WP 7 Applications of the database – environmental aspects

Work package number	WP 7			Start date or starting events:	Month 7		
Work package title	Applications of the database: environmental aspects						
Activity Type	RTD						
Beneficiary number	1	2	4	5				
Person-months per beneficiary	5	8	27	19				

Objectives

This work package focuses on designing and improving several types of models that attempt to explain recent changes in the environment and to predict future changes, at national, regional and global levels. The vast majority of improvements will be possible due to the construction of the new dataset in WP1-WP5. The unique feature of the database is that it contains harmonized data across time and space. In particular the time dimension allows for the use of (panel data) econometrics. Changes in the recent past will be studied by developing new IO and econometric techniques and applying them to the database. Second, we will build models and study methodological aspects of model building by using the database. The ex ante studies will benefit from the ex post analyses. Testing the variability of the outcomes and/or the robustness of the ex post analyses provides crucial information for a solid ex ante analysis. Special attention will be paid to the phenomenon of induced technological change. That is, if the direction of innovative activity would be strongly affected by changes in the prices of inputs, environmental taxes could have effects that supersede well-known substitution effects. The new dataset allows for studying induced technological change at an international level. Ex ante model experiments will be adapted to take induced technological change into account.

Description of work

The work in this work package is divided into two tasks, both of which are divided into subtasks.

Task 7.1: econometric approaches and structural decomposition analysis (partners 1, 2, 4, and 5 are involved)

1. The first subtask employs econometric techniques to study the linking of economic data and environmental indicators. An integrated database covering a large set of countries over time is a very suitable tool in order to perform ex post analyses. In this respect, the link between economic data and environmental indicators may serve as an excellent starting point in order to assess the interrelations between economic activities and the environment. In the past, analyses like these have suffered from inadequate data availability, especially because of lacking data comparability between industries and countries and of lacking integration of environmental data into economic data. Econometric panel data methods will be used to make full use of the rich dataset.
2. The second subtask focuses on the widely debated topic of the consequences of globalization and trade liberalization on the environment. We will study the environmental implications of structural change. These have emerged at the world level as a result of the globalization process. For the industries that have experienced the most significant structural changes, we will analyze the drivers behind these changes. This subtask will thus be conducted in two consecutive steps. The first step applies a structural decomposition analysis. The contribution of a set of determinants on the overall change of some environmental indicators is assessed. The determinants include production technology, trade patterns, consumption patterns and environmental efficiency. The second step implements an econometric approach to analyze in more detail the driving forces that push structural change in the industries that have been identified as the most relevant in the first step of the analysis. The purpose is to evaluate the contribution of some theoretically plausible driving forces (such as skilled labor endowments and environmental resources) on the overall comparative advantage between countries.

Task 7.2: environmental model building and related methodological aspects (partners 4 and 5 participate)

3. This subtask deals with the cost-efficiency assessment of environmental policies. A prerequisite to "get the prices right" is a thorough accounting of costs of reduction linked to economic production and consumption activities. Economy-wide models so far have only poor coverage of environmental indicators with a complex grounding in natural sciences. The central objective is to come up with operational algorithms for integrating bottom-up estimates on abatement cost functions for selected pollutants in economy-wide models. One approach is to use bottom-up information directly through an iterative updating of cost-effective abatement options starting from an initial shadow price of the pollutant (as delivered e.g. by cost estimates). Another approach is to approximate compact continuous reduced-form representations to given bottom-up point estimates based on flexible functional forms.
4. The second subtask within this task aims at improving the calibration of computable general equilibrium (CGE) models. Typically, a number of parameters of CGE models are calibrated to benchmark data from IO tables in a certain year. The calibrated parameters are thus based on single observations and the model reproduces these benchmark data as an equilibrium solution. Consequently, applying benchmark data from different years will yield different equilibria. Besides this, to calibrate free parameters to benchmark data, CGE models implement estimates

on all sorts of elasticities that are simply borrowed from the literature or from other (applied econometrics) studies. One of the unique features of the WIOD database is that it will provide a time series of IO tables. This immediately offers opportunities for investigations of the robustness of the model outcomes to the choice of calibration year. In addition, some of the elasticities required for calibration can be estimated from the dataset itself and the sensitivity of the results with respect to the calibration method can be studied.

5. This subtask deals with the research field of technological change in the context of environmental policy. To meet emission constraints and other environmental requirements without excessively diminishing welfare levels, the consideration of innovations is indispensable from an environmental economic perspective. In order to incorporate the significance of environmental innovations, the integration of induced technological progress into this work package is of high relevance. The WIOD-database contains data on (implicit) prices as well as input requirements per unit of output, measured in constant prices. These data, combined with innovation and investment data at industry level as contained in EU KLEMS and OECD data allow for a thorough international analysis of the effects of price changes on the rate and direction of innovation.
6. The fourth subtask in 7.2 develops a prototype CGE model, aiming at a 100% fit with the WIOD data. Typically, a large variety of data sources is used in the construction of CGE models, while WIOD allows for using a single source of harmonized data. The basic setup is a fully integrated interindustry, international CGE model of global trade and energy use. A further unique feature of the model is its inclusion of industry-specific degrees of induced technological progress based on WIOD data, which strengthens the estimation of effects of environmental taxes. In addition, the model makes use of unique WIOD data on trade in intermediate goods in order to improve the usual CGE specification of trade. Submodules allow for the problem-specific investigation of trade, environment, and tax policies as well.

Deliverables

D7.1 (month of delivery: 12): Report on linking economic data and environmental indicators using panel data econometrics

D7.2 (month of delivery: 18): Report on the effects of structural change on the environment using a structural decomposition analysis and on the causes of structural change in selected industries using econometric techniques

D7.3 (month of delivery: 24): Report on the cost-efficiency assessment of environmental policies using algorithms for a bottom-up analysis of the associated abatement cost functions

D7.4 (month of delivery: 18): Report on calibration of CGE models using time series of IO tables.

D7.5 (month of delivery: 24): Report on studying induced technological progress regarding energy use and pollution in an international comparative context.

D7.6 (month of delivery: 30): A report with a full description of the model developed in Task 7.2.