



Assessment and improvement of methodologies used for Greenhouse Gas projections

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General terminology used for modelling

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A. Top down and Bottom-up

A bottom-up approach is easily understood as details of individuals/firms/technologies that are simply aggregated in a similar way as an accounting system. Usually, bottom-up models are not dealing with the whole economy, but only with some particular aspects which are modelled in great detail like: the whole emission system, the energy system, the transport system etc.

Bottom-up models usually put a strong emphasis on the representation of different technologies. Economic aspects are modelled in three possible ways:

- Either they are completely ignored.
- Basic cost accounting aspects are considered. Investment and operational costs of technological options are taken into account, usually in a cost-minimizing framework.
- The model operates as a partial equilibrium model. The model then incorporates demand price elasticity. Increases in costs by environmental regulations do not only provoke shifts in the choice of technologies, but also shifts in the demand for products.

Bottom-up models usually ignore feedback effects of the economy (apart from price elasticity).

In top down modelling basically one starts from some aggregation and uses some allocation principles to decide on the details. This is for instance a typical structure to describe consumption behaviour. In a first level the global consumption depends on income and then the allocation over different types of consumption categories is decided. Similar allocation systems are used to model the producer behaviour when producers decide on the allocation of different production factors. Basically we can say that all macro-economic models have typical top-down properties.

B. Economic background: Neo-Keynesian – neo classical

These terms refer to the underlying economic theory in the models. Keynesian models have a strong emphasis on demand aspects of the economy. They are designed to analyse the short and medium term aspects of the economy.

Neo-classical models emphasize the supply side of the economy. Neo-classical economists claim that in the long run economic growth depends on the supply side (use of available resources, taking into account productivity increases due to capital accumulation, education..)

C. Equilibrium: Partial equilibrium and general equilibrium

Partial equilibrium models (PEM) describe demand and supply behaviours on one particular market at the time, ignoring the effects on other markets. The price of goods is determined by demand and supply and the model calculates the equilibrium price when demand and supply are in balance.

General equilibrium models (CGE) describe the whole economy, including all markets simultaneously, including the labour market, markets for investment goods etc.

D. Mathematics: Simulation and optimisation

All models have a number of unknown variables that should be determined.

Simulation models are specified as a number of equations and an equal number of unknown (= endogenous) variables. Simulating is equivalent to solving the system of equations. If the equations are non-linear, the model is solved by some iterative procedure.

Optimizing models are of a different nature. They are looking at some objective function such as maximum profits, minimum production cost or maximum welfare under a number of constraints. In this type of models the number of variables largely exceeds the number of equations and the constraints are partly inequalities. Some optimizing algorithm will choose the best combination of variables.

General equilibrium models are a special category as they can be considered both as simulating and optimizing models. General equilibrium models usually have as many variables as equations but the solution corresponds to maximum welfare conditions. Under assumptions of perfect competition and perfect foresight, market equilibrium corresponds to a situation of maximum consumer and producer surplus.

E. Myopic foresight – Perfect foresight

The terminology refers to the length of the horizon considered in determining investment choices in the model. Myopic models are solved year by year and consider only the current situation. Perfect foresight models on the contrary are solved simultaneously for all periods considered. The difference is especially relevant for the evaluation of investment decisions. In perfect foresight models, an investment decision is based on an evaluation of the profitability for the whole period. In myopic models, only the current period is considered.

