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An applied dynamic general equilibrium model of environmental tax reforms and pension policy

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Abstract

This paper is concerned with the analysis of environmental tax reforms within the framework of a dynamic computable general equilibrium model. The main policy option to be considered consists of using the revenues from CO_2 taxation to partially finance the pension system. It is shown that CO_2 reduction and financing the old-age pension system may be mutually compatible rather than conflicting policy objectives. Compared with other policy simulations, which also aim at lowering CO_2 emissions, the "CO_2-cum-pension" option shows itself to be the most favorable policy in terms of growth, demand of labor services, private investment and consumption. © 2001 Society for Policy Modeling. Published by Elsevier Science Inc.

Keywords: Computable general equilibrium; Overlapping generations; Dynamics; Carbon abatement; Pension policy

1. Introduction

The threat of a marked climate change as a consequence of anthropogenic CO_2 emissions and the financial requirements of the old-age pension system in the face of an aging population are commonly perceived as two of the most

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dominant problems of the future. Both problems are addressed in this paper and investigated within the framework of a dynamic computable general equilibrium model.

Projections of the age structure of the population show a significant increase in the ratio of older people to the total population in all industrial countries. In the United States, the percentage of the population older than 65 years was 10.5% in 1975 and is expected to reach 12.4% in 2000, with a rising trend predicted for the future (WRI, 1998). This development is even more marked in Europe. In Austria, for example, the increase was moderate in the past (from 14.9% in 1975 to 15.0% in 1995) although a strong growth in this ratio up to 25.3% is projected by the year 2030 (ÖSTAT, 1996). Since the social security system is not funded in most countries, it is argued that the shift in the age structure strongly affects the social security's impact on individual saving and consumption decisions and also on labor supply decisions (Feldstein, 1974). The "pay-as-you-go" method of financing social security is often seen as possibly leading to one of the major problems of our society in the future. This "implicit form of deficit finance" (Auerbach & Kotlikoff, 1987, p. 145) not only redistributes wealth from current younger towards current older generations with adverse effects on saving and capital accumulation, but because of the changing age structure of the population, it also requires either a marked increase of the social security tax rate or a benefit cut or both.

A second threat of major concern is the increase of the CO_2 concentration in the atmosphere. It has steadily increased from a pre-industrial level of 280 parts per million by volume (ppmv) to a level of above 363 ppmv today. Yearly, world fossil CO_2 emissions stemming from industrial processes amount to 24 billion metric tons of which 6 billion tons can be attributed to North America and another 6 billion tons to Europe. Austria's volume of CO_2 emissions amounts to about 60 million metric tons per year. Because of CO_2's greenhouse characteristics, experts fear an increase of the global mean temperature with widespread stratospheric cooling, an increase in global mean surface precipitation, reduction of sea ice, arctic winter surface warming and a rise in global sea level (OECD, 1992).

While the existing literature focuses on either environmental tax reforms or on social security tax reforms, this paper brings together both policy agendas within the framework of one model. By means of an intertemporal applied general equilibrium model, policies are investigated, which aim at a lowering of CO_2 emissions on the one hand and a reduction of the growth of the social security tax rates on the other hand. The framework employed is based on the overlapping generations models tradition as found first in the works of Allais (1947), Diamond (1965) and Samuelson (1958). In a computational context, the model is based on the applied overlapping cohort models as developed in Auerbach and Kotlikoff (1987), Keuschnigg and Kohler (1994) and Rutherford (1998). Based on perfect foresight, 55 overlapping cohorts choose