogen air pollutants are mostly produced by the transport sector from the internal combustion engines. Therefore the emitting sources are mainly non-stationary and are found spread throughout the urban areas as well as in the national road networks [16,17,18]. Bearing in mind the results presented for the oxidized sulphur exported

by the new EU members one may realize that the situation is not similar regarding the nitrogen oxides exports (figure 2). Poland is obviously playing the key role on the oxidized nitrogen emissions, transferred to the old EU members and only the contribution of the Czech Republic may be considered as comparable. Although the available data begin from 1997, the heavy industrialization together with the close neighboring to Germany and Austria are the major reasons for the high significance of the Czech emissions, despite its relatively small size. The rest of the new member states present only a minor contribution and only Slovenia exceeds in 1997 the 5kt of NO_x exported.

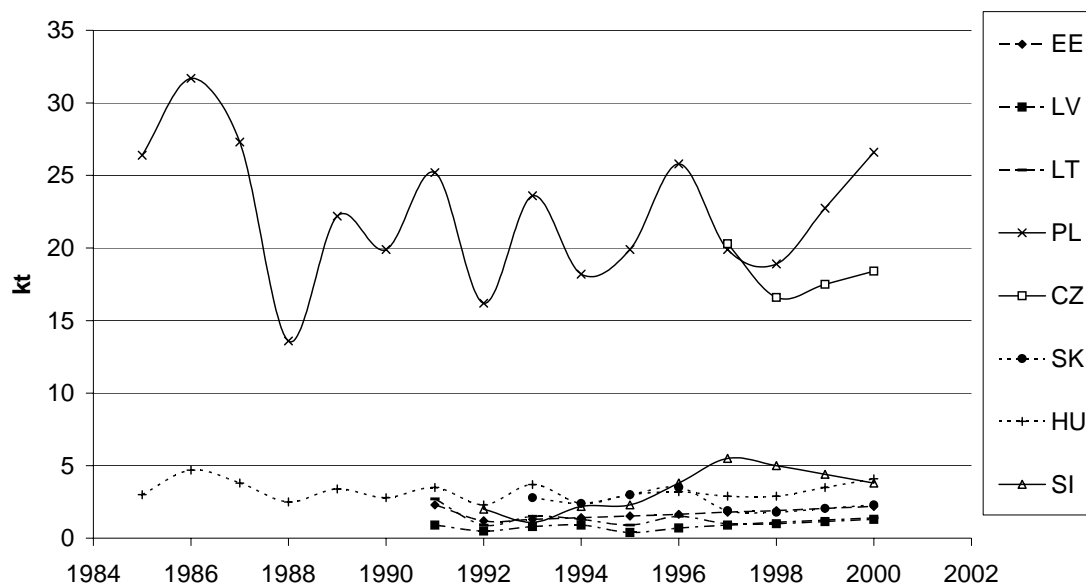


Fig.2: Nitrogen Oxides Exports from New EE States

In the light of the data presented concerning the oxidized nitrogen exports from the new EU states, an attempt to study their allocation to the old EU members follows. Hence, one may observe (figure 3) that despite the fact that Germany is the main nitrogen oxides importer from the eastern EU members, other countries like Sweden and Finland are receiving considerably high quantities, presenting an increasing trend in the last examined years. The situation for Austria and Italy is not the same since those two countries, together with Germany, show a declining tension.

As the transboundary transfer of the nitrogen oxides from the new member states to the old ones has been presented this part of the study focuses on the vice versa route of the air pollutants in question. In figure 4, the evolution of the exported oxidised

nitrogen quantities from the old EU members is presented. In this context one may realise that Germany is the major exporter not only of sulphur, but also of nitrogen oxides. Moreover, the increasing trend of the Italian emissions can be considered as remarkable, resulting in year 2000 in a percentage of 25% of the total western oxidised nitrogen exported. The Scandinavian countries of Sweden and Finland present no significant changes during the examined time period, and never exceed the 9% of the total emissions. Finally, Austria exporting to the new EU members more than 10kt of nitrogen oxides presents a noteworthy contribution.

Studying the allocation of the West Europe originated nitrogen oxides air pollutants one may refer to figure 5 out of which becomes obvious that

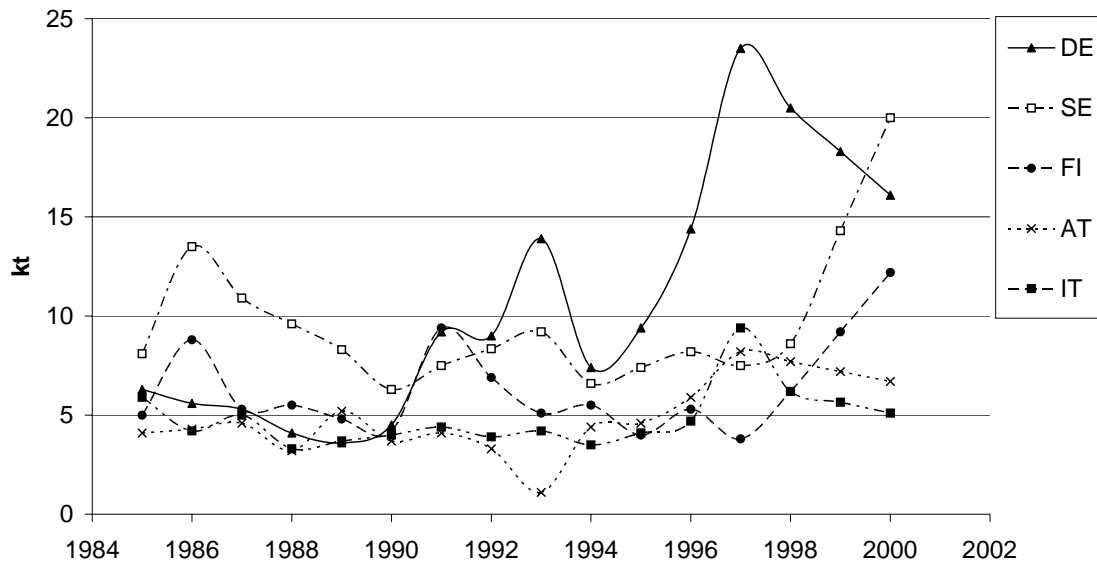


Fig.3: Nitrogen Oxides Imports to Old EE States

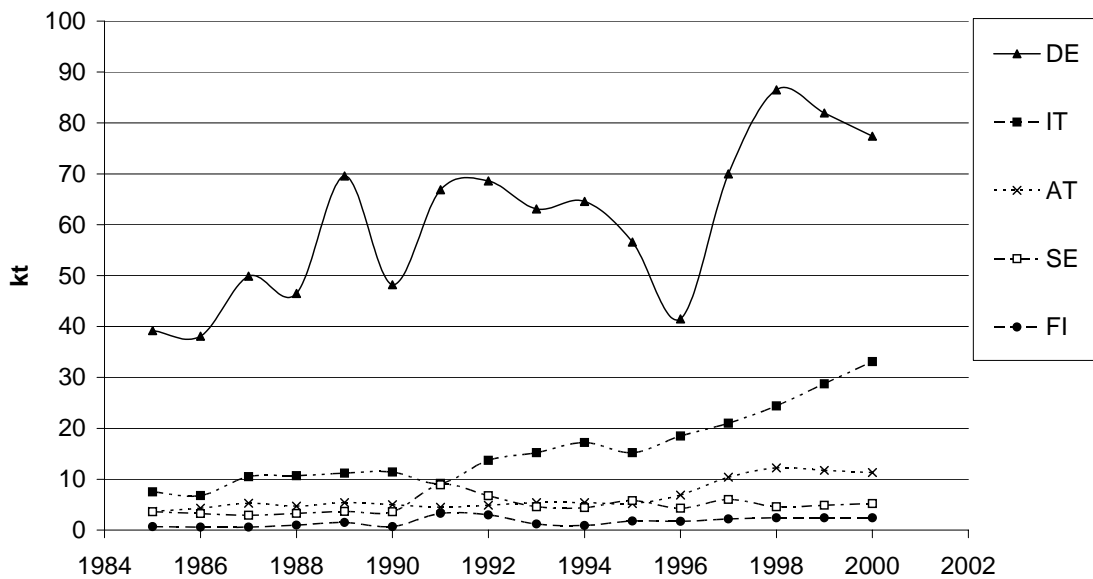


Fig.4: Nitrogen Oxides Exports from Old EE States

Poland is without any doubts the major receiver of oxidised nitrogen among all the new members. Czech Republic, being in the “Black Triangle” region is also receiving a considerably high amount of the NO_x emitted by the old EU members, while similar is the situation for Hungary, which neighbours to Austria. The rest of the countries under study receive individually quantities lower than 10kt without any considerable variation in the period examined.

4 Discussion of the Results

While having already examined the evolution of the air pollutant quantities which have been exchanged between the old and the new EU members, one may try to assess whether the transboundary transfer of the oxidised nitrogen is beneficial or not for every individual country.

Regarding the transboundary transfer of the oxidised nitrogen for the new EU members, it appears that all of them have received bigger NO_x quantities than those exported. Among the least harmed countries one may find Estonia, Latvia

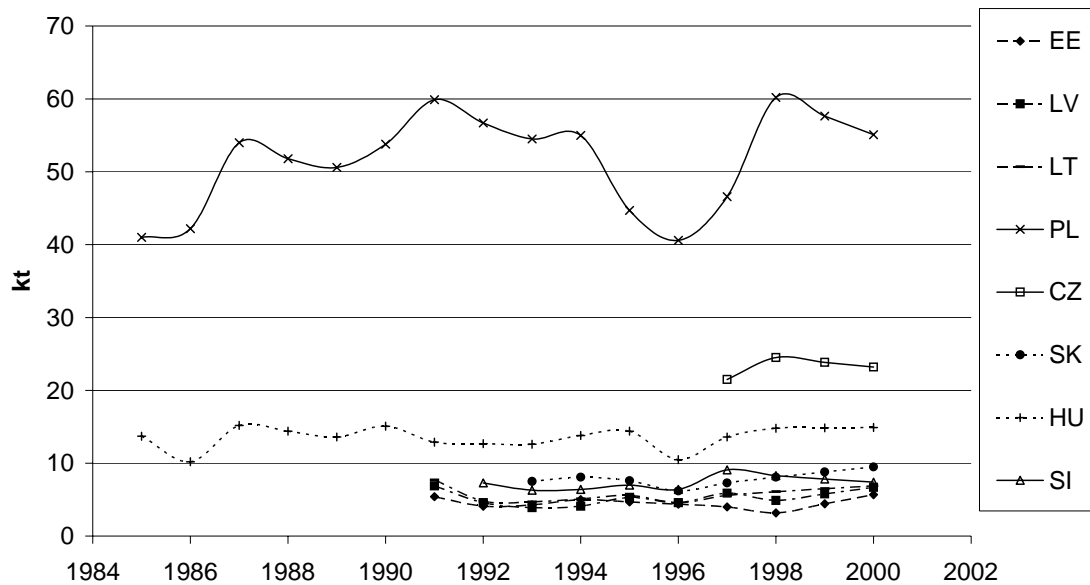


Fig.5: Nitrogen Oxides Imports to New EE States

and Lithuania together with the Czech Republic, Slovakia and Slovenia. While none of the aforementioned states has received more than 45kt of NO_x in comparison with their exports, Poland and Hungary are by far exceeding that limit. In fact, Poland is the country harmed in major, receiving in the period examined 466kt more emissions than those exported, while Hungary is following with 165kt.

As regards to the status of the old EU states towards the transboundary transfer of oxidised nitrogen, the study shows that only the Scandinavian countries of Sweden and Finland are harmed in average by not more than 5kt per year each. Austria is slightly benefited exporting less than 2kt of NO_x more than its imports, while the relevant quantity for Italy is barely exceeding the 11kt. Finally, Germany is in this case the major benefited country exporting 50kt more oxidised nitrogen emissions than its imports.

5 Conclusion

Recapitulating one may notice that the TAPT effect is harmful for most of the countries included in the present paper. While Germany is the only country benefited by large scale exports of oxidised nitrogen, some of the other countries are benefited too, but in a lower extend. As such may be considered Estonia, Hungary, Slovakia, Austria and Italy. However, all the rest of the countries under

study have been harmed severely from major nitrogen oxides imports.

Transboundary transfer of pollution is a phenomenon not strictly bound to air pollutants but also relevant to cases of water contamination when neighbouring countries share the same rivers or lakes. The air pollutants in question are considered to be responsible for various environmental hazards such as the eutrophication of aquatic ecosystems, the acidification of forests, the historical monuments degradation and the significant deterioration of the urban air quality [19,20].

The analysis presented in the current paper refers to data until year 2000 and therefore one may consider it as outdated. However, the authors believe that there is a certain reasoning supporting the usefulness of this study. Out of the parameters resulting in the TAPT effect, the climatic phenomena together with the land surface characteristics are not changing significantly in the course of time. Therefore the only factor which can be considered as variable in the short term examination is the air pollution emissions of every country. Thus, this paper, making use of the analytical data of EMEP for over 15 years can provide for a comprehensive outlook of the tendencies of the TAPT effect on either sides of the hypothetical border line of the integrated European continent.

While the environmental problems caused are severe, the TAPT effect seriously questions the applicability and adequacy of the "Polluter Pays" principle. Thus the need for a framework providing

for a steady ground which will better improve the environmental quality by allocating the funds and efforts more efficiently is emerging. The authors believe that the Integrated Europe with the old, new and forthcoming member states can meet these needs sufficiently.

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