

D. P. Broer · J. Lassila
Editors

Pension Policies and Public Debt in Dynamic CGE Models



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Pension Policies and Public Debt in Dynamic CGE Models

ETLA – The Research Institute of the Finnish Economy
Series A23 (ISSN 0356-7435)



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With 33 Figures



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ISBN 3-7908-0970-5 Physica-Verlag Heidelberg
ISBN 951-628-240-7 Taloustieto Oy, Helsinki

Die Deutsche Bibliothek – CIP-Einheitsaufnahme

Pension policies and public debt in dynamic CGE models/D. Peter Broer; Jukka Lassila (ed.). In assoc. with ETLA, Helsinki. – Heidelberg: Physica-Verl.; Helsinki: Taloustieto Oy, 1997

(Series/ETLA – The Research Institute of the Finnish Economy: A; 23)

ISBN 3-7908-0970-5 (Physica-Verl.)

ISBN 951-628-240-7 (Taloustieto Oy)

NE: Broer, D. Peter [Hrsg.]; Elinkeinoelämän Tutkimuslaitos (Helsinki): Series/A

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Printed in Germany

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SPIN 10550968

88/2202-5 4 3 2 1 0 – Printed on acid-free paper

PREFACE

In recent years, increasing attention has been devoted to the economic consequences of population ageing. The prospective increase in the share of elderly in the population in developed countries will have important consequences for the distribution of the net burden of government expenditure and social security provisions over generations. This raises a number of issues regarding the impact of current public debt policy and the system of public pension provisions on the efficiency and the distribution of welfare in these countries.

To study these issues, a workshop on "Pension Systems, Taxation, and Public Debt in Dynamic CGE Models," was organized by ETLA, The Research Institute of the Finnish Economy, in Helsinki, Finland, on April 6-7, 1995. At this workshop, papers were presented that addressed these questions using Computable General Equilibrium models. This book contains updated versions of these papers. The financial support from the Yrjö Jahnsson Foundation, both for the workshop and for the preparation of this book, is gratefully acknowledged.

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1 Introduction and Summary

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1.1 The Basic Issues

The age composition of the population in developed countries is shifting rapidly in favour of the elderly. Projections by the United Nations indicate that for the OECD area as a whole the share of the elderly (people at an age of 65 or above) will increase from 15 % in 1990 to 22 % in 2040. At the same time, the old-age dependency ratio¹ is expected to rise from 20 % to 37 %. For individual countries, these ratios may develop in an even more dramatic fashion, *e.g.* for Japan a rise of the dependency ratio from 16 % to over 50 % is projected, and for Germany from 22 % to 48 %. For developing countries, a similar change is expected at a later stage (United Nations (1994)). In the last decade, it is increasingly being recognized that this worldwide change in the age structure of the population will have far-reaching economic consequences. The change should give rise to substantial shifts in the distribution of the net financial burden of the public sector across generations, mostly as a result of a declining labour force participation. Rising dependency ratios imply a decline in the size of the tax base that can be used to finance public expenditure and social security transfers. Without a substantial cut in public expenditure programs and transfers, the ageing process will therefore cause a substantial increase in the net tax burden for younger generations.

This prediction can be substantiated by tracking net taxes and transfers of different generations over their lifetime, given a baseline projection of future developments. The method of *intergenerational accounting* has been advocated by Auerbach *et al.* (1991) as an alternative to the use of the official government per capita debt to measure the extent of redistribution implied by public policy. Intergenerational accounting calculations for the U.S. show that the lifetime tax

¹ The old-age dependency ratio is defined as the ratio of the elderly to the working-age population.

rates² for future generations are expected to *double*, from around 35 % to around 70 %, under the current policy regime (see Auerbach *et al.* (1994)). This dramatic change in the net burden of different generations stems mainly from two sources, first, the level of public debt and the associated projections of the government budget deficit and, second, the expected increase in social security transfers associated with the ageing of the population. Calculations for Germany show a similar pattern for the intergenerational burden (Boll *et al.* (1994)). However, Ablett (1996) obtains a different conclusion for Australia, mostly as a result of a smaller Australian public debt.

In itself, shifts in the burden between generations need not be a cause for concern, as they may simply reflect the role of social security as a public insurance contract.³ However, a social security system must be regarded as an *implicit* social contract, that is not strictly enforceable. This implies that large structural shocks may endanger the viability of the contract.⁴ Furthermore, the original social security contract may not have been optimally designed. These considerations point to the basic policy issues to be dealt with in this book, *viz.* the potential for a reform of the old-age social security system in OECD countries to cope with the demographic shock and the scope for fiscal policy in this respect.

1.2 Public Debt

One way to prepare for the ageing of the population is to reduce the level of public debt. Among policy makers, the negative effects of a high and rising level of public debt are virtually undisputed. Among academic economists, the predominant neoclassical view holds that a rising level of government debt implies a shift of the tax burden towards future generations that will boost current consumption of heterogeneous agents and lead to crowding out of capital formation. In addition, the probability that the debt will be monetized increases, which boosts expected inflation. Under the competing Ricardian view, families of intergenerationally linked households will adjust their consumption in reaction to any imbalance in the tax burden across generations. In that case, the consequences of the

² Defined as the ratio of lifetime net payments into the system and lifetime labour income.

³ On the lack of efficiency of private insurance markets in the presence of asymmetric information, see *e.g.* Eckstein *et al.* (1985).

⁴ For a discussion of the political stability of existing old-age provisions, see Verbon (1989) or Tabellini (1991).

ageing process for the distribution of the intergenerational tax burden are already discounted in the behaviour of households.⁵

The possible existence of intergenerational linkages does not deny the importance of a proper management of government finance, however. The conditions for the existence of Ricardian equivalence⁶ are unlikely to be met in reality, so that public debt will crowd out savings, even with intergenerational linkages. In a closed economy, this will directly affect the tax base, through a reduced accumulation of capital, but also in a small open economy the accumulation of foreign debt will crowd out consumption of future generations. Furthermore, lacking the availability of lump-sum taxation, both the neoclassical view and the Ricardian view stress the use of the public deficit as a means to achieve an optimal timing of taxes over the business cycle, to minimize the intertemporal distortions of taxation, see *e.g.* Barro (1986). The desirability of tax smoothing carries over to the case of anticipated demographic shocks (Bovenberg *et al.*, (1993)). To avoid increases in taxes or social security premiums, future deficits should be met by current surpluses. Such a policy may imply a direct reduction in government debt by increasing taxes or reducing public consumption, or a reduction in old-age social security, along the same lines.

Historically, control over the level of government debt has been difficult to achieve. Within the EC, the incentives for a reduction of government debt have increased substantially with the conclusion of the Maastricht agreement. However, the provisions of the treaty were formulated mainly with an eye on the requirements for a monetary union (see *e.g.* Buiter *et al.* (1993)). In fact, the asymmetric treatment of government debt and the burden of unfunded social security in the provisions of the Maastricht treaty suggests that issues of intergenerational redistribution are not yet high on policy makers's agendas. As it is well known that unfunded social security is by and large equivalent with government debt (see *e.g.* Auerbach and Kotlikoff (1987)), a difference in priority between both policy issues appears to be unwarranted.⁷

⁵ This is not to say that the distribution of the tax burden cannot have any consequences for household behaviour. For an exposition of both views, see *e.g.* Barro (1989) and Bernheim (1989).

⁶ *E.g.*, perfect capital markets, no bequest constraints, lump sum taxation, certainty over future taxes and income.

⁷ Except to the extent that there may be implicit escape clauses in the social contract between generations, that allow for a reduction of social security in case of large adverse shocks.

1.3 Social Security Reform

Next to a reduction in government debt, a straightforward way to deal with the distributional consequences of the ageing process may be to reform the social security system. In fact, the problems associated with a rise in the old-age dependency ratio originate partly from the current organization of old-age social security. The public old-age social security system in most western countries is largely on a Pay-As-You-Go (PAYG) basis.⁸ PAYG systems are by their very nature defined-benefit systems, so that the contribution rate in these systems is rather sensitive to demographic shocks. As a result, PAYG systems are usually not actuarially fair in the presence of demographic shifts, and the discrepancy can be substantial (see *e.g.* Nelissen (1987) for some illustrative calculations). The *linkage* between a dollar paid and the present value of a dollar received, which is never very high in defined-benefit systems, may therefore be rather low in a PAYG system. This causes the PAYG premium to act as a distortionary tax on labour, that adds to the distortionary impact of the income tax. Given the high taxes on labour in most OECD countries, the additional efficiency loss may thus be very serious, which makes it worthwhile to look for efficiency-increasing reforms of the standard PAYG social security contract. To this end, several options may be considered:

- One option is to reduce the amount of social security by increasing the statutory retirement age, or reducing the replacement rate between wages and pension benefits. This could be interpreted as a break of the social contract. However, it might be justified by an appeal to the increased longevity of the population, or to the increase in wages as a result of the decline in labour supply. Making the contract contingent on these events need not impair the basic insurance function of the system.
- A second option is a transition to a funded system. A funded system offers a buffer against demographic shocks, that can give a more equal distribution of the generational burden. In conjunction with this, it should cause less distortion of labour market decisions. Homburg (1990) and Breyer and Straub (1993) show that, departing from a steady state, such a transition can be made in a Pareto-improving fashion. However, if the demographic shock is well under way, as is the case at present, a Pareto-improving transition to a fully funded system may take too long to be of practical use.
- Instead of a transition to full funding, it may be possible to achieve a better intergenerational distribution by allowing the pension fund to run surpluses and deficits, that are financed on the capital market. In this way, the distributional

⁸ Some countries also have a supplementary pension system that is completely or partially funded. This is the case in Denmark, Finland, and the Netherlands.

role of the pension fund becomes quite similar to that of the government in its use of public debt. The advantage over the previous option is that a change to a system with an *ex ante* constant contribution rate can be made even at a late stage in the demographic transition.

- Lastly, it is possible to abandon the defined-benefit character of existing public pension schemes and switch to a defined-contribution system. This would put the public pension system more on a par with existing private pension schemes, that are always defined-contribution. In comparison with the previous option of premium smoothing, this system also implies stable premium rates, but it does not guarantee any specific level of pension benefits. Thus the insurance role of a defined-contribution system falls short of that of a defined-benefit system.⁹ The big advantage of defined-contribution schemes is that they can be made actuarially fair, thus allowing for a better linkage between contributions and pensions. This does away with the distortionary character of pension contributions. In comparison with private pension schemes, the added benefit of a public defined-contribution pension scheme is that its compulsory character ensures that no adverse selection on the basis of private information about longevity risks can take place (see *e.g.* Townley and Boadway (1988)).

1.4 Evaluating Reform Proposals

Any evaluation of reform proposals should involve two criteria, *equity* and *efficiency*. The application of these criteria to the consequences of population ageing is not without difficulties, however, as ageing may be expected to have a considerable impact on the future development of the economy. As a result, an evaluation of an existing scheme of social security by means of a simple extrapolation of existing trends may be highly misleading. Auerbach and Kotlikoff (1987) show that, within the framework of their life-cycle model, the demographic transition will have significant effects on savings rates, wages, and current accounts. In particular, the decline of the working age population will lead to a fall in labour supply, that results in higher wages and lower interest rates during the transition period. This will affect the relative position of generations both through their lifetime income and through the link between pension benefits and wages.

⁹ In particular, there is no hedge against unfavourable demographic or macro-economic shocks, that may affect some generations more than others. On the impossibility of private insurance markets to engage in intergenerational risk-sharing, see Gordon and Varian (1988).

To account for the effects of ageing on the position of households, reliable predictions of the general macroeconomic effects of ageing appear to be required. However, straightforward application of generational accounting methods to these projections, to determine the degree of intergenerational equality, does not necessarily provide clear results. The differences in net tax payments of the successive generations emerge partly from changes in household behaviour, that affect factor prices and incomes. The question to what extent a possible *ex post* difference in treatment before taxes of generations can be regarded as inequitable is then no longer well-defined (see also Haveman (1989)).¹⁰

Obviously, what is needed theoretically is a (money-metric) indicator of the change in utility of the generations involved. To what extent generational accounts provide a good indication of this change in utility is still open to debate. Fehr and Kotlikoff (1995) provide examples of welfare effects of policy measures in the Auerbach-Kotlikoff Computable General Equilibrium (CGE) model, where the utility gain of generations is approximated satisfactorily by the change in the generational accounts. Buiter (1995) and Raffelhüschen and Risa (1995) provide examples of CGE models where the use of the generational accounts would provide a very misleading idea about the welfare effects of policy changes. This objection gains weight when the problem at hand is the evaluation of a policy reform in reaction to a structural shift, *e.g.* population ageing. In that case, it is less likely that substitution effects can be treated as of second-order magnitude, so that the change in the generational accounts caused by the policy change cannot be isolated from the change caused by the policy shock. As an example take the result that a transition from a PAYG system to a funded system may be welfare-improving in the presence of distortionary labour taxation (Breyer and Straub (1993)). With an expected decline in interest rates, as a result of the demographic shock, this result need no longer hold.¹¹

1.5 The Use of Computable General Equilibrium Models

The discussion of the preceding section shows that conventional macro-economic measures are not well suited for the evaluation of demographic shifts, because they do not link events to preferences. Computable General Equilibrium (CGE)

¹⁰ To carry the argument to its logical conclusion, the process of ageing itself may be an optimal reaction of intergenerationally linked households, that adjust their fertility in response to a changing environment (see *e.g.* Razin and Sadka (1995)). In that case it is clearly pointless to compensate generations for the changes in their own behaviour.

¹¹ In view of the predicted surplus of capital on the transition path, a shift to a funded system might be carrying coals to Newcastle.

models are better equipped because they derive the behaviour of agents from structural parameters of preferences and technology. This also gives them an advantage over macro-econometric models in the construction of policies designed to deal with the shock (Bovenberg (1987)). In addition they can be disaggregated more easily in the relevant dimensions because their empirical status is different. CGE models do not usually aim at a good description of a given set of macro-economic variables in the time domain. Instead they are calibrated on a small number of years, while many parameters are obtained from separate data sets.¹² This brings a considerable extra amount of flexibility in the specification of behavioral equations, and allows for a much lower level of aggregation than in fully data-based (*e.g.* macro-econometric) models.¹³

In comparison with analytical models too, CGE models offer definite advantages. Existing theoretical models are not able to handle any substantial degree of household heterogeneity. This implies that the insights offered by these models are only of limited value, if the composition of households is an important characteristic of the economy, as it is in the analysis of the consequences of ageing. In this respect, the general life-cycle model of household behaviour can be imbedded in CGE models in a much more general fashion than in theoretical models, taking into account the finite length of life. Compared to the length of business cycles, a human life is long, between 70 and 80 years in industrialized countries. This gives rise to a completely different time scale when one tries to evaluate the effects of policies such as changes in pension systems. The changes are long-lasting almost by definition. An average citizen will feel the effects in many phases: first possibly as a child, through the living conditions of parents, afterwards in the labour market and finally upon retirement. Ultimately, he or she will probably pass on some of the effects in the form of bequests. All these phases must be taken into account if we want to know whether the change in pension system was beneficial or disadvantageous to the person in question.

As a result of these advantages, CGE models can be tailored to a much larger degree to the policy issue at hand. In fact, the rise of CGE models as a tool for economic policy analysis coincides with a shift of attention from macro-economic stabilization to structural problems. CGE models are now routinely employed for the analysis of tax reforms and international trade liberalization (for a survey, see Shoven and Whalley (1992)). The general equilibrium character of these models allows for the calculation of the incidence of taxes or tariffs, in terms of a money-metric measure of welfare. This, together with the generally low level

¹² For a discussion of the use of calibration techniques in CGE models, see Shoven and Whalley (1992). A more general discussion and a critique can be found in Hansen and Heckman (1996).

¹³ A fully data-based model can be defined as a model that has a non-degenerate likelihood function in terms of its free parameters on the data set that it claims to describe.

of aggregation, provides policy-makers with a tool for a detailed analysis of the distribution effects of policy measures for specific groups or sectors of interest.

The growing popularity of CGE models as an alternative to conventional macro-econometric models has not occurred without a fair amount of criticism, however. Some of the main objections are discussed below.

- *CGE models are unreliable because of a weak empirical base.*

CGE models indeed do not usually possess a well-defined probability distribution of the model forecasts. Also, in terms of within-sample performance, macro-econometric models certainly hold an advantage. However, it should be borne in mind that parameters in macro-econometric models are usually also underidentified, in the sense that arbitrary exclusion restrictions are needed to obtain parameter estimates (see Sims (1980)). This implies that their reliability cannot be determined from their goodness-of-fit.

- *CGE models do not take account of market imperfections.*

This objection is somewhat obsolete, as imperfections are being built into CGE models, *e.g.* labour market imperfections in Jensen *et al.* (1994), both labour market imperfections and product market imperfections in Gelauff and Graafland (1994), or portfolio behaviour in Goulder and Eichengreen (1989). However, neither of these models offers a fully satisfactory choice-theoretic analysis of real-world phenomena like unemployment, cartels, uncertainty, *etc.* It seems fair to say that here macro-econometric models have an edge in terms of descriptive power, but as they lack a structural explanation of market imperfections, this does not necessarily make them more useful for policy analysis on this account.

- *CGE models unrealistically assume perfect foresight.*

Although perfect foresight is not a realistic assumption, it is difficult to replace it with a more satisfactory one. It would be desirable to incorporate uncertainty into CGE models, as well as incomplete information about the structure of the economy. Both steps provide serious theoretical and computational challenges, however. Uncertainty in non-linear models implies that the entire distribution of the endogenous variables becomes the relevant entity to solve for in each separate time period. Except for simple cases, no solution methods are known.¹⁴ The introduction of incomplete information calls for a theory of learning, which is not available. Furthermore, while economic agents are certainly not in possession of perfect foresight, they do display forward-looking behaviour, which cannot be captured by a simple adaptive expectations scheme. The distinction seems especially relevant in the case of population ageing, the consequences of which are widely discussed on television and in the newspapers.

In addition, the weight of these objections may shift over time. For instance, market imperfections may become less important, as the liberalisation of financial markets shows. Blundell-Wignall and Browne (1991) list three important

¹⁴ In Real Business Cycle theory, approximate solutions are obtained by linearizing the model.

ingredients of this liberalisation. First, the role of liquidity constraints in private spending and portfolio decisions is reduced. Current income and the availability of money are less binding constraints on expenditure and portfolio behaviour. Second, new inefficiencies may arise in liberalised markets, *e.g.* asset price bubbles. Third, globalisation of financial markets enables domestic savings and investment to diverge over prolonged periods. Issues one and three will probably make the approach in this book more relevant in time, whereas the second issue emphasises the increasing importance of an element missing in all these models, *i.e.* risk.

1.6 The Papers in this Volume

Among the central policy issues in population ageing are the financial consequences of the current system of old-age social security provision in OECD countries. Are these current systems financially feasible in the face of a substantial increase in the share of the elderly or can they be upheld only by imposing unacceptable burdens on younger generations? To what extent does an answer to this question depend on the demographic structure of each individual country?

The first paper, *The Future of Public Pensions in the Seven Major Economies*, by Thierry Chaveau and Rahim Loufir, considers these questions for the PAYG pension schemes of the seven major OECD countries for two alternative financing modes of the PAYG scheme. The first is a defined-benefit rule, in which case current benefits as a percentage of current wages are held constant and the contribution rates adjust to maintain a balanced budget. The second scenario is a defined-contribution rule, in which case the contribution rates, also as a percentage of wages, are held constant and pension benefits adjust to maintain budget balance. The consequences of both pension schemes for economic developments over the next 60 years are studied within the context of a dynamic CGE model, separately calibrated for each of the seven economies.

The model used is constructed along the lines of the Auerbach-Kotlikoff (1987) model. An innovative feature is that the mortality rate of households increases with age (no sudden death). This enables a realistic calibration of the model on the historic time path of the economies (*i.e.*, the reference path is not the steady state). Public pensions are determined by applying a replacement rate to current wages and they are financed by a tax on current wage income.

The main conclusions that arise from the paper are

- Ageing of the population affects the different countries in much the same way, despite initial differences in age structure. The growth of output per head will slow down and the real interest rate will fall during the transition phase. The slow down of output growth will be most severe in Germany and Italy, and least in the U.S.