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# CGE modeling social security reforms<sup>☆</sup>

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## Abstract

The paper reviews CGE models that have dealt with social security issues during the last two decades. After introducing the benchmark model from [Auerbach and Kotlikoff \(1987\)](#), we consider the impact of the demographic transition on international capital markets and national wages. Then the discussion focusses on optimal funding and optimal progressivity of social security and concludes with some possible directions for future research.

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*Keywords:* Population ageing; Social security funding; Progressivity of social security

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## 1. Introduction

I am deeply honored to participate in this symposium celebrating Leif Johansen's contribution to the development of CGE models. As a Ph.D. student I developed a static multi-country, multi-sectoral general equilibrium model which was applied to the problem of tax harmonization in the European Union. At that time I was quite aware that my own work is based on Leif Johansen's doctoral dissertation which was published as *A Multi-Sectoral Study of Economic Growth* in 1960 (and later in a second edition in 1974). In my own dissertation I did not follow the so-called "Johansen-method" of solving a system of non-linear equations by log-linearization but applied instead a variant of Scarf's numerical algorithm for finding the equilibrium. Nowadays Scarf's

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<sup>☆</sup> This is a revised version of the paper presented at the Symposium in memory of Professor Leif Johansen in Oslo, 20st and 21st May 2010. I would like to thank the participants at the Symposium and an anonymous referee for helpful comments and suggestions.

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algorithm is quite antiquated since many computational tools are available to solve nonlinear equation systems efficiently. However, even after half a century, the economic structure of many applied models is still very similar to Leif Johansen's path breaking work.

Since my dissertation I have changed my research agenda from static multi-sectoral to dynamic one-sector growth models with overlapping generations dealing with social security issues. With the exception of [Samuelson \(1958\)](#) and [Diamond \(1965\)](#) overlapping generation models were hardly discussed up to the early 1980s, so it is not surprising that (at least to my knowledge) none of Leif Johansen's work is directly connected to this specific class of models. Nevertheless, since Leif Johansen showed a lifelong interest in the use of long-term models as a guide for practical problems in macroeconomic planning, I am quite sure that he would have liked the studies I will discuss. Due to the demographic transition, social security has become an extremely important area of economic policy. In the recent past dynamic CGE models have highlighted the economic consequences of the ongoing and upcoming demographic transition. They have assessed the sustainability of many existing pension schemes and indicated the need for dramatic policy reforms. Even in Norway, a country where public finances look impressively solid due to its large petroleum revenues and an ambitious pre-funding strategy, fiscal policies seem not to be sustainable in the long-run. Consequently, since [Steigum \(1993\)](#) dynamic CGE models are used to evaluate the macroeconomic, the distributional and the insurance and efficiency effects of alternative policy options. Currently, Statistics Norway applies modern variants of its MSG model (which was initiated by Leif Johansen) to welfare state and pension reform issues, see [Holmøy and Stensnes \(2008\)](#).

In my discussion I will not present a survey of the literature<sup>1</sup> but concentrate on three central issues: The impact of population aging, the privatization and the progressivity of social security. I will explain how CGE models are applied to analyze these questions and how model structures, results and policy conclusions have changed over time. My intention is not to present projections for the future path of the economy or definite answers for policy practice, but to show how institutional assumptions shape the assessment of economic problems. In my opinion this is the main advantage of CGE models. They can go beyond theoretical models and analyze practical policy issues in very complex institutional settings which require evaluating different economic effects quantitatively. My discussion will focus on numerical models in the tradition of [Auerbach and Kotlikoff \(1987\)](#). For this reason the next section describes the general structure of this approach. Then I discuss the policy issues mentioned above before I conclude with some (personal) notes on expected future developments.

## **2. The Auerbach–Kotlikoff model**

Alan Auerbach and Larry Kotlikoff developed their dynamic life-cycle simulation model (henceforth the AK model) in the early 1980s.<sup>2</sup> Whereas CGE models at that time were typically static in nature, they were the first who integrated a dynamic optimization procedure and solved for the transition path between steady states. The original AK model distinguishes between 55 overlapping generations (representing ages 21–75), the preference structure of a “newborn”

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<sup>1</sup> For recent surveys of the literature see [Fehr and Thøgersen \(2008\)](#) and [Fehr \(2009\)](#).

<sup>2</sup> [Kotlikoff \(2000\)](#) provides a nice insight on the origins of this approach.

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