Preface

GUNTER STEPHAN*

This volume contains six papers presented in March 1990 at a workshop on Computable General Equilibrium Modelling, organized by the Institute for Applied Microeconomics, University of Berne, Switzerland. The articles were selected by anonymous referees and have undergone revisions since their presentation. Common topic is the application, formulation and solution of dynamic CGE (computable general equilibrium) models. Some of the papers are expository in nature, some contain contributions to model applications, and others survey the state-of-art of CGE modelling.

In applied micro-economics, there is a continual interplay between policy issues and tools of analysis. During the 1950s and early 1960s, economic growth was identified as one of the major policy problems and development was largely viewed as a question of economic efficiency. At the beginning of the 1970s and 1980s, it became apparent that distributive economics is also a key issue. Many important topics in political economy cannot be approached from a pure allocational viewpoint. Policy changes may have significant impacts on the distribution of income, and equity-efficiency trade-offs between individuals in different income groups cannot be neglected.

The tools of analysis developed over the last decades reflect this change in focus. Starting from Leontief's input-output work, economists and policy analysts have used increasingly sophisticated simulation models capable of dealing with economy-wide aspects. By the 1970s, it became routine to handle large-scale linear and non-linear programming problems. Compared to an input-output framework, these approaches permit a more flexible treatment of the economy's production side, but they are still rigid in the requirements placed upon the consumers' side. Generally, they start from a planning viewpoint with a single decision maker. This may be appropriate, if the analysis is concentrated on efficiency issues, but it is inappropriate for analyzing distributive effects. The most logically consistent way to capture allocational as well as distributive aspects is to model all agents in a general equilibrium framework.

Today, general equilibrium modelling lies in the heart of economic theory. It explains in a simplified but logically consistent way the functioning of complex economic systems where decisions are price-guided and made on the micro-level: Production is carried out by profit-maximizing agents and is viewed as the transformation of commodities by using the technological knowledge available. Households own certain stocks of physical commodities or assets. Given the relative prices for commodities and depending on consumers' preferences, demand and supply of goods and services are expressed as a function

*Department of Economics, University of Berne, Gesellschaftsstrasse 27, CH-3012 Bern.

of prices and income. The invisible hand then assures that supply equals demand for each commodity.

As an analytical tool, such a description of an economy has a long tradition in economic theory. Its roots can be found in the work of ADAM SMITH, JOHN STUART MILL and LÉON WALRAS. Particularly, WALRAS' conceptional ideas have served as a starting point for the development of today's general equilibrium approach that was put forward by ARROW, DEBREU, GALE, MCKENZIE and NIKAIDO with a high degree of precision and generality. Using fixed-point arguments, they have been able to answer fundamental questions of economic theory. Since the end of the 1950s, the logical and internal consistency of general equilibrium models as well as the existence of equilibrium solutions are definitively granted.

But the price of this remarkable achievement seemed relatively high. It was not until the pioneering work of SCHARF at the beginning of the 1970's that techniques became available which enabled to solve equilibrium problems numerically. Over the last twenty years, however, based upon the experience with linear and non-linear optimizing problems, different approaches have been developed which allow to compute equilibrium solutions for general equilibrium models. The improvement of both computational tools and numerical methods have extended the potential applications of computable general equilibrium models. Today, these models have a number of attractive features and may serve as a workhorse for policy investigations. This weight attached to CGE calculations by the policy community is reflected in the fact that many of the leading models are used in-house by governmental agencies and international organizations.

Despite these advantages, CGE models are still unsatisfactory in some respects. One of them is the treatment of time and dynamics. In this volume two types of applications of dynamic CGE models are discussed. The first two papers deal with public finance applications and focus on equity-efficiency trade-offs within a single country. The following papers are concerned with applications to environmental and resource economics.

The first paper is by CHRISTIAN KEUSCHNIGG. It presents a one-good two-country CGE model with overlapping generations designed to evaluate intertemporal and international effects from tax reform. The paper deals with the effects of implementing a cash flow income tax in closed and open economies. In solving for transition paths to new intertemporal equilibria, the generational welfare consequences of various arrangements affecting the transition paths are discussed.

The second variant of dynamic tax policy models is introduced by BERND METTELSIEFEN. He shows that such an approach is appropriate for analyzing intertemporal efficiency effects of tax policy changes and can provide tentative insights into the quantitative magnitude of tax reforms. Despite of some simplifications, METTELSIEFEN's preliminary simulations' results suggest major policy conclusions: First, eliminating business profits taxes and taxes on business capital has strong positive effects on investment. Second, permitting partial deductibility of the interest payments on debt leads

to a reduction of intertemporal inefficiencies. Third, corporate tax cuts can result in a taxation paradox and generate a strong disincentive effect with respect to investment.

Environmental policy applications of CGE models start with ALAN S. MANNE's Global 2100. Global 2100 describes an analytical framework for estimating the costs of carbon emission limits in terms of CO_2-energy-economy interactions. The name Global 2100 has been adopted in order to emphasize both the global nature of the carbon emissions problem and the need for a long-term perspective. ALAN S. MANNE has based the analysis on parallel computations for five major geopolitical regions: the USA, other OECD nations, the USSR and Eastern Europe, China and ROW (rest of world). For each region, a dynamic nonlinear optimization is employed to simulate either a market or a planned economy. Supplies and demands are equalized within each individual time period, but there are "look-ahead" features to allow for interactions between periods. These interactions are particularly important for the depletion of exhaustible resources and for the accumulation of capital over time.

In economic accounting and in traditional forecasting procedures two basic and important facts are usually neglected. First, economic activities deplete natural resources and, second, nature is commonly used as a sink for wastes discharged by the economic system. In his paper, KNUT H. ALFSEN provides an overview on the development of CGE models in Norway and their applications to environmental issues. It is shown how the model tools used for socio-economic planning in Norway by the Central Bureau of Statistics has been revised and extended to cover at least one aspect of the use of the environment: air pollution.

KLAUS CONRAD and MICHAEL SCHRÖDER also analyze economic and environmental effects of taxing air pollution from a single country perspective. They have built a temporary CGE model to identify and to measure the trade-offs between various goals of environmental and economic policy. The main features of their approach are: (1) They empirically implement the impact of abatement activities on economic growth and environmental quality. (2) Adjustment costs are considered in order to gain a more realistic treatment of the time path of investment.

JOHN ROWSE does not present a truly CGE paper, but reviews an important question in intertemporal equilibrium analysis: What are the consequences of using an improper discount rate to allocate a non-renewable resource? Starting from a multi-period, multi-regional, multi-technology model of Canadian natural gas allocation, ROWSE finds small percentage social welfare losses from using the wrong discount rate, even for wide divergences from the social rate. The numerical results obtained strongly complement theoretical findings that ROWSE has observed in previous work using a simple continuous-time model and a more complex discrete-time model. As such ROWSE's findings seem to reflect a general tendency.

Without authors, discussants and financial support by the Swiss National Fund, the Max und Elsa Beer-Brawand Foundation and the Swiss National Bank, this workshop would have been impossible. Their and the editor's assistance is gratefully acknowledged.