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Pollution abatement in the Netherlands: A dynamic applied general equilibrium assessment

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Abstract

This paper introduces a dynamic applied general equilibrium model with bottom-up abatement information for important environmental themes, which can be applied to a wide variety of countries. Empirical abatement cost curves determine the characteristics of abatement and substitution possibilities between pollution and abatement.

The analysis of efficient reduction strategies for the Netherlands shows that the costs of current environmental policy targets can be limited via a mixture of technical abatement measures, economic restructuring and a temporary economic slowdown. Smog formation is the most costly environmental theme, due to the absence of sufficient technical abatement options.

JEL classification: D58; H23; O41; Q28

Keywords: Applied general equilibrium; Pollution abatement; Dynamics; Environmental policy; Netherlands

1. Introduction

The economic costs of environmental policies can be substantially reduced if an assessment is made of the most efficient policies and technological options. The costs of measures are determined by the direct costs of emission reductions (marginal abatement costs) and the indirect effects induced by these policies, such as sectoral shifts in production and consumption. These indirect effects can be properly captured by using a multi-sectoral applied general equilibrium model.

The vast majority of dynamic AGE models for environmental policy issues focus purely on Climate change (for an overview, see Conrad, 1999 and Harrison, Hougaard Jensen, Haagen

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Pedersen, & Rutherford, 2000). These energy–environment–economy models assume that end-of-pipe measures are not available or prohibitively costly compared to fuel switches, and therefore can be neglected in the model. Recent contributions to the field include Bye (2000), Wendner (2001), Dissou, MacLeod, and Souissi (2002), Gerlagh and van der Zwaan (2003) and Böhringer and Welsch (2004). Models that capture several environmental problems simultaneously are rare; a notable exception is Xie and Saltzman (2000), who distinguish between pollution abatement activities for air quality, water quality and soil quality.

At the other end of the spectrum are bottom-up models that contain detailed empirical information on the technical characteristics of specific abatement options, e.g. RAINS (Alcamo, Shaw, & Hordijk 1990). Nowadays, most of these models include estimates of the associated direct costs of the measure; they are, however, not capable of assessing the indirect economic effects.

The easiest way to integrate the bottom-up model with a top-down economic model is via so-called soft-linking. In this approach, two separate models are specified, and the outcomes of one model are entered as exogenous input into the other model. The converging outcome is then achieved via an iterative procedure. An example of this approach is given in Jacobsen (1998). Other studies aim at integrating both the bottom-up and top-down modules into one model (so-called hard-linking). Noteworthy examples of such integrated models are the model by Böhringer (1998) and the NEMO energy model (Koopmans & te Velde, 2001). Full-scale estimation of abatement costs is not common in top-down environmental-economic models. The detailed description of abatement processes in terms of economic inputs as used in Nestor and Pasurka (1995a) is an exception; Nestor and Pasurka (1995b) show that a proper specification of abatement costs is vital for quantitative estimates of the economic costs of environmental policy.

The aim of this paper is to assess the long-run economic costs of environmental policies in the Netherlands, using a dynamic AGE model augmented with several environmental themes and special attention to the (empirical) characteristics of pollution abatement. The detailed information on abatement costs, in combination with a consistent assessment of the indirect effects, provides a suitable framework for an empirical evaluation of environmental policies in the Netherlands. The novel contribution of this paper is that a consistent methodology that covers both direct and indirect effects is used, allowing for a proper assessment of the interactions between sectoral economic activity and multi-pollutant environmental policy. Thus, the model facilitates to make both ex ante and ex post assessments of a wide variety of environmental policy options, for each of the environmental themes, including the various interactions amongst the policy options. It can be applied for individual countries, whereas in this paper we report on environmental policy making in the Netherlands.

The set-up of this paper is as follows: Section 2 provides an overview of the model; Section 3 deals with the data for the Netherlands. The results of the model simulations for Dutch environmental policies are discussed in Section 4; Section 5 concludes.

2. Description of the model

2.1. Economic activity

DEAN[1] is a forward-looking neo-classical growth model. This model type has the advantage that the specification is fully dynamic: the agents take not only the current state of the economy, but

[1] Acronym for “Dynamic applied general Equilibrium model with pollution and Abatement for the Netherlands”.