Assessment of Health-Cost Externalities of Air Pollution in Denmark and Europe using the EVA Model System

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Abstract

Air pollution has significant negative impacts on human health and well-being, which entail substantial economic consequences. We have developed an integrated model system, EVA (Economic Valuation of Air pollution), based on the impact-pathway chain, to assess the health-related economic externalities of air pollution; in particular, the EVA system can be used to estimate the external costs resulting from specific emission sources or sectors. Such estimates can be used to support policy-making with respect to emission control. Key to the EVA system is that it employs more accurate yet computationally demanding methods in each part of the impact-pathway chain, relative to comparable modelling systems. Furthermore, we have developed a tagging method able to calculate the contribution from a specific emission source or sector to overall air pollution levels. In this study, we apply the EVA system to Europe, with a more detailed analysis of health impacts in Denmark.

The first objective of this work is to test the EVA system. This is done by simulating a number of realistic and relevant scenarios with the purpose of finding the anthropogenic activities and emission sources in and around Denmark that have the largest impact on human health. This involves evaluating the contributions of all significant emission sectors in Denmark that may impact on human health, as represented by the 10 major SNAP (Selected Nomenclature for Sources of Air Pollution) categories, as well as all emission sectors simultaneously.

We also assess the external costs from international ship traffic, since this sector is an important contributor to air pollution within Denmark as well as in Europe. Special attention has been paid to international ship traffic in the Baltic and North Seas, since these waters border Denmark and special regulatory actions on sulphur emissions have been introduced in these areas. Furthermore, we assess the health-related external costs from the total air pollution levels in Europe (including both natural and anthropogenic sources), and these results are compared to similar results obtained in the Clean Air For Europe (CAFE) project. The scenarios represent the years 2000, 2007, 2011 and 2020, and are given both for Denmark and Europe.

We conclude that despite regulatory action in Europe in recent decades air pollution still constitutes a serious problem to human health, and that the related external costs are considerable. The main Danish emission sectors contributing to health-related external costs in Denmark are: agriculture, road traffic, domestic heating (including wood stoves), other mobile sources and power plants. We estimate that emissions from international ship traffic are responsible for health-related external costs in Europe of 58 bn Euros/year in the year 2000, increasing to 64 bn Euros/year in the year 2020. The number of premature deaths in Europe due to international ship traffic is estimated to be around 50,000 cases per year, and increasing in spite of the introduction of the sulphur emission control area (SECA). The total health-related external costs for the whole of Europe is estimated at 803 bn Euro/year for the year 2000, decreasing to 537 bn Euro/year in the year 2020. We estimate the total number of premature deaths in Europe in the year 2000 due to air pollution to around 680,000/year, decreasing to approximately 450,000 in the year 2020.

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