Annuities, public policy and demographic change in overlapping generations models

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Chapter 7

Conclusion

In this thesis we have developed a series of small macroeconomic models to analyse a variety of issues relating to the macroeconomics of ageing. In developing these models we have tried to balance the necessity of having solid microfoundations against the ability of clearly seeing what the driving forces are in the interaction between individual decisions and aggregate outcomes. In this part we will briefly summarize the main conclusions, discuss some of the limitations of the used models and touch upon areas for future research.

In the second chapter we developed a continuous-time overlapping generations model featuring single-sector endogenous growth in the spirit of Romer (1989). Using this model we took the Blanchard (1985)-Yaari (1965) assumption of the existence of a perfectly competitive annuity market by the horns. Annuities are life-insured financial products that pay out conditional on the survival of the individual agent. The annuity firm pays a premium to the annuity holder, which, if the annuity is priced actuarially fair, is equal to the individual's instantaneous probability of death. In return, the annuity firm receives the individual's assets upon his/ her death. We introduced an imperfectly competitive annuity market into the model by allowing the return received on annuities to be less than actuarially fair. The imperfection leads individual agents to discount their future utility by their instantaneous probability of death. This in turn lowers the incentive to save because agents anticipate that they might not live to benefit from their savings. If all agents save less, the growth rate of the economy decreases because capital accumulation is the driving force behind economic development in Romer's (1989) growth model. For the annuity firms the imperfectly priced annuities mean that they are making pure profits, which we let the government tax away and then redistribute equally over all agents. In terms of magnitude, we found that the impact of annuity market imperfections on economic growth is mild if proper account is taken of both age-dependent mortality and productivity.

In the third chapter we used the model to analyse the impact of, and difference between, consumption and labour-income taxes. In addition to introducing the taxes, we extended the model by allowing the redistribution of tax income (which also includes the profits of the annuity firms) to be age-dependent. We found that consumption taxes redistribute assets from the elderly, who are strong consumers, to the young,

who barely consume but save a lot. At the aggregate level the redistribution of assets between non-savers and savers leads to more growth because aggregate capital accumulation is spurred. The labour-income tax, on the other hand, redistributes assets from working to retired individuals. Thus, the labour-income tax induces a redistribution of assets between saving workers and non-saving retirees. Needless to say, the growth impact of this redistribution is negative. Finally, through the same mechanism, a regime in which taxes are redistributed with a bias toward young agents leads to a higher growth rate than a regime in which taxes are redistributed to the elderly.

In the fourth chapter we used the model developed in the first chapter once more in order to analyse the moderating role of public pensions during a demographic shock that decreases the mortality rate. We simplified the model by making the labour supply decision exogenous but extended the model to allow for a public pension system. The public pension system can be run on either a defined benefit or a defined contribution basis. In addition, the government can use the retirement age as a policy variable. We found that, in general, a decrease in the mortality rate increases the economic growth rate because individuals need to accumulate more assets for their retirement period. However, if the public pension is run on a defined benefit basis the growth effect is smaller because the contribution rate for the pension has to adjust to accommodate the larger amount of pensions that have to be paid out. Surprisingly, we also found that an increase in the retirement age decreases the economic growth rate of the economy. This is a direct consequence of the fact that a higher retirement age implies a shorter retirement period and, hence, less assets necessary to make it through retirement.

The analysis of chapters 2-4 showed that substantial mileage can be achieved by using small macroeconomic models. Indeed, we saw that both theoretical issues and questions of interest to public policy can be analysed meaningfully. The proverbial tank is, however, not empty yet. In its current form the model can easily be extended to allow for an initial period in which individuals engage in human capital formation. Such an extension would shed more light on the role of individual productivity over the life-cycle. Naturally, in such a model there is an important role for financial frictions once more. After all, if individuals are born bare of assets and no loans are available from the banking sector, how should they finance their human capital in-

vestment? A more formidable, yet equally important, task is to study the transitional dynamics underlying the various policy changes which we considered. Currently we focus on a comparison between steady states while the transition between them need not be monotonic. Although we touched up the issue of transitional dynamics in later chapters, their lion's share remain open.

While in chapters 2-4 we focused on the role of annuity market imperfections for individual and aggregate outcomes, in the fourth chapter we turned to the question of whether annuities increase aggregate as well as individual welfare. To facilitate this analysis we stepped away from the continuous time overlapping generations model used in chapters 2-4 and used a smaller, more stylized model. The model builds on the canonical Diamond (1965)-Samuelson (1958) model in which agents live for two periods. One period of working (and saving) and one period of retirement (and running down savings). In order for there to be a meaningful role for annuity markets we let the transition between the two periods of life be uncertain. That is, individuals face a positive probability of death at the end of the first period. In the absence of annuities, individuals that die after the first period of life leave an accidental bequest. On the firm side of the model we allowed for a more general production structure that allows for both endogenous and exogenous growth.

In the initial analysis we assumed that the government taxes these bequests away. Within this set-up we compared and contrasted various ways in which the government can use its tax income. In order not to muddle the analysis we focused on three distinct regimes: either the government distributes the funds to the young or to the elderly, or the government uses them for unproductive spending. In this regard we found that the regime in which the government redistributes the assets toward the young outperforms the other two systems in both welfare and growth terms. The mechanism driving these effects is that the young save a lion's share of their additional funds so that redistribution towards them increases the capital stock. Somewhat surprisingly, the regime where the government wastes the bequests outperforms the system in which the bequests are transferred to the elderly. Intuitively, if the bequests are transferred to the elderly, the young save less because they anticipate a large transfer in old age.

Starting from any of the three redistribution scenarios we studied the impact of

opening a perfectly competitive annuity market. That is, a market in which annuities are priced actuarially fair. From an individual perspective the annuity market offers a financial product with a superior return. Therefore, it is perfectly rational for the individuals to annuitize their assets. From an aggregate perspective, however, matters are, however, dramatically different depending on how the accidental bequests were initially redistributed. If the bequests were initially redistributed toward the young we find what we call "the tragedy of annuitization". That is, although full annuitization of assets is individually optimal it is not socially beneficial, in terms of growth and welfare, due to adverse general equilibrium repercussions. By opening up the annuity market, the young lose the wealth transfer, part of which they save for their retirement. In addition, the higher return received on the savings reduces their incentive to save. In concert these two effects assure that all generations but the initial one are worse off. In a similar vein to the results on the redistribution, we find that the tragedy also arises if the bequests were initially wasted by the government. In this respect it is unsurprising that the tragedy does not arise if the bequests were initially redistributed to the elderly.

The analysis of annuity markets in this chapter highlighted once again the insights that can be gained from employing small macroeconomic models. By eliminating all but the essential features of the individual life-cycle we were able to not only compare steady-states but also the transitional dynamics between the regimes. Starting from the bare model a very natural next step would be to allow the overlapping generations to be interconnected through the introduction of intentional bequests. In such a set-up there would be substantial intergenerational transfers even if annuity markets are present. A second interesting extension would be to combine the current model with that of the earlier chapters. Hereby we should be able to get a better feel for the magnitudes involved in the growth and welfare consequences of opening op an annuity market.

In the final chapter, we returned to the analysis of demographic shocks by focusing on different sources of demographic change as a driving force behind the economic consequences of an increase in the population growth rate. To analyse these issues we developed a continuous-time overlapping generations model akin to the model used

in chapters 2-4. Although the model used in this chapter was similar to the previously used model, it differed in a number of key ways. Most important, we stepped away from Romer (1989) endogenous growth model and no longer allowed the annuity market to be imperfect. In addition, we simplified the choices faced by the individual household by letting labour supply and productivity be constant over the life-cycle. Naturally, we did keep the realistic mortality structure intact. These changes to the model allowed us to provide a deeper analysis of the equilibrium structure and dynamics governing the model. In this regard, we found that there is in fact a second equilibrium that is often overlooked in the literature. This equilibrium is, however, not sustainable in the absence of international transfers in an open economy or an unbalanced pension system in a closed economy. Thus, we focused on the more common equilibrium in the remainder of the analysis.

In the numerical analysis we showed that, depending on the source of demographic change, an increase in the population growth rate can increase, decrease or not affect the aggregate per-capita capital stock at all. If the population growth rate increases due to an increase in the birth rate, the capital stock present in the economy must be divided over more agents, which leads to a dilution of the per-capita capital stock. On the other hand, if the increase in the population growth rate is due to a decrease in the mortality rate, the agents will save more, thus increasing the per-capita capital stock. Finally, if the increase in the population growth rate is due to a combination of an increase in the birth rate and a decrease in the mortality rate, it is possible that the two effects exactly offset each other.

In close relation to the other chapters, the final chapter emphasized once more the usefulness of small macroeconomic models in the analysis of demographic change. In its current form the analysis has been able to shed light on interesting issues regarding the theoretical and quantitative structure of the model. The natural next step is to enrich the model with a meaningful government sector and analyse questions relating to public policy. A more substantial, and equally interesting, extension is to make fertility decisions or the mortality rate depend on the choices made by the individuals. In this way, we can shed more light on the interplay between the economic and demographic structure of an economy. Naturally, such an extension opens up alleys for public policy research that we have neither been able to address yet in this chapter nor the others.

This completes this section and, thereby, this thesis. The aim of this thesis was clear from the start: to contribute to the challenge of developing macroeconomic models that, on the one hand, are solidly founded in the microeconomic environment of the individual agent and, on the other hand, are able to show the analyst which main mechanisms are at play. It is up to the reader to decide whether a contribution to this challenge has been delivered.