Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

MASTER THESIS

The Political Sustainability of Pension System

Author: **Bc. Viktor Zeisel**

Supervisor: **PhDr. Martin Gregor PhD.**

Academic Year: **2010/2011**

Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

The author grants to Charles University permission to reproduce and to distribute copies of this thesis document in whole or in part.

Prague, May 19, 2011

Signature

Acknowledgments

The author is grateful especially to PhDr. Martin Gregor PhD. for his patience and helpful comments.

Abstract

The master thesis evaluates in theoretical models political sustainability of public pensions system when the households are time inconsistent. It uses overlapping generations model with two working generations and one retired. It shows that myopia (shortsightedness) increases the political support for public pension schemes in the model where median voter decides about the obligatory contribution rate into the public pension system. The reason is that the households use the obligatory contribution rate as a commitment device to overcome their time inconsistency. In the model with endogenous returns to capital, the presence of myopia also explains that households may prefer a mix of public and private pension system. The thesis also shows that expansion of the public pension system crowds out capital accumulation. The effect of myopia on this crowding out effect is tested in an interest group model and it is shown that its sign depends on the parameters of the economy. The extent of activity of the interest group is thus dependent on the parameters of the economy.

JEL Classification	H55, E6, D72, D78, G23
Keywords	pension, myopia, social security, dynamic efficiency

Author's e-mail	viktor@zeiselweb.com
Supervisor's e-mail	gregor@fsv.cuni.cz

Abstrakt

Diplomová práce hodnotí udržitelnost veřejného penzijního systému v prostředí, kde domácnosti jsou časově nekonzistentní. K analýze je použit model se třemi překrývajícími se generacemi, kdy dvě jsou vždy v produktivním věku a třetí je již v důchodu. Na tomto modelu ukazuji, že myopie (krátkozrakost) zvyšuje politickou podporu pro veřejný penzijní systém v modelu, kde o povinném příspěvku do veřejného penzijního systému rozhoduje mediánový volič. Domácnosti totiž používají povinný příspěvek do veřejného penzijního systému jako způsob závazku, který jim pomáhá překonat jejich časovou nekonzistenci. V modelu s endogenní návratností kapitálu myopie vysvětluje, že spotřebitel může upřednostňovat kombinaci ve-

řejného a soukromého penzijního systému. Diplomová práce také ukazuje, že expanze veřejného penzijního systému snižuje akumulaci kapitálu. Dopad myopie na tento efekt je testován v modelu se zájmovými skupinami a ukazuje se, že jeho směr záleží na parametrech ekonomiky. Aktivita zájmových skupin je tak v přítomnosit myopie také závislá na parametrech ekonomiky.

Klasifikace JEL	H55, E6, D72, D78, G23
Klíčová slova	penze, myopie, sociální systém, dynamická efektivita

E-mail autora	viktor@zeiselweb.com
E-mail vedoucího práce	gregor@fsv.cuni.cz

Contents

List of Tables

Master Thesis Proposal

Author	Bc. Viktor Zeisel
Supervisor	PhDr. Martin Gregor PhD.
Proposed topic	The Political Sustainability of Pension System

Topic characteristics Pension system reform is nowadays very hot topic not only in the Czech Republic, but also in other transformation countries. In my thesis I want to concentrate on the political economics of this reform. I will analyze the preferences of the consumers about state run pay-as-you-go (PAYG) system and private savings on capital markets. In particular, I will focus on myopic agents. The role of PAYG system as a commitment device for the myopic agents will be discussed. I will also analyzed closed economy with neo-classical production function. I would like to show the effects of myopia in combination with diminishing returns to capital. I will use various approaches of the political economy such as median voter or lobbying. At the end, I would like to discuss the role of capital markets.

Hypotheses

- Is demography crucial for the decision of the pension reform from the point of view of political economics.
- Does myopia change the outcomes of political economic models.
- Does developed capital market affect the decision about the shape of pension reform.
- Is it possible that in dynamic efficient economy the consumers prefer PAYG system.

Methodology In the first part of the thesis I will present the literature concerning the Overlapping generations models (OLG), which will play crucial role in my work. The OLG models show the economy with two (or more) generations. One is productive in the period and one receives payments from the state or from private funds as their pensions. I am also going to use classical tools of political economics as median voter theorem and interest group models. I will assume the consumers are myopic and thus not completely rational. In my thesis, there will be also role for the neo-classical production function in closed economy.

Outline

1. Introduction
    - The role of pension system
    - Description of PAYG and fully funded system and their potential risks
    - The political model of pensions and its extensions
    - Collective decision making rules and principles
2. Myopic median voter
    - Optimal size of PAYG system in the OLG model
    - PAYG system as a commitment device
    - Pension pessimism as another form of myopia
    - Myopia's effect on pensions in closed economy
3. Capital markets
    - Interest group pressure on government
    - The role of myopia in presence of lobbying

Core bibliography

1. FELDSTEIN, M. (1985): "The optimal level of social security bene?ts." *European Economic Review* **100(2)**: pp. 303.
2. ANDERSEN, T.M. & BHATTACHARYA, J. (2008): "On Myopia as Rationale for Social Security." *Economic Theory*, **pages 1–24**
3. BREYER, F. & BUCHHOLZ, W. (2008): "Ökonomie des Sozialstaats." *Springer*

4. CASAMATTA, G. et al. (2000): "The political economy of social security." *The Scandinavian Journal of Economics*,

5. GALASSO, V. & PROFETA, P (2002): "The political economy of social security: a survey." *European Journal of Political Economy*, **18(1)**, pages 1–29

6. GROSSMAN, G. & HELPMAN, E. (1998): "Intergenerational Redistribution with Short-lived Governments." *The Economic Journal*, **108(450)**, pages: 1299–1329

7. KEMMERLING, A. & NEUGART, M. (2009): "Financial market lobbies and pension reform." *European Journal of Political Economy*, **25(2)**, pages: 163–173.

Author Supervisor

Chapter 1

Introduction

The sustainability of the pension system is one of the main political topics in the Czech republic for more than 10 years. The society is aging and the population growth declines. The public pensions system records growing deficits in recent years, but politicians still did not find the courage to reform it.

Literature provides several reasons why the public pension system, which is not optimal in dynamic efficient economies, remains popular. In this thesis, several rationals for the public pension system are introduced, but in the center of the analysis remains only one: Myopia. According to Kaplow (2010) many consider myopia (shortsightedness) as the main rational for obligatory pension system. People have self-control problems and pursue immediate gratification which lead to time inconsistency. To overcome this problem they use public pension system as a commitment device. In this thesis I will present how myopia enters the modeling of the political sustainability of the pension system and how it influences the political equilibrium.

But before I come to the modeling, I will provide the background information about private and public pension schemes and describe the risk and benefits which are connected to them. After that, in the second chapter, I will present a general political economy model of sustainability of pension system. Several modifications of this model, which present different rationals for obligatory pension schemes, will be shown as they compose the basic literature concerning political sustainability of the pension system.

In the third chapter, I will present a brief introduction to collective decision making schemes from median voter to interest groups models. It is important to understand these models when we talk about the political sus-

tainability as they determine process of how the pensions schemes are getting to the equilibrium.

The core of the work begins in the fourth chapter. The myopia is introduced into modeling in very basic political economy overlapping generations (OLG) model. This chapter shows the effect of myopia on equilibrium pension schemes in the model and modifies the stylized dynamic efficiency condition (the condition is described below). Nevertheless the model only works with constant exogenous parameters and thus we get only corner solutions where the households either privately save their money or put it into public pension system, but they never use a mix of the two schemes. The production side of the economy, which endogenizes the interest rate and wage, is introduced in the fifth chapter. With the production side of the economy, one of the main goals of the chapter will be to verify the crowding out effect (described below) which is myopia independent. According to Samuelson (1975) a rational household in a dynamic efficient economy would never prefer public pension scheme. With the help of andersen2008myopia, I will show that this conclusion is not necessary valid when the households are myopic. In the presence o myopia they can prefer a mix of both, public and private pension system.

After verification of the crowding out effect, it is logical to concentrate on the capital markets. If the crowding out effect works then the capital markets are damaged by expansion of the public pension scheme. The capital markets thus have an incentive to interact with the government and try to persuade it to change its policy and decrease the obligatory contribution rate. This is described in the sixth chapter where the interest group model is used to determine the equilibrium in such a state when the agents are myopic and the government paternalistic.

The conclusion part provides a summary of findings of the thesis where especially the effects of myopia are discussed.

1.1 Objectives of Pension Systems

Every developed state has a some kind of pension system and in most developed countries government takes responsibility at least for a part of it. In Europe, there are state run pension systems in all countries. Barr & Diamond (2006) introduce several objectives which explain the role of pension system from individual viewpoint. These reasons advocate the existence of pensions systems.

1.1.1 Consumption Smoothing

Consumption smoothing is very well known in the economic theory. It stems from the permanent income hypothesis and it is a part of modern growth theory as well as other macroeconomic frameworks. The economic agents do not maximize their actual utility, but they rather they try to smooth their consumption over time. In this sense consumption smoothing is a mechanism which enables people to postpone today's consumption (in the productive age) to later periods (retirement), when the agent chooses preferred time path of consumption over working and retired life. It is clear that vast majority of the people is not able to work life long and transferring a part of the income to the life stage when people are not productive any more is desirable. An important question is how big the state system should be. The decisions about the size of the system are described in the later chapters of this thesis.

1.1.2 Insurance

As already Forest Gump's mother said: "Life was like a box of chocolates. You never know what you're gonna get" and when people think about their retirement age there is lot of uncertainty. The crucial uncertainty is the length of one's life. If we consider system when one saves for his pension only on his own, then it can easily happen that one does not save enough for unexpectedly long life, or on contrary saves inefficiently much for a unfortunately shorter life. Although we cannot be sure about the parameters of individual lives, we can estimate the parameters for a large group of individuals. Any risk averse individual would than accept to pool his savings in common pension insurance and thus they can together in a larger group mitigate the longevity risk. Some pension schemes allows the pension scheme to insure

also family members in case of sudden death or disability. The above mentioned problems could be solved without government, but when there are problems as missing markets, imperfect information, uncertainty distortions due to progressive taxation and above all there are concerns that individuals are able to use effectively most of markets opportunities available to them, the government is needed.

1.1.3 Poverty relief

No developed state would let its inhabitants to suffer from poverty. There are people who are poor over their whole life time and they are not able to save enough over their whole lifetime. The public pension programs can assure that these people live in relative welfare for reasonable costs. Also there is a risk of moral hazard. In the case people are aware of the fact that the government would not let them live in poverty, they would count with that and they would deliberately save insufficiently. This may be as we will see later a case when there are altruistic agents in the economy or a case of myopic agents. In this work myopia will be one of the main topic so this question will be reflected as well.

1.1.4 Redistirbution

When talking about pensions systems the main topic is intergenerational redistribution, but the system can redistribute also from the people with the higher income towards those with lower income. This can ensure that also the low earners smooth their lifelong consumption. But the redistribution does not necessarily have to be only from high earners towards low earners. Politicians often discuss the system which redistribute to families who raised more children as they ensured some future sources of wealth. One of the key redistribution effect is the intergenerational redistribution, thus "from children to their fathers", which implies also intergenerational sharing of risks. This includes the cases when an productivity shock affect one generation, but the cost is spread to other generations as well, which may show ex ante Pareto efficient.

1.2 Types of Pension Systems

Let me now introduce to you the most common pension system schemes as they exist in developed countries. The first division of the pension system will be to privately run and publicly run pension schemes.

- **Public pension systems** are state organized and thus the state guarantees the contribution collection and benefit payments. This system is mostly mandatory. The benefits from the system may be flat, providing same benefit to all beneficiaries independent of their contribution or the scheme may diversify. This system with same benefits is also called *Bismarckian* after the chancellor Bismarck who, after German unification, first developed a social system. The other way is earnings related system, which makes a strict relation between contributions and benefits from the system. This system is in literature called *Beveredgian*.
- **Private pension schemes** provide a possibility for the consumer to insure his consumption in later period of his life on his own. Nevertheless, this system is also widely supported by the governments as it has some positive spillovers (mitigates moral hazard, increases saving rate and thus capital formation). The private funds may be contributed by individuals themselves or they can be contributed by employers into so called employer-sponsored occupational scheme.

Both types of system are not mutual exclusive and can be (and is considered as desirable) run simultaneously. Their combination is called multi-pillar system as each system presents one pillar.

1.2.1 Pay-as-you-go (PAYG) Systems

PAYG system is used by the most states having social system which includes pensions. The system is based on contributions of working generations which are redistributed to the retired generation. The system can (and in the past did) work fine when there is population growth. In a very simple case, where we have two overlapping generations, one working and one retired, and balanced public budget the pension would be:

$$P_{t+1} = \frac{T_t(1+n)}{1+r}, \tag{1.1}$$

where P_{t+1} stays for pensions of the "older generation". T_t for the transfer of the currently working generations and n stays for the population growth. This composes a baseline for a very basic over-lapping generation (OLG) model. The essential description of PAYG system given the above equation is that the younger generation contributes to the system where the older generation benefits from the system and gains its pension. The government budget remains balanced when both sides are equal. There is an outside option of the system when each generation saves its money and these funds would then be used as a source of consumption in the next period (this is what would the saver get in the Fully Funded system). So if the population growth is larger than the interest rate, the PAYG system is socially optimal, because every generation receives more than it has paid. Such an economy is called **dynamic inefficient**. Even though the population growth is not strong enough it does not mean that everybody would get less than he has contributed. We have to take into account also the economic growth. Economic growth increases the base from which the working generation pays the rents retirees. We then have:

$$P_{t+1} = \frac{T_t(1+n)(1+g)}{1+r}, \tag{1.2}$$

where g stays for economic growth. If we multiply the animal in the denominator we get:

$$P_{t+1} = \frac{T_t(1+n+g+ng)}{1+r}, \tag{1.3}$$

We can say that the term ng is negligible, because it is a product of two very small numbers and thus very small. For $(n+g) > r$, the PAYG system is still socially efficient. This was already stated by Samuelson (1958). This is again dynamically inefficient economy as we have seen in previous paragraph. Dynamic inefficiency which was present for many years in many developed economies was a reason for introducing and maintaining the PAYG systems. Nowadays we deal with economies which are due to demography and slower growth dynamically efficient, but this does not say anything yet about the political sustainability of PAYG system. Even though on the first sight we would say that switching to Fund system beneficial. Even though this may hold for some conditions the political decision may be different.

When talking about the traditional PAYG system we might would like to compare some OECD countries in terms of public expenditures which are

usually the main source for PAYG systems. This comparison is depicted in Table 1.1 .

Table 1.1: Public contributions to Pension system as a % of GDP (source: OECD)

Country	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Austria	11.1	12.1	11.9	12.1	12.3	12.4	12.2	12.2
Canada	3.8	4.2	3.9	3.9	3.9	3.9	3.8	3.7
Czechia	5.2	6.0	7.3	7.2	7.4	7.3	7.0	7.2
Denmark	5.1	6.2	5.3	5.3	5.3	5.4	5.3	5.4
Finland	6.3	7.7	6.7	6.8	7.1	7.4	7.4	7.5
France	9.0	10.4	10.3	10.3	10.2	10.3	10.4	10.6
Germany	9.4	10.0	10.5	10.6	10.9	11.0	11.0	11.0
Greece	9.3	9.1	10.0	10.8	10.4	10.3	10.3	10.7
Japan	4.0	5.1	6.2	6.5	6.9	7.1	7.2	7.4
Norway	5.2	5.1	4.5	4.6	4.9	5.0	4.8	4.6
Poland	4.1	7.6	9.6	10.5	10.8	11.0	10.8	10.4
Slovak Republic	..	6.1	6.2	6.2	6.3	6.1	6.1	6.0
Sweden	7.0	7.4	6.7	6.6	6.7	7.2	7.2	7.0
Switzerland	5.2	6.2	6.2	6.4	6.3	6.5	6.4	6.4
United Kingdom	4.6	5.1	5.2	5.3	5.3	5.3	5.4	5.5
United States	5.1	5.3	5.1	5.2	5.3	5.3	5.3	5.3
OECD average	5.6	6.1	6.2	6.2	6.4	6.4	6.4	6.5

Not surprisingly European countries have overall higher contribution rate into public pensions systems than for example the United States or Canada. The Czech contribution rate, as well as the Slovak, is under the European average. Surprisingly when we compare Denmark, which is often given as an example of a typical welfare state, we do not see big difference to the United States, but this is only exception among welfare states.

1.2.2 Fund System

The other type of pension system which was already mentioned is the Fully Funded system. In this system the contributor saves on his own account and his pension is composed only from the funds he put aside on his own. Formally written:

$$c_{t+1} = rs_t \tag{1.4}$$

where c_{t+1} is the consumption in the retirement period and s_t are the savings from the productive period. In this system the overall development of population does not have direct influence on ones retirement benefit. The growth of the economy does not play its role either. This system as mentioned above may be even state run as well as private. Mandatory fund system is often called second pillar, the voluntary funded system is then called third pillar. Very often the pension scheme is a combination of both. In Slovakia, for example, they introduced 3 pillar system. The second pillar is the compulsory fund. In some states people must compulsory contribute to funds, but there is one managed by state. In the Table 1.2 are the private contributions usually pension system.

Table 1.2: Private contributions to Pension system as a % of GDP (source: OECD)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Austria	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2
Canada	2.1	2.1	2.1	2.1	2.2	2.0	2.2	2.2	2.4
Czech Republic	0.2	0.2	0.2	0.2	0.2	..	..	0.3	0.3
Denmark	..	3.1	3.1	3.2	3.2	3.4	3.8	3.3	4.1
Germany	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Hungary	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2
Iceland	2.9	3.2	3.2	3.4	3.4	3.4	3.5	3.7	3.8
Korea	..	1.0	1.0	1.0	0.6	0.8	0.9	1.0	0.8
Mexico	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.2
Netherlands	3.0	3.1	3.1	3.2	3.4	3.5	3.6	3.6	3.7
New Zealand	2.2	2.0	2.0	1.8	1.4	1.3	1.5	1.3	1.4
Portugal	0.8	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.4
Spain	0.4	0.6	0.6	0.4	0.5	0.5	0.6	0.5	0.6
Switzerland	4.7	4.8	4.8	5.1	5.3	5.3	5.3	5.4	5.3
United Kingdom	2.9	3.0	3.0	2.9	2.8	3.0	3.1	2.8	2.9
United States	3.1	3.0	3.0	2.8	2.9	2.9	3.1	3.3	..
OECD average	1.8	1.9	1.9	1.8	1.8	1.8	1.9	2.0	2.1

We can see that the Czech private contributions are negligible and thus we can easily identify also other countries relying on the PAYG system. Again if we pick USA and Denmark there is not a big difference between the welfare state and USA.

1.2.3 Problems with Pension Systems

Pensions systems face several different problems and risk connected.

Politics

There is quite large risk concerning governmental policy. It is enough to look at the pensions schemes in the domestic economy where the plans for the reform change not only when the government changes but also within one political cycle. The change of parameters of the system is very usual in all European economies. Germany prolonged the pension age to 67 and France is planning to increase it from 60 to 65.

Population growth

As we have seen in the PAYG model description, for its smooth performance it is needed that the population grows. The problem of todays Western Europe is that the population does not grow but it shrinks.

Aging

The problem of contemporary pension systems is that the population is aging. Longevity is welcomed by most of the people but the pension system suffers. New methods in health-care and overall higher quality of life make people live longer and thus create negative externality to the pension systems. OECD makes forecasts of the so called *Dependancy ratio* . This ratio shows the share of the population over 65 year on the overall labor force. The ratio captures both, the decline in newborns and aging phenomenon. The former decreases the denominator and the latter increases the numerator. As this ratio is among the most important for the pension system table 1.3 shows the OECD forecast of the development of this ratio in the most developed countries in the world thus in the countries which do have developed pension system which are jeopardized by the aging.

Table 1.3: Development of the Dependency ratio (forecast of OECD)

	2005	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Austria	16.3	17.4	18.3	19.3	21.1	23.4	25.4	26.4	26.8	27.4
Canada	13.1	14.1	16	18.2	20.7	23.1	24.3	25	25.6	26.3
Czechia	14.1	15.4	17.9	20.1	21.5	22.7	23.9	26.5	29.5	31.2
Denmark	15.1	16.8	19.2	20.9	22.4	24.1	25.5	26.2	26.2	25.4
Finland	15.9	17.3	20.4	22.8	24.6	26.2	27.1	27	27.2	27.6
France	16.4	16.7	18.6	20.3	21.8	23.4	24.7	25.6	25.9	26.2
Germany	18.9	20.4	21.2	22.7	24.8	27.8	30.4	31.1	31.3	31.5
Japan	20.2	23.1	26.9	29.2	30.5	31.8	33.7	36.5	38.2	39.6
Norway	14.7	15.1	16.7	18	19.3	20.6	22	22.9	23.1	23.2
Poland	13.2	13.5	15.5	18.5	21.3	22.7	23.5	25	27	29.6
Slovakia	11.7	12.8	14.6	17.3	19.7	21.6	22.9	25	27.7	30.1
Sweden	17.3	18.5	20.2	21.2	21.9	22.8	23.6	24	23.8	23.6
Switzerland	15.9	17.2	18.7	20.2	22	24.2	26	27	27.4	27.9
UK	16	16.5	18	19	20.2	21.9	23.2	23.7	23.6	24.1
US	12.4	13	14.4	16.1	17.9	19.3	19.9	20	20	20.2
EU27 total	16.7	17.5	19	20.6	22.4	24.4	26.3	27.7	28.7	29.3
OECD total	13.8	14.8	16.4	18	19.7	21.5	23	24.2	25.1	25.8
China	7.6	8.2	9.4	11.7	13.4	15.9	19.2	21.8	22.4	23.3
World	7.3	7.6	8.2	9.3	10.4	11.7	13	14.2	15.2	16.2

Let me come back to the basic setting introduced earlier, but including the demographic components.

$$(l-a)P_t = T_t(1+n+a), \tag{1.5}$$

where P_t stays for pensions of the "older generation" which is here understood as the generation of $(l-a)$ meaning those who are already in the pension, because a stays for the retirement age and l stays for life expectancy. T_t for the transfer of the currently working generations and n stays for the population growth. Let us define the rate of replacement as:

$$\rho_t = \frac{p_t}{w_{t-1}} \tag{1.6}$$

and thus we can express it as follows:

$$\rho_t = \frac{T_t(1+g)(1+n+a)}{l-a}.$$

Wee see that the system gets into trouble when aging takes place. The denominator is increasing and thus whole rate of replacement decreases. One of the solutions is to increase the retirement age a. As already mentioned above, these parametric reforms do take place in the Western Europe as well as in the Czech Republic. In the table 1.3 we can see that dependency ratios are increasing in all developed countries and the OECD forecast up to the year 2050 is not favorable. E. g. in the Czech republic there will should be 31.2 % of the population over 65 years.

Macroeconomic Risks

So far the risks I discussed were mainly related to the PAYG system. The macroeconomic risks mainly influence the FF pensions schemes. The benefit of this system depends on the market interest rate. In the long term it is quite stable, but the rate of return suffers from quite high volatility. A possibility is to invest into some low volatile and thus low risk assets, but this may result into lower rate of return.

Another risk stemming from the macroeconomic side is the negative output shock. This problem concerns both the PAYG system as well as the FF. The PAYG system may suffer from lower amount of contribution, but the government can smooth this problem into longer period of time and partly transfer to other generations and thus the effect on consumers is dampened. But the FF system is individual and the effect cannot be smooth to other periods. In the case of a period with higher unemployment the revenues of the PAYG system can be replaced from other source such as VAT or excise tax.

Overall we can say that both main types of pensions schemes suffer from uncertainty and risk. In this Thesis I would like to concentrate mainly on the transforming the system and its sustainability from the perspective of the political economics in the society with myopic agents.

Chapter 2

Types of Political Models

This chapter will be devoted to basic literature review. In the first part, I will briefly go over the basic development of the literature and its main contributions to the research of political economy of pension systems. Later in the chapter I will look into more detail on some stylized components of the OLG models and some of its extensions.

2.1 Development of the Political Economics Models of Pension System

The pension system and its reform is being a hot topic in a political and economic discussions for quite a long period. There are many papers discussing the advantages and disadvantages of possible pension systems. Even though there in no system which would be definitely favorable and recommended, on a general level in the models, there are recommended principles that the economist have developed to check that the system is financially sustainable and that it will be financial sustainable given the expected parameters of the economy. But the financial sustainability is only one side of the coin. The other side of the coin is the political sustainability of the system. There are various agents in the economy that pursue different goals. When we focus on the users of the pensions system, they differ in a many ways and thus we cannot expect that they will promote the same scheme. I will introduce here basic but important steps done in the political economy research of pension system. Some of the articles which are later more important in the thesis will be elaborated into more detail. First model on political sustainability of pension system were developed in 70s. The paper from Browning (1975) cre-

ated a basic benchmark model of overlapping generations which calculates the political equilibrium. This benchmark model is very nicely described in Breyer & Buchholz (2008). The outcome of the the model explained why are the contributions to the social system over the optimal amount as a result of political equilibrium rather than of an equilibrium which would be optimally achieved by some omnipotent planner. The model is very basic because the agents in the economy differ only in age. In everything all the agents are homogeneous. The model is also fully deterministic. Uncertainty was introduced by Hu (1982). The uncertainty lies in the possibility of revoting the equilibrium contribution rate once the generations age. The economy of this model also consists of 3 generations and again majority voting is used. But on contrary to the basic Browning's scenario the agents do not expect that the system would not change but rather incorporates the expectation of the change already in their voting. The change in voting outcomes in Hu (1982) is mainly due to demographic changes and obviously due to expected demographic changes. Thus the political economy of pensions was further significantly developed. Boadway & Wildasin (1989) introduced explicit capital markets and they role in the political economy of pension systems. The crucial aspect of the todays modeling is the intergenerational redistribution, which may be accompanied by paternal altruism. These aspects were incorporated into the model by Veall (1986). Further was the model adjusted for many heterogeneities. Important is the adjustment for different productivity of agents and thus for different wages. In these classical models agent decide whether the pension system should be so called pay-as-you-go (PAYG) or fund system and further in the PAYG systems they decide on the optimal contribution rate. This summary is definitely not exhausting, but presented the main extensions of the basic model and are considered already as classical literature of the Political Economics of Pension reform. Recently there are other directions of the research. One with the rapidest development is considering myopic agents and will be thoroughly discussed later. There are also papers generalizing the whole settings into general equilibrium models. Very interesting are the models which search for a rationale of PAYG system in shock redistributions. This approach was described in D'Amato & Galasso (2010). Before I go on with describing the basic model and its extensions let me summarize different properties of the models:

Time Structure

- Infinite Horizon (2 or 3 generation OLG models)
- Static: 1 or 2 period models

Voter's perception of the duration of the decision

- Infinite (commitment case)
- Just one period (dynamic case)

Collective Decision Rules

- Direct democracy, Median voter
- Veto Power
- Interest Groups influence
- Dictatorship of workforce
- Dictatorship of Retirees (Gerontocracy)

Voter's Target

- Selfish Voters
- Parental Altruism

Heterogeneity

- No heterogeneity
- Productivity
- Number of Children

Myopia

- Classical Shortsightedness
- Pension Pessimism

General Economic Model

- Small Open Economy
- Closed Economy

Labor Supply

- Exogenous
- Endogenous

2.2 General Model

In this part I will show assumptions we need to evaluate bit more thoroughly, because they are used in the basic political models of social reforms as mentioned in Galasso & Profeta (2002) and add some more recent approaches. I will begin with very general framework which is usually used and either extended and/or very often simplified. Firstly we are going to introduce **overlapping generations** (OLG). OLG is a setting where several different generation live in one time period and interact. Following the basic literature we will have 3 generations. First generation, the youngest one of the people just entering the working phase of their life. The second generation are older workers. Those have already some working behind but not enough to retire. The oldest, third, generation are retirees who are already prohibited to work in our framework. The size of oldest generation is normalized to 1 and the size of the middle generation and youngest generation is then $(1+n)$ and $(1+n)^2$ respectively. Every working generation is endowed with 1 unit of time which it could divide between work and leisure denoted as v and l respectively so that $1 = v + l$. We also assume that the workers are of **different ability** e. The ability is drawn from skewed distribution of abilities where the mean is higher than the median. The agents are **non-altruistic** in this setting and they have **utility function**:

$$u_t^t(l_t^t, c_t^t) + \beta u_{t+1}^t(l_{t+1}^t, c_{t+1}^t) + \beta^2 u_{t+2}^t(c_{t+2}^t), \tag{2.1}$$

where β is a time discount factor. The marginal utilities are positive and decreasing in both parameters. The budget constraints for each type are (with respect to his e_t) are:

$$\begin{aligned} c_t^t + s_{t+1}^t &= e_t w_t (1-\tau_t) v_t^t \\ c_{t+1}^t + s_{t+2}^t &= e_t w_{t+1}(1-\tau_{t+1}) v_{t+1}^t + s_{t+1}^t (1+r_{t+1}) \\ c_{t+2}^t &= s_{t+2}^t (1+r_{t+2}) + P_{t+2} \end{aligned}$$

where the left side are the expenditures an the right side are the sources. s_t are the savings in the respective period and τ is the contribution rate into the state pension system collected from working generations and redistribute to the oldest retired generation. We assume a **balanced budget** each period so $P_t = \tau_t w_t \hat{v}_t$ and $\hat{v}_t = (1+n)^2 \hat{v}_t^t + (1+n)\hat{v}_t^t - 1$ which is a sum of average la-

bor supply for each generation multiplied by the size of each generation. We see that the direct effect of increased contribution rate is raised the pension but on the other hand we assume that **with higher taxes the labor supply decreases** which is also quite reasonable assumption and thus there is a opposite effect which decreases the pension.

On the production side of the economy, we assume **standard neo-classical production side of the economy** where factors of production pay their marginal product. That means that producers solve following problem:

$$\max_{K,L} F(K,L) - wL - rK \tag{2.2}$$

where we have the F.O.C.:

$$[L] \quad : \quad \frac{\partial F(\cdot)}{\partial l} = w \tag{2.3}$$

$$[K] \quad : \quad \frac{\partial F(\cdot)}{\partial k} = r \tag{2.4}$$

We assume standard economic equilibrium where for given set of tax rates the consumers maximize their utility through choosing allocation of their consumption and leisure under market prices. In some models both r and k are taken exogenously. Social security budget is balanced in every period and capital labor and good markets clear. We will further assume that the **tax will remain same for all periods**. This is very strong assumption, but we will see that the models which will be discussed in this thesis support this assumption.

Let me also define already in the beginning one very important property of an economy. The economy is **dynamically efficient** if the population growth n is smaller than the return from the capital market r.

Let me now describe more thoroughly some properties of the model which were already briefly mentioned.

2.3 Reduced Time Horizon

Reduced time horizon describe the state where the middle and oldest generation already realized or partly realized their decision about optimal savings and it updates its behavior according to current conditions. In their decision at time t they perceive their savings from previous periods already as a **sunk**

cost. In this setting all from the oldest generation will have an incentive to set very high τ, because they do not internalize the full cost of social pension system and they only benefit from it. The middle generation also does not make the decision for its whole life but only for the periods it has ahead and thus the decision making differs from the youngest generation. Only the youngest generation does not suffer from time horizon problem because it internalizes all the cost of social security in its decision making. In a setting without heterogeneity in e and with no growth of real wages, the ratio between future benefits from the social system future contributions to the state social system in the steady state is $1+i = (1+n)+(1+n)^2$ then the middle aged generation F.O.C. will be following:

$$vw\left[-1+\frac{1+i}{1+r}\right]+\frac{\tau w(\partial\hat{v}/\partial\tau)}{1+r}=0 \tag{2.5}$$

This implies that the middle age generation would prefer positive tax rate if the return from the system is larger than real return on capital accumulation:

$$i \approx 1+3n > r > n$$

This idea was used already in Browning (1975) and then used by Boadway & Wildasin (1989), Hu (1982) and others. The consequence of the **reduced time horizon** and thus **sunk costs** is bigger than optimal contribution into the pension system when we take the decision of the youngest generation without reduced time horizon as optimal. It also shows that the PAYG system may be sustainable even if the economy is dynamically efficient. In this thesis I will work with the same setup and reduced time horizons will be present. Interesting development of the idea was offered by Cooley & Soares (1999) who combined it with the crowding out effect described next.

2.4 Crowding Out

Boldrin & Rustichini (2000) expect that the intergenerational redistribution represented by the debt each generation transfers on the next because of social security [1]. This debt creates a crowding out effect for the capital. The

[1]The public social system is in fact a debt, the working generations lend to the system and are repaid when they retire by funds lent by the following generations when it starts working and the cycle continues

larger the public pension system is, the less savings households do and the less capital is in the economy. This cause the reduction of real wages and also increases returns on capital since when there is less capital its marginal gain is higher, because of decreasing marginal productivity of capital stemming from the neo-classical production theory. This causes another redistribution effect and thus from workers to the capital holders. If we have our dynamically inefficient economy but only two periods and again no heterogeneity in e and exogenous labor supply then we would get F.O.C. with respect to the contribution rate for the youngest generation:

$$-wv + \frac{wv(1+n)}{1+r} + \frac{\left[s\frac{\partial r}{\partial k} + \frac{\partial P}{\partial w}\frac{\partial w}{\partial k}\right]\frac{\partial k}{\partial \tau}}{1+r} = 0$$

The first term represents the disutility from higher contribution rate in the first period. The second term discounted direct utility gained in the second period from the social system, the ghird term represents the crowding our effect. The sum of the first two terms are negative and the last term represents the increasing gains on capital with growing social security taxes. If the crowding out effect is large enough people would be willing to leave the PAYG system and access the funding system. The crowding our effect will be proved thoroughly described in chapters 5 and 6.

2.5 Altruism

If we talk about intergenerational redistribution we shall not forget about models of altruism. At least Veall (1986), Hansson & Stuart (1989) and Tabellini (2000) did not. The assumed that there exist a solidarity between the younger and older generation. More precisely that the younger generation is willing to help the older when it cannot gain their income through labor and it did not save enough to ensure consumption for the last period. Knowing this it gives the older generation an incentive to undersave because they correctly believe that their sons will bail them out. This creates a space for inefficient allocation. Under this framework the mandatory social security is actually treating the moral hazard problem. This setting also explains why the young generation which is forced to contribute as was shown more than optimally supports the obligatory pension system.

In the original Veall (1986) model the utility function of a generation looks

like:

$$u^t = u(c_t^t, c_{t+1}^t, c_t^{t-1}) \tag{2.6}$$

where again superscripts denote the time when the generation was born and subscripts time of consumption. The last term in the utility function represents the altruism. It is the positive externality of older generation's consumption to utility of younger generation. The utility function can be thus rewritten:

$$u^t = u(c_t^t, (1+r)s_t + (1+n)g_{t+1}, (1+r)s_{t-1} + 1 + rg_t) \tag{2.7}$$

where g_t is a gift and other variables are same as in previous models. The budget constraint has form: $M - c_t^t - s_t^t - g_t$. Veall (1986) makes one reasonable assumption about the utility function and thus: $u_2(c_1, c_2, c_2) > Ru_3(c_1, c_2, c_2)$, where $R = \frac{1+n}{1+r}$. In words this means that individual puts more weight on his own utility than on the utility of the elderly. The F.O.C. yield following gift function:

$$g_t = \phi(M + \frac{S_{t+1}}{R} + Rg_{t+1}) - \frac{S_{t-1}}{R} \tag{2.8}$$

where ϕ expresses the optimal C_t^{t-}. Other assumption made is that all consumptions are normal goods: $0 < \phi < 1$. And thus it follows that:$-1 < \frac{\partial g_t}{\partial S_{t-1}} < 0$. This last inequality shows that it is not optimal for the older generation to save, but rather to rely on the younger generations and their gifts. As Veall (1986) then shows public pension system may solve this problem and it is also in the interest of the younger generation to implement it.

2.6 Redistribution inside Generation

We introduced reduced time horizon and altruism as reasons why some household would prefer PAYG system over private savings. Another reason described by Tabellini (2000) suggest that some individuals prefer the PAYG system because of redistribution inside generation. That means from the individuals with lower wages to the individuals with higher wages. Thus even in dynamically efficient economy, some from the youngest generation would prefer the PAYG system over private savings because it enables the intragenerational redistribution. Now we will look on two period dynamically efficient economy with stable real wages. The steady state implicit

return will look like:

$$1 + i = \frac{(1+n)\tilde{v}}{ev(e)} \tag{2.9}$$

which means that $i > n$ if $\tilde{v} > ev(e)$. For the lower income group it means that they have higher implicit return than the average return. For any type e we can than write its F.O.C.:

$$ev(e)w\left[-1 + \frac{1+i}{1+r}\right] + \frac{\tau w(1+\mu)}{1+r}\frac{\partial v}{\partial \tau} = 0 \tag{2.10}$$

So any agent whose return is above average return would surely prefer non-negative τ. This is the majority if we take into account the assumptions we made in the beginning of this chapter.

Different point of view is presented by Casamatta *et al.* (2000), whose result states that in favor of higher redistribution inside PAYG system are those who are already receiving social benefits (pensioners) and those who have incomes close to the middle of the distribution. In the paper, there are standard parameters r_t and n_t which represents the interest rate and population growth respectively. Individuals are divided into only two generations of actively working and contribution into the PAYG system and already older having the working stage of their life behind receiving the social benefits and consuming their savings. Wage of the agents is heterogeneous and distributed with support (w_-, w_+), where $\bar{w}$ (mean wage) is lower than w_m (median wage). The pension benefit is composed by two parts. One part is dependent on individual's income and the second one is derived from the mean income. And the pension benefit thus looks:

$$P_{t+1}(w) = 1 + n_{t+1})\tau_{t+1}(\alpha w + (1-\alpha)\bar{w}), \tag{2.11}$$

where α represents the above mentioned Bismarckian factor. If $\alpha = 1$ the system is fully contributory and does not depend on actual individual's income. In the other extreme case of $\alpha = 0$ the system is fully Beveredgian and the incomes of other individuals in the cohort do not play role. The authors assume dynamic efficiency $r_t \geq n_t > 0$. And they consider steady state economy, where the parameters do not change in time. The results of the model state that some of the workers with the highest wages would choose zero tax. To decide who they are the authors compare the returns from saving

and returns from capital markets:

$$1 + r > \left(\alpha + (1 - \alpha)\frac{\bar{w}}{w}\right)(1 + n) \tag{2.12}$$

Those are agents with wage higher than:

$$\hat{w} = \frac{1 - \alpha}{\frac{1+r}{1+n} - \alpha}\bar{w} \leq \bar{w} \tag{2.13}$$

Those who have lower wage than this, will prefer positive public pension system. Moreover up to households with the wage $\hat{w}$ the preferred contribution rate increases with their wage. All in all, the authors conclude and prove that the preferred tax rates of the younger generation has following properties:

- $\tau^A(w) = 0$ if $w > \hat{w}$ and $\tau^A(w) > 0$ if $w \leq \hat{w}$
- $\frac{\partial \tau^A(w)}{\partial w} > 0$ if $w < \hat{w}$
- $Max\tau^A(w) = \tau^A(\hat{w}) < 1 = \tau^R$

Especially the second and third property are very interesting. The preferred tax rate is increasing with wage up to $\hat{w}$ where is then step move to zero. And this high at $\hat{w}$ is less than one, which is the preferred rate of the retired. The reason is that the more productive individuals receive also higher proportion of the funds collected in the PAYG system.
In the part devoted to comparative statics the authors conclude that the effect of population growth is indeterminable.

Chapter 3

Collective Decision Rules

The decision making could be made in a very different way. We usually assume that in democracies the majority voting shall take place, but it occurs that lobbying is quite powerful mean of implementing policies. In this chapter, I will describe some different types of collective decision making as they are introduced in the literature.

3.1 Voting

3.1.1 Majority Voting

The key assumptions when talking about majority voting are that the policy makers are fully opportunistic and that after elections they commit to the policy they announced before the vote started. Opportunistic policy makers have only one motivation which is to hold the office and thus they do not care about the policy which is implemented. They do not benefit from the policy directly. Their only benefit is to be elected and hold the office which brings them some exogenous benefit (rent) which is independent of the policy they pursue. The second assumption that the policy makers do after election what they promised before the vote, enables us to see the political competition only as a choice of policy. In the electoral competition thus the policy makers choose such a policy which maximizes their probability to be elected. This framework was developed by Downs (1957) where in the case of two parties both converge to the median voter optimum. In this setting the solution which gets the majority of votes is implemented. The models differ in the way they perceive the sustainability of the solution. The first

models of social security (Browning, 1975) assumed full commitment. That means that the generation votes for a setting which they expect will hold also in the time they are retire. Even if there was Pareto improvement possible the system is not going to change. This rather unrealistic assumption was abandoned e.g. by Hu (1982) who introduced dynamic random component in the future. Sjoblom (1985) introduced a voting game of rational agents. The game represented a kind of implicit social contract with system of rewards and punishments. The reward is there for younger who invest into their fathers. If the generation does not fulfill its contract, it would be then punished by the following generation. In our case the youngest generation contributes to the system and then it expects that it will also later benefit from the system. If from any reason the members of younger generations decide not to comply with the system, they cannot expect also any later benefit from the younger generation.

3.1.2 Veto Power

When we talk about such an important things as social security for the elderly, in many democracies there might be a insurance that hinders quick and often changes to the system. This might be a constitutional law or any other higher law act. This might give every generation a veto power. This was reflected in Hansson & Stuart (1989). They took a social security legislation as a contract among all generations. The contract can be only adjusted if all the generations benefit from the change. This creates Pareto efficient system. The negotiation in the society in this system would proceed as follows. The young generation would propose a tax τ and the older generation would decide if it accepts the modification or not. Very important property of this decision making procedure is that it very much depends on status quo. There can be only change to the current system if all the groups in the society agree.

3.2 Interest Group Models

This method is more general in a sense, that we do not need a democratic society to be analyzed. On contrary to the voting models, in this kind of models the political power of the agents does not come only from their preference over the policy. In this case the political action may be exerted by or-

ganized interest groups in other form of political action than voting. There are several types of these models. One called influence model stems from the political competition of younger and older generation and their pressure on policy makers. Another one called support model studies the contributions of the lobbies which represent the generational groups. First models of lobbying competition could be seen by Becker (1983) and Becker (1985). These models is based on the fact that exerting a political pressure on policy makers is time consuming. This and overall interest group model approaches have the drawback that there exists free-rider problem. At the end of the day the necessary fundamentals for the policy are the size of the group and the size of the pressure it exerts. The group exercising higher pressures wins and it can implement its solution and thus receive a transfer from the other group which was not successful in the political lobbying. Mulligan & i Martin (1999) claim that interest group models describe more accurately the environment of decision making of such proposals as are pension reforms. Especially considering decision making in representative democracies.

The problem we see in the lobbying process is the classical free-rider problem, because there are members who do not place any effort, but they also benefit from the lobbying of their colleagues in the cohort. The size of the free-rider problem is influenced by the quality of the organization of the group. E. g. Grossman & Helpman (1998) assumes that the older generation is better organized than the younger.
In many models it is not only time consuming to create a lobby, but it might be costly. The government might collect contributions from the groups to ensure himself enough funds for his election campaign. The policy of the group which is able to contribute more will have greater chance to be implemented.

3.2.1 Short-lived Governments

Grossman & Helpman (1998) presents a government which is unable to ensure that the policy which will be implemented would persist in further periods. The government is elected only for a short time. The agents in the economy forecast the future policies of the government with respect to current state of the economy and expected future economic conditions. The equilibrium concept used in the paper is Markov perfect equilibrium.

3.2.2 Capital Market Lobbying

Kemmerling & Neugart (2009) introduced simple although very interesting model of lobbying in favor of the capital market. As we already mentioned earlier, the public pensions scheme is crowding out possible investment on the capital market. In other words people instead of investing into some capital instruments and thus insure themselves for their retirement age, they rely on PAYG systems and thus underinvest. Authors also show that there exist correlation between the PAYG system generosity and a scope of the financial markets. If we look at the Czech Republic it fits this framework very well as the PAYG system is usually the only source of pension and the capital markets are still underdeveloped. However this is a topic for other very interesting debate. The basic idea is that if the governments reduced the public pensions schemes people would be forced to enter the capital market to save enough to smooth their life long consumption. Authors also compare two cases of pension system privatization. The case of United Kingdom in 1986 and Germany in 2001.

Interest Group Problem

As already mentioned above the companies from the capital market (banks, insurance companies, pension funds etc.) struggle to get under control some of the savings s of the Households as they would like to finance their pension from these savings. There is i firms in the economy and they share equally the savings of the households, $s = \sum_i s_i$ where s_i are savings hold by firm i. On the market there is an imperfect competition and thus firms can charge a mark-up $\mu > 0$ on the marginal cost. So firms have profit:

$$V_{i,t} = \mu s_{i,t} - C_{i,t}. \tag{3.1}$$

$C_{i,t}$ are the cost of lobbying. In other words it is the amount the firm transfers to the government for implementing a policy X_t. The policy X_t determines the size of the public pension system. The higher X_t the more must the consumer in young age contribute to the public pension system. It is equivalent the the social contribution rate.

Government Problem

The authors follow common way to express the governments preferences as already used in Grossman & Helpman (1998):

$$\max_{X_t} \lambda W(X_t) + (1-\lambda) \sum_i C_{i,t}, \tag{3.2}$$

where $0 \leq \lambda \leq 1$. The first part of the function determines the government prospects to be elected again and the second part of the function the second part of the function determines the preference of the policy maker. How much weight the government puts on the well-being of the voters and how much he cares about the funds he receives from the capital markets is captured by the parameter λ. In this king of models the interest group trades its money for influence and on the other side stays politician who sells the influence for money. The variable which determines the appearance of the pension scheme is X_t. The government pays the contributions to the pensioners P_t and is constrained by the balanced budget condition $P_t = G_t X_t$, where G_t is growth factor of population defined by $G_t \equiv +g_t \equiv \frac{N_t}{N_{t-1}}$. N_t is the population growth.

Household Problem

In Kemmerling & Neugart (2009) authors consider classic overlapping generations. In this case two. One working and one generation of already retired. Government weights the welfare of both groups with the same weights. And thus the voters' well being as seen by opportunistic government is:

$$W(X_t) = U_t^t(c_t^t, c_{t+1}^t) + U_t^{t-1}(c_t^{t-1}). \tag{3.3}$$

The superscripts here denote the time the generation was born and the subscripts denote the time of consumption.
We can rewrite the utility of the older generation :

$$U_t^{t-1} = u(Rs_{t-1} + G_t X_t), \tag{3.4}$$

where the utility function has usual properties $u'(\cdot) > 0$ and $u''(\cdot) < 0$ (positive but decreasing marginal utility from consumption). The first term in the utility function are the savings of the retiree which he made in productive

age. The second term represents the utility stemming from the PAYG system. R is exogenous as the authors consider small open economy.
The utility of younger generation looks more complicated as it consists of two consumption periods:

$$U_t^t = u(1 - (1+\mu)s_t - X_t) + \frac{1}{R}u(Rs_t + G_{t+1}X_{t+1}). \tag{3.5}$$

The first term in the utility function for the first period is wage which is normalized to 1, subtracted are contribution to her own fund and to PAYG system and savings put on capital market with the mark-up. The second utility is discounted by R and we expect that the government can make credible commitment and ensure that$X_{t+1}^e = X_t$.

Timing Firstly the financial market lobby approaches the government and offers a scheme of policies X_t and possible contributions $C_{i,t}$ they offer in exchange. Then the government decides on its optimal policy (maximizes its objective function) and after that household determine their consumption and savings.
We need to use backward induction and thus we look at the household behavior as the first. households maximize their welfare when they learn the PAYG parameter X_t. Then they set their savings. This is represented by maximizing Household utility function with respect to s_t. And we get then the maximization condition:

$$-u'(1 - (1+\mu)s_t - X_t)(1+\mu) + u'(Rs_t + G_{t+1}^e X_t) = 0 \tag{3.6}$$

Not surprisingly the household equal the today's marginal utility from consumption with the marginal utility from consumption they will receive in the second stage of their life. Kemmerling & Neugart (2009) show that household save more when they face lower contribution rate (this is proved in chapter 5). And that incentivize the financial market sector to lobby for the lower X_t and then collect the fees for saving on private accounts.
It is now government's move to maximize the utility. The government maximizes its Welfare function with respect to the size of PAYG system X_t and

its optimal policy is characterized by:

$$\lambda \frac{dW(X_t)}{dX_t} + (1-\lambda)\sum_i \mu \frac{ds_{i,t}}{dX_t} = 0 \tag{3.7}$$

Authors then rewrite decompose the part of the first part of the government optimality condition as:

$$\frac{dW(X_t)}{dX_t} = O_t + Y_t, \tag{3.8}$$

where

$$O_t = u'(Rs_{t-1} + G_t X_t) G_t \tag{3.9}$$

as the marginal effect of the change of the mandatory contribution on the older generation and

$$Y_t = u'(1-(1+\mu)s_t - X_t)\left(-(1+\mu)\frac{ds_t}{dX_t} - 1\right) + \frac{1}{R}u'(Rs_t + G^e_{t+1}X_t)\left(R\frac{ds_t}{dX_t} + G^e_{t+1}\right), \tag{3.10}$$

which represents the marginal effect of the change of the mandatory contribution on the younger generation. The above equations fully characterize the equilibrium level of X_t mandatory contribution into PAYG system. Other interesting, although not surprising, are that the greater is the weight the government puts on capital markets the lower is the mandatory contribution $\frac{dX^*_t}{d\lambda} > 0$.

At the end of the paper authors examine two states which performed the pension reform. These countries were UK, where the financial market is strong, and Germany where it is weaker. Nevertheless it is only one case, and whether it holds on general level should be more elaborated.
This model is adjusted and then thoroughly solved in the sixth chapter of this theses.

Chapter 4

Political Models of Median Voter with Myopia

4.1 Myopia

One of the above mentioned reasons for the presence of social security and obligatory pensions programs is myopia, in other word shortsightedness. Kaplow (2010) even states that myopia constitutes to some the most important rationale for social security retirement systems. The problem of people with such a behavior is that they are not able to save enough to cover their life-expenses in the later life periods. In other words, the people are impatient and consume more of their resources immediately which makes them time-inconsistent, because the immediate consumption does not follow from their time preference. They seek instant gratification. Phelps & Pollack (1968) studied first these kind of preferences which are also called 'hyperbolic discounting'. This kind of preferences create gap between ones long-run goals and short-run behavior and lead to undersaving and procrastination. All this may even lead to poverty in the later period of the life. Campbell & Mankiw (1989) found that only half of the consumer follow the permanent income hypothesis and one of the main reasons for this is myopia. Of course there are other reasons why people do not save their money, but it is difficult to distinguish between them and myopic behavior. Myopia is well described in the field of Behavioral economics. E.g. in O'Donoghue & Rabin (1999), they see procrastination stemming from myopia "as a major source of suboptimal retirement planning". Even though they see the source of procrastination in the fact that people do not want to spend the time to

find the best way to secure them for their retirement.
Myopia is a problem of time-consistency. The consumer makes his optimal consumption plan for all the life periods. However when it comes to saving (in other words cutting their consumption) and he has the opportunity to consume more he deviates from his optimal plan and chooses higher immediate consumption than savings.

The consumer may be corrected so that his intertemporal utility increases. This may then be solved by forced savings or giving more incentives to the agents to save such as saving subsidies. State pensions schemes are one of the means of forced savings. Cremer & Pestieau (2010) note that this can be called "old paternalism", while the situation when the individuals with hyperbolic preferences are later grateful to the government that they behaved time consistently is called "new paternalism". The mandatory contributions into pension system could be also taken as a commitment device for those who are not able to save voluntarily and thus they insure their consumption smoothing. It is beneficial for them even in the economy is dynamically efficient.
The first to implement myopic preferences into social contributions model was Feldstein (1985). He already concludes that public pension scheme may be economically justified even in a dynamically efficient economy. Very nice overview of the role of myopia in the social security systems is given by Andersen & Bhattacharya (2008).

4.2 Basic Political Models with Myopia

In this main chapter of the thesis I will present the role of Myopia in basic Political economics model. I will use the basic OLG model with three generations, exogenous labor supply, with no heterogeneity as used e. g. in Breyer & Buchholz (2008). As a benchmark the socially optimal case will be shown. Then I will continue begin with an economy where the Median voter is decisive. For the sake of simplicity (but without loss of generality of the analysis) I will assume that real (not myopic) discount rate is 1. Myopia will be established by adding a "myopic discount factor" $\beta < 1$. The social planner will share the real discount rate 1.

As mentioned above there will be three overlapping generations which

will maximize their current utility for the rest of their life, but the decision process will be updated every period and they will be able to change their vote every time they age. Their decision will be made about the individual optimal savings and contribution to the state run pension system. The contribution to PAYG system will be at the end of the day decided by the median voter. The agents are myopic and they are aware of their myopia and thus they discount their savings decision. Even they make their optimal savings plan the household is not able to follow this plan when the time to make the savings come. On the other hand they can commit themselves with higher social contribution rate which will enable them consumption in the later period. As the contribution into state run system is obligatory, their myopic behavior is overcome by forced savings. In this simple model negative savings will not be allowed as the financial institutions would not lend their money when they could be only repaid by politically uncertain social contribution. The timing of the process will be as follows:

1. Households decide about their optimal contribution into state run pension system

2. In the collective decision making the median voter decides about the obligatory contribution into pension system

3. Households make their optimal savings plan given the obligatory contribution rate

4. Households contribute to the obligatory pension system and realize their consumption and savings

5. This process updates every period the generations age

We see that the making an optimal savings/consumption and realizing savings/consumption are done in two different moments and they do not have to correspond when the agent is time-inconsistent.
In this part I will firstly show how the socially optimal situation looks like. Next I will discuss the equilibrium that will be achieved by median voter if the agents are myopic.

Let me now recall the basic setting, but already with the myopic agents. The following terms represent maximization problem of respective genera-

tion. We assume separable additive utility functions:

$$u_t^t(c_t^t) + \beta[u_{t+1}^t(c_{t+1}^t) + u_{t+2}^t(c_{t+2}^t)] \tag{4.1}$$
$$u_t^{t-1}(c_t^{t-1}) + \beta(u_{t+1}^{t-1}(c_{t+1}^{t-1})) \tag{4.2}$$
$$u_t^{t-2}(c_t^{t-2}) \tag{4.3}$$

where again the subscripts denotes the time of consumption and superscript the time where the generation was born. The respective budget constraints for each period for the young generations are:

$$\begin{aligned} c_t^t &= (1-\tau)w - s_t && (4.4)\\ c_{t+1}^t &= (1-\tau)w + (1+r)s_t - s_{t+1} && (4.5)\\ c_{t+2}^t &= P(\tau,n) + (1+r)s_{t+1} && (4.6) \end{aligned}$$

The budged constraints for other generations are very similar:

$$\begin{aligned} c_t^{t-1} &= (1-\tau)w + (1+r)s_{t-1} - s_t && (4.7)\\ c_{t+1}^{t-1} &= P(\tau,n) + (1+r)s_t. && (4.8) \end{aligned}$$

We assume that the government's budget is balanced and thus:

$$P(\tau,n) = \left((1+n) + (1+n)^2\right) w\tau, \tag{4.9}$$

where fro further reference denote $\left((1+n) + (1+n)^2\right) = N$.

4.3 Socially Optimal Equilibrium

In this section I will look at the equilibrium which would be achieved if only the youngest no suffering from myopia could decide. This constitutes maximization problem which lead to social optimum because, there is no distortion in form of reduced time horizon or myopia. The way to solve this problem is to plug the respective constraints including the government balanced budget constraint into the utility function and then solve for s_1, s_2 and τ. We shall not forget that if we want to get socially optimal solution we optimize only the problem of the youngest generations as it does not suffer from the reduced time horizon problem and solves the life-long problem. All these condition lead to that that the problem simplifies to a very basic

one and we should get to the derivation of the dynamic efficiency condition which was mentioned several times already. Thus the social planner solves a problem:

$$\max_{s_t^t, s_{t+1}^t, \tau} u_t^t((1-\tau)w - s_t^t) + u_{t+1}^t((1-\tau)w + (1+r)s_t^t - s_{t+1}^t) + u_{t+2}^t Nw\tau + (1+r)s_{t+1}^t) \tag{4.10}$$

To solve this problem we should take F.O.C.:

$$\left[s_t^t\right] \quad : \quad -\frac{\partial u_t^t}{\partial c_t^t} + (1+r)\frac{\partial u_{t+1}^t}{\partial c_{t+1}^t} \leq 0 (= 0 \text{ if } s_t^t > 0) \tag{4.11}$$

$$\left[s_{t+1}^t\right] \quad : \quad -\frac{\partial u_{t+1}^t}{\partial c_{t+1}^t} + (1+r)\frac{\partial u_{t+2}^t}{\partial c_{t+2}^t} \leq 0 (= 0 \text{ if } s_{t+1}^t > 0) \tag{4.12}$$

$$\left[\tau\right] \quad : \quad -\frac{\partial u_t^t}{\partial c_t^t} w - \frac{\partial u_{t+1}^t}{\partial c_{t+1}^t} w + \frac{\partial u_{t+2}^t}{\partial c_{t+2}^t} Nw = \leq 0 (= 0 \text{ if } \tau > 0) \tag{4.13}$$

Substituting from 4.11 into 4.12 and rewriting both we get:

$$\frac{\partial u_t^t}{\partial c_t^t} = (1+r)^2 \frac{\partial u_{t+2}^t}{\partial c_{t+2}^t} \tag{4.14}$$

$$\frac{\partial u_{t+1}^t}{\partial c_{t+1}^t} = (1+r)\frac{\partial u_{t+2}^t}{\partial c_{t+2}^t} \tag{4.15}$$

Plugging these two into 4.13 we get an equation:

$$(1+r)^2 \frac{\partial u_{t+2}^t}{\partial c_{t+2}^t} + (1+r)\frac{\partial u_{t+2}^t}{\partial c_{t+2}^t} = \frac{\partial u_{t+2}^t}{\partial c_{t+2}^t}\left((1+n) + (1+n)^2\right) \tag{4.16}$$

Which can be simplified to:

$$(1+r)^2 + (1+r) = (1+n)^2 + (1+n) \tag{4.17}$$

This equation holds only for $r = n$. This means that there would be positive voluntary contribution (savings) as well as mandatory contribution only if the interest rate on savings is equal to population growth, which is the very well known dynamic efficiency condition. The only case we can receive non-corner solution is when $r = n$. As the contribution rate and private savings behave in this linear form as a perfect substitutes, the one with lower costs will prevail. From the F.O.C. we have that if $r > n$ there would be optimally no mandatory social system $\tau = 0$ and if the on the other hand $r < n$ than

voluntary savings would drop to zero and the whole consumption in the third life period would be funded from the social security system.

4.4 Median Voter

In the first political economy setting we will have a look at the median voter. I will discuss the case when the individuals are myopic, but they are aware of their shortsightedness and take social insurance as a commitment device which ensures him consumption in the elderly period when their ability to save deliberately on the financial market is limited. The difference to the social planner solution is the myopic discounting of the utility in coming periods derived from his private savings. As we know from the previous example the consumer either saves or contributes to the social security system. So there are two maximization problems; one for savings problem and second for the social security benefits. We will then have:

$$\max_{s_t^t, s_{t+1}^t} u_t^t((1-\tau)w - s_t) + \beta\left[u_{t+1}^t(\tau w + (1+r)s_t^t - s_{t+1}^t) + u_{t+2}((1+r)s_{t+1}^t)\right] \tag{4.18}$$

for savings and:

$$\max_{\tau} u_t^t(\tau w) + u_{t+1}^t(\tau w) + u_{t+2}\left(\left((1+n) + (1+n)^2\right)w\tau\right) \tag{4.19}$$

When we take the F.O.C for both maximization problems, we receive

$$\left[s_t^t\right] \quad : \quad -\frac{\partial u_t^t}{\partial c_t^t} + (1+r)\beta\frac{\partial u_{t+1}^t}{\partial c_{t+1}^t} \leq 0 (= 0 \text{ if } s_t^t > 0) \tag{4.20}$$

$$\left[s_{t+1}\right] \quad : \quad -\beta\frac{\partial u_{t+1}^t}{\partial c_{t+1}^t} + (1+r)\beta\frac{\partial u_{t+2}^t}{\partial c_{t+2}^t} \leq 0 (= 0 \text{ if } s_{t+1}^t > 0) \tag{4.21}$$

$$\left[\tau\right] \quad : \quad -\frac{\partial u_t^t}{\partial c_t^t}w - \frac{\partial u_{t+1}^t}{\partial c_{t+1}^t}w + \frac{\partial u_{t+2}^t}{\partial c_{t+2}^t}Nw \leq 0 (= 0 \text{ if } \tau > 0) \tag{4.22}$$

The equation 4.22 remains the same which is not surprising when the agent is not affected by myopia in this case. When we do the same operations as in the previous case we again get a break even point which now looks slightly differently:

$$(1+r) + \beta(1+r)^2 = (1+n)^2 + (1+n) \tag{4.23}$$

Table 4.1: Break even points for the youngest generation

$\frac{\beta}{r}$	0.9	0.8	0.7	0.6	0.5
0.01	-0.024	-0.059	-0.095	-0.132	-0.170
0.03	-0.051	-0.041	-0.078	-0.116	-0.154
0.05	0.014	-0.022	-0.061	-0.099	-0.139
0.07	0.033	-0.005	-0.043	-0.083	-0.124
0.09	0.052	0.013	-0.026	-0.067	-0.109

In this case we see that even lower population growth ensures that the PAYG system is sustainable even when the population growth is smaller than the interest rate. In the table below we see some values of break-even points when the consumers are indifferent between social security system and private savings.

The consumers may realize the fact that their myopia is a systematic problem and thus they would include into their consideration that even though they plan now that they will save some amount of money for their future retirement in the second period s_{t+1}^t, they will still be myopic at the time they update their plan and as myopia is the problem of time inconsistency, they will not be able to stick to their plan and thus they already solve a different problem even in first period. Their maximization problem would change to:

$$\max_{s_t^t, s_{t+1}^t} u_t((1-\tau)w - s_t^t) + \beta \left[u_{t+1}((1-\tau)w + (1+r)s_t^t - s_{t+1}^t) + \beta u_{t+2}^t((1+r)s_{t+1}^t) \right]. \tag{4.24}$$

The maximization problem for the social security would remain same and the break-even equation for the youngest generation would turn into:

$$\beta(1+r) + \beta(1+r)^2 = (1+n)^2 + (1+n). \tag{4.25}$$

The break even points would thus in this case be: We see that in the case when the consumers are aware of their systematic myopia the population growth needed for the PAYG system to sustain is smaller.

Let me now have a look at the middle generation which maximizes the utility only for the two last periods. It suffers from the limited horizon problem discussed above. Recall that this problem "hinders" this household to vote for socially optimal pension scheme even if it was not myopic. The

Table 4.2: Break even points for the youngest generation with systematic myopia

$\frac{\beta}{r}$	0.9	0.8	0.7	0.6	0.5
0.01	-0.059	-0.131	-0.207	-0.288	-0.375
0.03	-0.040	-0.113	-0.191	-0.273	-0.362
0.05	-0.021	-0.096	-0.175	-0.258	-0.348
0.07	-0.002	-0.078	-0.158	-0.243	-0.335
0.09	0.017	-0.060	-0.142	-0.228	-0.321

agent thus solves problem:

$$\max_{s_t^{t-1}} u_t^{t-1}((1-\tau)w + rs_{t-1}^{t-1} - s_t^{t-1}) + \beta u_{t+1}^{t-1}\left((1+r)s_t^{t-1}\right), \tag{4.26}$$

when being myopic and not able to save optimally in the first period. When he is committed by the social security system he solves different problem and thus:

$$\max_{\tau} u_t^{t-1}((1-\tau)w + (1+r)s_{t-1}^{t-1}) + u_{t+1}^{t-1}\left((1+n+(1+n)^2)w\tau\right), \tag{4.27}$$

which is maximization of the social security contribution. We see that in both cases there is a contribution s_{t-1}^{t-1} from the previous period. This contribution is not subject to maximization because it was already decided in the previous period. And thus the F.O.C.s are:

$$\left[s_{t+1}^{t-1}\right] \quad : \quad -\frac{\partial u_t^{t-1}}{\partial c_t^{t-1}} + \beta(1+r)\frac{\partial u_{t+2}^{t-1}}{\partial c_{t+2}^{t-1}} \leq 0 (= 0 \text{ if } s_{t+1}^{t-1} > 0) \tag{4.28}$$

$$[\tau] \quad : \quad -\frac{\partial u_t^{t-1}}{\partial c_t^{t-1}} w + \frac{\partial u_{t+1}^{t-1}}{\partial c_{t+1}^{t-1}} Nw \leq 0 \ (= 0 \text{ if } \tau > 0) \tag{4.29}$$

When using the same step as above we get the break-even condition for the social security the second generation:

$$(1+n)^2 + (1+n) = \beta(1+r). \tag{4.30}$$

In this case there is no discussion about systematic myopia, because there is only one period to be myopic about. I will again provide a table of necessary Population growths depending on myopia parameter and the interest rate

Table 4.3: Break even points for the middle generation

$\frac{\beta}{r}$	0.9	0.8	0.7	0.6	0.5
0.01	-0.423	-0.471	-0.522	-0.575	-0.631
0.03	-0.415	-0.464	-0.515	-0.568	-0.625
0.05	-0.407	-0.456	-0.508	-0.562	-0.620
0.07	-0.399	-0.448	-0.501	-0.556	-0.614
0.09	-0.391	-0.441	-0.494	-0.549	-0.608

in the economy: We see that the population growths needed to maintain sustainable PAYG pensions scheme are much lower than in both cases in young generation. This is the result of the reduced horizon phenomenon.

At last we will have a look at the oldest generation which solves rather easy problem. It does not suffer from myopia and it does not optimize the value of savings, because all savings decisions were already made in the previous periods. Thus it is left with a problem:

$$\max_{\tau} u_t^{t-2} \left((1 + n + (1 + n)^2) w\tau \right), \tag{4.31}$$

where the F.O.C. is:

$$\frac{\partial u_t^{t-2}}{\partial c_t^{t-2}} \left((1 + n) + (1 + n)^2 \right) w > 0 \tag{4.32}$$

The term in the equation 4.32 is positive and thus the differentiation with respect to τ is always positive and thus the older generation would always set the contribution rate on the highest possible level which is in our case 1. Let me denote the optimal contribution rates of all three generations with subscript describing respective generation. We obviously assume that:

$$\frac{\partial u_t^t}{\partial \tau} \text{ and } \frac{\partial u_t^{t+1}}{\partial \tau} \text{ and } \frac{\partial u_{t+1}^{t+1}}{\partial \tau} < 0 \tag{4.33}$$

$$\frac{\partial u_t^{t-2}}{\partial \tau} \text{ and } \frac{\partial u_{t+1}^{t-1}}{\partial \tau} \text{ and } \frac{\partial u_{t+2}^{t}}{\partial \tau} > 0 \tag{4.34}$$

because the increase of the contribution rate decreases the utility in the periods when the agent works and obviously increases the consumption in the periods when he receives funds from the system. And from all above follows that $\tau_1 \leq \tau_2 < \tau_3 = 1$ (denotes optimal τ for each generation). Which

of these τs would be implemented in the economy depends on the shares of the population respective group has in the society. Let me denote the shares of the groups by α_1, α_2 and α_3 for old, middle and young generation respectively. Then their shares in the society are:

$$\alpha_1 = \frac{(1+n)^2}{1+(1+n)+(1+n)^2} \tag{4.35}$$

$$\alpha_2 = \frac{(1+n)}{1+(1+n)+(1+n)^2} \tag{4.36}$$

$$\alpha_3 = \frac{1}{1+(1+n)+(1+n)^2} \tag{4.37}$$

$$\tag{4.38}$$

For the youngest generation in the society to have majority $\left(\alpha_1 > \frac{1}{2}\right)$ we need to have:

$$2+n < (1+n)^2, \tag{4.39}$$

which holds if $n > 0.618$ which is consistent with a population growth from generation to generation of 61.8%. In this case the economy would implement the τ_1 which would be zero if $\beta\left((1+r)+(1+r)^2\right) > (1+n)^2 + (1+n)$.
We can call the system gerontocracy if $\alpha_3 > \frac{1}{2}$ thus the oldest generation holds the majority. In this case it must hold that:

$$(1+n)+(1+n)^2 < 1, \tag{4.40}$$

which is consistent with $n < -0.382$ which means that the society would have to be shrinking by 38.2 % generation to generation. In this case we would get in our simple model that the tax rate τ would rise to 1. This tax rate would not make sense if we extend the model a bit and add leisure than the old generation would set the tax rate on the top of the Laffer curve.
If none of above is true and $\alpha_3 < \frac{1}{2}$ as well as $\alpha_1 < \frac{1}{2}$ we would have the most probable case when the median voter is in the middle generation and would set the optimal tax to τ_2.

In the simple model described above we see the results of the vote on social security when we assume a democracy where the medial voter decides about the governmental policy. In the economy there were myopic agents

who used the mandatory social security policy as a commitment device because they are not able to save optimally. The main results show that even in the dynamic efficient economies the youngest generations may vote for mandatory social security instead of saving for their pensions on the capital market through their savings. Myopia also decreases the necessary population growth rates necessary to make mandatory social contributions system sustainable when the median voter is in the middle generation. We have seen there rates given some economic parameters in tables in this section.
It is now clear that the condition of rigid contribution rate holds, because it depends in this case on the parameters of the economy and there are assumed to be constant. So once the vote is done the contribution rate τ should not be threatened by future vote, because the outcome should be the same.

4.5 Pension Pessimism

Other form of myopic behavior which was developed by Feldstein (1985) is so called pension pessimism. The point of this problem is that the consumers do not believe that the government is going to fulfill the "agreement" they make with it and will not pay out everything it collects. This might be caused by the some expected costs government has due to handling the redistribution or even political risks connected with pension system. No matter where the pension pessimism comes from, it is also systematic mistake of the consumer. Let me also briefly discuss this kind of myopia. Let σ be the parameter which describes the extent of the expected "loss" in the process of redistribution. The consumer will solve the same problem as in the setting with classic myopia which for the youngest generation means:

$$\max_{s_t^t, s_{t+1}^t, \tau} u_t^t(c_t^t) + u_{t+1}^t(c_{t+1}^t) + u_{t+2}^t(c_{t+2}^t) \tag{4.41}$$

The constraints are now slightly modified:

$$\begin{aligned} c_t^t &= (1-\tau)w - s_t^t && (4.42)\\ c_{t+1}^t &= (1-\tau)w + (1+r)s_t^t - s_{t+1}^t && (4.43)\\ c_{t+2}^t &= (1+r)s_{t+1}^t + \Big((1+n)^2 + (1+n)\Big)\sigma\tau w && (4.44) \end{aligned}$$

Table 4.4: Pension pessimism: Break even points for the youngest generation

$\frac{\sigma}{r}$	0.9	0.8	0.7	0.6	0.5
0.01	0.083	0.170	0.275	0.406	0.576
0.03	0.104	0.192	0.299	0.432	0.605
0.05	0.125	0.215	0.323	0.459	0.639
0.07	0.145	0.237	0.248	0.485	0.663
0.09	0.168	0.260	0.372	0.512	0.692

In this case we do not have to separate the problems into two and we can directly solve it. So the F.O.C.s for the youngest generation look like:

$$\left[s_t^t\right] \quad : \quad -\frac{\partial u_t^t}{\partial c_t^t} + (1+r)\frac{\partial u_{t+1}^t}{\partial c_{t+1}^t} \leq 0 (= 0 \text{ if } s_t^t > 0) \tag{4.45}$$

$$\left[s_{t+1}^t\right] \quad : \quad -\frac{\partial u_{t+1}^t}{\partial c_{t+1}^t} + (1+r)\frac{\partial u_{t+2}^t}{\partial c_{t+2}^t} \leq 0 (= 0 \text{ if } s_{t+1}^t > 0) \tag{4.46}$$

$$[\tau] \quad : \quad -\frac{\partial u_t}{\partial c_t^t} w - \frac{\partial u_{t+1}^t}{\partial c_{t+1}^t} w + \frac{\partial u_{t+2}^t}{\partial c_{t+2}^t} N\sigma w \leq 0 (= 0 \text{ if } \tau > 0) \tag{4.47}$$

The problem is very similar to the previous so we immediately see that the consumer will either prefer saving or contributing to the common pool depending on the parameters, but he would not do both in the same time. The break-even between mandatory social security and private saving will be for him given by equation:

$$(1+r) + (1+r)^2 = \sigma\left((1+n)^2 + (1+n)\right) \tag{4.48}$$

Let me again show some values of σ, r and n which lie on this boundary: We see that the young generation, when it suffers from pension pessimism, would need a very high population growth to vote for the PAYG system. In recent situation in Europe and even in the US we cannot expect these high population growths. Nevertheless we know the chance that the youngest generation becomes the decisive power requires the population growth of $n > 0.618$ so if such a growth exists we see that the chance that it would support the PAYG system is quite high. Let us have a look at the middle

Table 4.5: Pension pessimism: Break even points for the middle generation

$\frac{\sigma}{r}$	0.9	0.8	0.7	0.6	0.5
0.01	-0.329	-0.270	-0.199	-0.110	0.007
0.03	-0.320	-0.260	-0.188	-0.098	0.020
0.05	-0.310	-0.250	-0.177	-0.086	0.033
0.07	-0.300	-0.240	-0.166	-0.074	0.046
0.09	-0.291	-0.230	-0.156	-0.062	0.059

generation which solves the problem:

$$\max_{s_{t+1}^{t-1},\tau} u_t^{t-1}(c_t^{t-1}) + u_{t+1}^{t-1}(c_{t+1}^{t-1}) \tag{4.49}$$

The constraints are now slightly modified:

$$c_t^{t-1} = (1-\tau)w + (1+r)s_{t-1}^{t-1} - s_t^{t-1} \tag{4.50}$$

$$c_{t+1}^{t-1} = rs_{t+1} + \left((1+n)^2 + (1+n)\right)\tau\sigma w \tag{4.51}$$

The F.O.C.s of the middle generation are:

$$\left[s_t^{t-1}\right] : -\frac{\partial u_t^{t-1}}{\partial c_t^{t-1}} + \beta(1+r)\frac{\partial u_{t+1}^{t-1}}{\partial c_{t+1}^{t-1}} \leq 0 (= 0 \text{ if } s_t^{t-1} > 0) \tag{4.52}$$

$$[\tau] : -\frac{\partial u_t^{t-1}}{\partial c_t^{t-1}} w + \frac{\partial u_{t+1}^{t-1}}{\partial c_{t+1}^{t-1}} N\sigma w = \leq 0 (= 0 \text{ if } \tau > 0) \tag{4.53}$$

Again I will the usual operation and get the description of the break even point for the middle generation:

$$\sigma\left((1+n)^2 + (1+n)\right) = (1+r). \tag{4.54}$$

The table **??** summarizes again the break even points for different parameters: We see that even the middle generation does not have to be in favor of PAYG system if it does not believe its government enough and the population growth is small.

In this chapter, I showed that in the economy where myopia is present the dynamic efficiency condition does not hold. For the PAYG system to be sustainable, population growths necessary to for the agents to favor the public

pension scheme are much lower, than in presence of time-consistent households. On contrary, in presence of pension pessimism the balance moves towards high population growths and thus the PAYG system in developed countries might be politically threatened.

We see that the results end in the corner solution when the households either prefer saving or it contributes into the public pension budget. This is given by the constant parameters r and n. In the next chapter I will introduce the production function which determines the return r which is not going to be constant any more and I will show how the crowding out effect works.

Chapter 5

Endogenous Wage and Return to Capital

5.1 Introduction of Production Technology

So far we analyzed the case where the rate of return for savings was exogenous and constant. I will now relax the condition that the interest rate r and the wage w are exogenous, but they will be determined by neo-classical production function. This will very much increase the complexity of the model and we have to make some simplification so that we can see some implications this extension produces. First of all we will assume the population growth rate n is zero (which is in line with the development in many developed countries). This simplification implies that dynamic efficiency condition turns to $r > 0$. I will not allow negative savings either. Moreover, savings in the model will work truly as pension insurance which can be withdrawn only when the agent reaches the last life period. The non-negative savings have a rational because the financial markets are usually not willing to lend people when their future income is guaranteed by social security benefits. The production function has constant returns to scale (CRS). The final good is thus produced using $F(K_t, L_t)$, where K_t denotes capital input into the production and L_t labor input into production. The final good is then consumed by all three generations. The capital fully depreciates in one period. However the youngest generation is bounded (it is our assumption) to save/invest all the its savings from the first period $(1 + r)s_t^t$ back into production. The total capital in the steady state is composed by all current

savings in the economy which are:

$$\bar{k} = s_t^t \left(w(\bar{k}, r(\bar{k})\right) + s_t^{t-1} \left(w(\bar{k}, r(\bar{k})\right) + (1 + r(k)) s_{t-1}^{t-1} \left(w(\bar{k}, r(\bar{k})\right), \qquad (5.1)$$

If we recall the consumer consumption function we would see that the utility from leisure is missing and thus the labor supply is fixed. The obligatory contribution rate thus does not distort the labor supply. Nevertheless I will show how it affects the savings decision of the household. As already mentioned the PAYG system is unproductive as its funds do not enter the production function. It is only rolling over a debt/commitment from one generation to other generation (the younger generations provides the debt which is repaid when they retire). In this part I would like to show the already mentioned crowding out effect. I would like to rigorously show as Andersen & Bhattacharya (2008) that the increase of the obligatory contribution rate is decreasing the total amount of capital in the economy. Yet this result is myopia independent, it will be an important one step on the way to show other interesting role of myopia in the household's decision about the optimal mix of PAYG social contribution and private savings invested into the capital. In a basic model, similar to the one presented in this chapter, Samuelson (1975) shows that in dynamic efficient economy with two generations the working generation would never choose positive contribution rate into public social system. Basically we saw the reasoning in the previous chapter, where the young non-myopic consumer (socially optimal equilibrium) in the dynamic efficient state chose only private savings to smooth the consumption, because the difference in benefits (increase of utility in the last period) and costs (decrease of utility when saving or contributing) was lower by private savings. But as myopia discounts more the benefits from private savings it can be shown that even in a dynamic efficient economy (in our case $r > 0$), with diminishing returns to capital ($r'(k) < 0$, see below) the consumer may prefer combination of positive private savings and a positive social contribution rate. However to show this result is not trivial and further simplification will be needed; the number of generations will have to be decreased to two. But in the beginning I will follow with the setting from the previous chapter and I will show the effects of the change of wage w and interest rate (return to capital) r on the private savings. Both variables are a function of capital. Their derivation is described on next lines.

Let me denote $k_t = \frac{K_T}{L_T}$ the capital labor ratio. Now we can use the CRS

property of the production function and express the intensive production function:

$$f(k_t) \equiv F\left(\frac{K_T}{L_t}, 1\right) \tag{5.2}$$

As the function is neo-classical CRS we have that $f(0) = 0$ and $f' > 0 > f''$. We also assume Inada conditions to hold. The producers maximize the their profit and thus we have:

$$\max_{K_t, L_T} f(k_t) - wL_t - rK_t, \tag{5.3}$$

and as we have $k_t = \frac{K_t}{L_t}$ and thus the first order conditions are:

$$[k_t] \quad : \quad f'(k_t) = r_t(k) \tag{5.4}$$

$$[L_t] \quad : \quad f(k_t) - k_t f'(k_t) = w_t(k_t) \tag{5.5}$$

when combining 5.4 and 5.5 we get:

$$w'(k) = -kr'(k) > 0, \forall k. \tag{5.6}$$

This describes the production part of the economy.

5.1.1 Consumers in the Economy

We assume that the consumers take wage and the rate of return of the capital as given and thus they solve their maximization problem given they are myopic. After we add the simplifications commented earlier we get adjusted maximization for the first generation in a form:

$$\max_{s_t, \tau} u_t^t(c_t^t) + \beta \left(u_{t+1}^t(c_{t+1}^t) + u_{t+1}^t(c_{t+2}^t)\right), \tag{5.7}$$

constrained by:

$$c_t^t = (1-\tau)w_t - s_t \tag{5.8}$$

$$c_{t+1}^t = (1-\tau)w_{t+1} - s_{t+1} \tag{5.9}$$

$$c_{t+2}^t = P(\tau) + [(1+r_t)(1+r_{t+1})s_t + (1+r_{t+1})s_{t+1}] \tag{5.10}$$

As we have no population growth we can simplify $\tau w_t = P_t$ as a government budget constraint. So the first order conditions for the youngest generation regarding savings are:

$$[s_t] \quad : \quad -\frac{\partial u(c_t^t)}{\partial c_t^t} + \beta \frac{\partial u(c_{t+2}^t)}{\partial c_{t+2}^t}(1 + r(k_{t+1}))(1 + r(k_{t+2})) \tag{5.11}$$

$$[s_{t+1}] \quad : \quad -\frac{\partial u(c_{t+1}^t)}{\partial c_{t+1}^t} + \beta \frac{\partial u(c_{t+2}^t)}{\partial c_{t+2}^t}(1 + r(k_{t+2})) \tag{5.12}$$

For the savings of the middle generation there is only one condition and thus for their s_t^{t-1} (savings of the generation born in $t-1$ in the period t).

$$\left[s_t^{t-1}\right] \quad : \quad -\frac{\partial u(c_t^{t-1})}{\partial c_t^{t-1}} + \beta \frac{\partial u(c_{t+1}^{t-2})}{\partial c_{t+1}^{t-1}}(1 + r(k_{t+1}))s_t \tag{5.13}$$

The equations 5.11, 5.12 and 5.13 characterize the equilibrium capital-labor ratio. There is a steady-state value $\bar{k}$ which is the time-invariant solution to the three equations. The reactions of savings and thus (indirectly of steady state of capital $\bar{k}$) can be derived by the implicit function theorem and the first order conditions. Following equations describe these reactions:

$$s_{t,w}^t = \frac{\partial s_t^t}{\partial w} = \frac{u_t^{t\prime\prime}}{u_t^{t\prime\prime} + \beta u_{t+1}^t{}''(1 + r(k))^4} \tag{5.14}$$

$$s_{t+1,w}^t = \frac{\partial s_{t+1}^t}{\partial w} = \frac{u_{t+1}^t{}''}{u_{t+1}^t{}'' + \beta u_{t+1}^t{}''(1 + r(k))^2} \tag{5.15}$$

$$s_{t,w}^{t-1} = \frac{\partial s_t^{t-1}}{\partial w} = \frac{u_t^{t-1\prime\prime}}{u_t^{t-1\prime\prime} + \beta u_{t+1}^{t-1\prime\prime}(1 + r(k))^2} \tag{5.16}$$

which show us how the savings of respective generations change with change of wage which is in this case with production side the marginal productivity of labor. From above equations we can clearly state that $s_{i,w} > 0 \; \forall i$ for every working generation in any period. It is interesting to look at the role of myopia in this case as well. Savings of myopic agents react less to the change of the wage. This should not be surprising, because as they discount their future utility more, they increase rather their current consumption than the future one as their wage increases.

The reaction on the change of interest rates could be seen in the following equations. For simplification I will use following notation $s_{t,r}^t = \frac{\partial s_t^t}{\partial r}$ and

respectively:

$$s^t_{t,r} = -\frac{2\beta(1+r)^3 u_t^{t\prime\prime} s^t_t + 2(1+r(k))\beta u_t^{t\prime}}{u_t^{t\prime\prime} + \beta {u^t_{t+1}}^{\prime\prime}(1+r(k))^4} \tag{5.17}$$

$$s^t_{t+1,r} = -\frac{\beta(1+r(k)) s^t_{t+1} {u^t_{t+1}}^{\prime\prime} + \beta u_t^{t\prime}}{{u^t_{t+1}}^{\prime\prime} + \beta {u^t_{t+1}}^{\prime\prime}(1+r(k))^2} \tag{5.18}$$

$$s^{t-1}_{t,r} = -\frac{\beta(1+r(k)) s^t_{t+1} u_{t+1}^{t-1\prime\prime} + \beta u_t^{t-1\prime}}{u_{t+1}^{t-1\prime\prime} + \beta u_{t+1}^{t-1\prime\prime}(1+r(k))^2} \tag{5.19}$$

It is rather difficult to derive the sign of reaction of savings on the change of interest rates from above equations. But empirical support suggest that it is non-negative and thus we have $s_{i,r} \geq 0 \; \forall i$. This also rules out the possibility of endogenous cycles.

5.1.2 Changes in Capital

To show the most important results stated int the beginning of this chapter (crowding out effect and positive savings and contribution rate) I will have to implement the announced simplification and reduce the number of generations to two. I will now for a while follow the paper Andersen & Bhattacharya (2008). The first generation which works and the second generation which enjoys the benefit of being retired. For this case I will focus only on the working generation. The most important effect of this simplification, for the time being, is that the generation will decide about all the capital in the economy, because $s = k_t$. Its F.O.C. condition with respect to savings will be:

$$-\frac{\partial u(c^t_t)}{\partial c^t_t} + \beta \frac{\partial u_{t+1}}{\partial c_{t+1}}(1+r(k)) \tag{5.20}$$

The reactions on wage and interest rate will be also very similar to the 3 generations case and thus we will have:

$$s_w = \frac{u_t^{\prime\prime}(\cdot)}{u_t^{\prime\prime}(\cdot) + \beta u^{\prime\prime}_{t+1}(\cdot)(1+r(k))^2} \tag{5.21}$$

$$s_r = -\frac{\beta(1+r(k)) s u^{\prime\prime}_{t+1}(\cdot) + \beta u^{\prime}_{t+1}(\cdot)}{u_t^{\prime\prime}(\cdot) + \beta {u^t_{t+1}}^{\prime\prime}(\cdot)(1+r(k))^2} \tag{5.22}$$

where both denominators can be denoted for further reference as θ. The effects remain same as in the case with three generations.
Using implicit function theorem and 5.20 we will establish the reaction of capital on the change of contribution rate into state pension system:

$$\frac{\partial k}{\partial \tau} = \frac{w\left(u_t'' + (1+r(k))\beta u_{t+1}''\right)}{u_t'' w'(k) - u_t'' - r'(k)\beta u_{t+1}' - (1+r(k))\beta u_{t+1}''(r'(k)k + (1+r(k)))} \tag{5.23}$$

Now I would like to prove the crowding out condition at locally stable steady state. The numerator of 5.23 is clearly negative due to decreasing marginal utility. Next steps will help us to determine the sign of the denominator. Andersen & Bhattacharya (2008) show this result indirectly and I will follow their approach. We know that:

$$k_{t+1} = s(w(k_t), r(k_{t+1})) \tag{5.24}$$

and we can easily derive that:

$$\frac{dk_{t+1}}{dk_t}\Big| bar_k = \frac{-s_w(\cdot)sr'(k)}{1 - s_r(\cdot)r'(k)} \tag{5.25}$$

The terms on the right hand side of 5.25 fulfill following inequalities:

$$\frac{-s_w s(1+r(k))}{1 - s_r r'(k)} < 1 \Leftrightarrow 0 < 1 + r'(k)\left(ss_w - s_r\right) \tag{5.26}$$

Let me begin showing that the 5.26 is bigger than zero. The denominators of 5.26 can be rewritten as:

$$\begin{aligned} 1 + r'(k)(ss_w - s_r) = 1 + \frac{r'(k)}{\theta}\left(su_t''(\cdot) + \beta(1+r(k))su_{t+1}''(\cdot) + \beta(u_{t+1}'(\cdot)\right) &> 0 \\ \Leftrightarrow \frac{1}{\theta}\left[u_t'' + \beta(1+r)^2 u_{t+1}'' + r'(k)su_t'' + r'(k)\beta^2(1+r)su_{t+1}'' + \beta r'(k)u_{t+1}'\right] &> 0 \\ \Leftrightarrow \frac{1}{\theta}\left[u_t'' + \beta(1+r)^2 u_{t+1}'' + r'(k)ku_t'' + r'(k)\beta^2(1+r)ku_{t+1}'' + \beta r'(k)u_{t+1}'\right] &> 0 \end{aligned} \tag{5.27}$$

The denominator of 5.23 can be rewritten as:

$$-\left[u_t'' kr'(k) + u_t'' + r'(k)\beta u_{t+1}' + (1+r(k))\beta u_{t+1}'' r'(k)k + u_{t+1}''\beta(1+r(k))^2)\right] \tag{5.28}$$

which has the same sign as 5.27 and thus we can say that $\frac{\partial k}{\partial \tau} < 0$ which describes the so called crowding out effect. But this very important result is only one step to show that the consumer can prefer both together the positive contribution rate and level of private savings.

Let me now focus of the optimal case the central planner without myopic preferences would choose as a contribution rate. The maximization problem would look like:

$$\max_{\tau} U(\tau) = u_t(w(k) - \tau w(k) - k(\tau)) + u_{t+1}((1 + r(k))k(\tau) + \tau w(k)) \tag{5.29}$$

and maximization together with 5.20 for non myopic agents we get:

$$\begin{aligned} U'(\tau) &= u'_t \left(w'(k)\frac{\partial k}{\tau} - w(k) - \tau w'(k)\frac{\partial k}{\tau} - \frac{\partial k}{\partial \tau} \right) + \\ &+ u'_{t+1} \left(r'(k)\frac{\partial k}{\partial \tau}k + (1 + r(k))\frac{\partial k}{\partial \tau} + w(k) + \tau w'(k)\frac{\partial k}{\tau} \right) \\ &= u'_{t+1}(-r(k)) \left(w(k) + (1 - \tau)kr'(k)\frac{\partial k}{\partial \tau} \right) \end{aligned} \tag{5.30}$$

We see now that the neo-classical production function has its place, because if we have positive return to capital $r(k)$ which is constant ($r'(k) = 0$) then the social planner would never get positive $U'(\tau)$ and thus positive τ. This is the reason why we have in the chapter 4 only positive contribution rate of positive savings. Also when we have $r'(k)\frac{\partial k}{\partial \tau} > 0$ and we do not have myopia we cannot reach positive $U'(\tau)$ and thus $\tau > 0$. As already conclusion made already by Samuelson (1975) when he showed that rational consumers would not choose positive contribution rate to the state pension system when the economy is dynamically efficient.

Now we will have a look at the myopic agents who time inconsistently discount the future utility given by their savings. As they, due to myopia, discount their future utility given by savings more than the one given by PAYG system, there is a chance that they might choose both positive. Simi-

lar to 5.30, but with myopic agents, we have this equation:

$$\begin{aligned} U'(\tau) &= u'_t\left(w'(k)\frac{\partial k}{\tau} - w(k) - \tau w'(k)\frac{\partial k}{\tau} - \frac{\partial k}{\partial \tau}\right) + \\ &+ u'_{t+1}\left(r'(k)\frac{\partial k}{\partial \tau}k + (1+r(k))\frac{\partial k}{\partial \tau} + w(k) + \tau w'(k)\frac{\partial k}{\tau}\right) \\ &= u'_{t+1}\left((1-(1+r(k))\beta)w(k)\right)\frac{\partial k}{\partial \tau}\left(1-(1+r(k))\beta\left(\tau w'(k)\frac{\partial k}{\tau} - w'(k)\frac{\partial k}{\tau}\right)\right) + \\ &+ u'_{t+1}\left((1+r(k))\beta + (1+r(k))\right) \end{aligned} \tag{5.31}$$

From 5.31 we see that:

$$U'(\tau) = 0 \Leftrightarrow \frac{\partial k}{\partial \tau} = \frac{((1+r(k))\beta - 1)w(k)}{(1-(1+r(k))\beta)(1-\tau)kr'(k) + (1+r(k))(1-\beta)} \tag{5.32}$$

From the point of consumer considering $\frac{\partial k}{\partial B}$ from the point of view of optimal social contribution 5.32 must hold, but the same consumer maximizes also the savings and from this maximization we have 5.23. The consumer maximizes one utility but he uses two ways and both deliver some function $\frac{\partial k}{\partial B}$. Our goal is to show that we have interior solution. The solutions from $\frac{\partial k}{\partial B}$ from 5.23 and 5.32 must make sense together. When we put those equal and make algebraic reorganization we obtain the following result:

$$-\left((1+r(k))\beta - 1\right)(1-\tau)r'(k)\beta u_{t+1} = r(k)\left((1+r(k))^2\beta^2 u''_{t+1} + u''_t\right) \tag{5.33}$$

The equation only makes sense when both sides have same sign. It is clear that the right hand side of 5.33 is negative if $r(k) > 0$ which we assume. We also assume $r'(k) < 0$ because it is the property of the production function. As we see it is also necessary that $(1+r(k))\beta - 1 < 0$ the left hand side to be negative and thus the equation to make sense. Combining what was mentioned above, it is clear, that β must be small enough. As for myopia we expect β to be between one and zero we see that this result is possible and in line with our assumptions. This is a significant change to our previous chapter where contribution rate and private savings behaved like perfect substitutes with different price (cost). This results shows that if the assumptions are fulfilled, the optimal choice for a consumer may be a mix of both pension systems. The most important conclusions of this model are then:

- If the government increases the obligatory contribution rate it crowds out private savings and thus decreases capital accumulation.
- With neo-classical production function and myopia strong enough, the working generation may prefer both, the positive private savings and positive contribution rate for social insurance.

Chapter 6

Myopia and Capital Market Lobby

After I have shown the reaction of savings on the contribution rate and also presented that both can be imperfect substitutes (both can be in optimal case positive at the same time) let me focus on the capital markets and their role in political economy of pension reform. We see that the firms on the capital market have an incentive to lobby the government to decrease the obligatory contribution rate as it can increases the private savings which are then put on the capital markets. In this chapter I will show the interaction of capital markets and the government as they reach an equilibrium in the economy where the firms on the capital markets join into an interest group and lobby the government. There is a limited number of companies operating on the market and thus we assume that it is easier for them to organize themselves into a interest group and lobby the government. On the other hand there is many individuals that are divided into three generations and it is much more difficult for them to overcome the free-riding problem and thus we assume them not organized. This capital market interest group then interacts with the government and lobbies for lower obligatory contribution rate. In the chapter 3, I introduced an interest group model from Kemmerling & Neugart (2009) which elegantly and relatively simply shows the influence of capital markets on the political process of decision making about pension scheme. Now, I would like to analyze how the presence of myopic agents changes the outcome of the model and adjust the model to correspond to the analyses I did so far. Moreover I will add a discussion the objectives of the government. For more clarity and simplification I will assume the saving to be only withdrawn in the last period. In this model the consumers do not decide about the contribution rate in any way, but the government

does. The myopia may be introduced as a **different discount factors of the government (*paternalistic* government) and consumers**. Let me recall the basic setting of the model.

6.1 Financial Market Companies

There are financial market companies who benefit from lower social security system run by the state. There is no change due to myopia, so thus we can recall its form:

$$V_{i,t} = \mu S_{i,t} - C_{i,t}, \tag{6.1}$$

where $C_{i,t}$ are the payments the private firm transfers on the government for conducting a policy $\tau_{i,t}$, μ is the payment firms get from households for the management of the funds on the capital market and $S_{i,t}$ is a share of total new savings in time t which are managed by company i. The capital market companies will truthfully reveal their profits and will contribute all the gain they receive from the change of the contribution rate $\mu \frac{dS_{i,t}}{d\tau}$.

6.2 The Government

The objective function of the government is composed by two parts. Firstly the utility of living generation which is important for the reelection and secondly from direct contributions from firms in financial sector benefiting from private savings. The government thus maximizes:

$$\max_{\tau} \lambda W(\tau) + (1-\lambda) \sum_{i} C_{i,t}. \tag{6.2}$$

It is common in the literature (e.g. Grossman & Helpman (1998)) the λ describes the weights government puts on the gain from the financial markets and the future prospects to be reelected. The $W(\tau)$ represents in this case the part of the governments utility function where he wants to please the households and thus increase its probability to be reelected. On the other hand his prospects to be reelected also increase with the funds he puts into the campaign. The term $\sum_i C_{i,t}$ is the contribution of the financial markets which can then be used in the election campaign. The government can think about $W(\tau)$ in several ways. In the original paper Kemmerling & Neugart (2009) the government maximizes the current welfare of all living generations and

thus behaves opportunistically. In this case the government accepts that the older generations does not maximize its life-long utility because it has already some sunk costs invested in previous period (s_{t-1}^{t-1}). In this setting the $W(\tau)$ changes to similar equation as in original model:

$$W(\tau, S) = U_t^t(c_t^t, c_{t+1}^t, c_{t+1}^t, c_{t+2}^t) + U_t^{t-1}(c_t^{t-1}, c_{t+1}^{t-1}) + U_t^{t-2}(c_t^{t-2}) \tag{6.3}$$

The respective utility function inside $W(\tau)$ can also differ according to the perception of the myopia by the government. Either it can be *paternalistic* and thus set the real discount factor 1, or might not distinguish the myopia from usual discount factor and maximize the myopic preferences of households. In this work we assume that the government is paternalistic. Recall that the respective utility functions would thus look like:

$$\begin{aligned} U_t^t(\tau) &= u_t^t(c_t^t) + u_{t+1}^t(c_{t+1}^t) + u_{t+2}^t(c_{t+2}^t) && (6.4)\\ U_t^{t-1}(\tau) &= u_t^{t-1}(c_t^{t-1}) + (u_{t+1}^{t-1}(c_{t+1}^{t-1})) && (6.5)\\ U_t^{t-2}(\tau) &= u_t^{t-2}(c_t^{t-2}) && (6.6) \end{aligned}$$

I will be calling this case paternalistic but opportunistic government. It is paternalistic because it works with the real discount factor of consumers 1, but it is opportunistic because it does not want to set $W(\tau)$ socially optimal (at least in the part $W(\tau)$.

The government can also maximize $W(\tau)$ as a social optimum. As already described in chapter 4, this is equivalent to maximize the utility of the youngest generation (no sunk cost and thus limited time horizon problem) and he behaves in a paternalistic way. this corresponds to maximization of only 6.4. Further in the text this government will be denoted as a welfare maximizer, even though it is imprecise because he maximizes social welfare only in one part of his objective function.

6.3 Households

Households in the model are myopic and thus they maximize:

$$\begin{aligned} & u_t^t(c_t^t) + \beta[u_{t+1}^t(c_{t+1}^t) + u_{t+2}^t(c_{t+2}^t)] && (6.7)\\ & u_t^{t-1}(c_t^{t-1}) + \beta(u_{t+1}^{t-1}(c_{t+1}^{t-1})) && (6.8)\\ & u_t^{t-2}(c_t^{t-2}). && (6.9) \end{aligned}$$

The budget constraints of respective households have slightly different form than in previous chapters, because of the premium they pay to capital markets:

$$\begin{aligned} c_t^t &= (1-\tau)w - (1+\mu)s_t^t && (6.10)\\ c_{t+1}^t &= (1-\tau)w - (1+\mu)s_{t+1}^t && (6.11)\\ c_{t+2}^t &= P(\tau,n) + (1+r)s_{t+1}^t) + (1+r)^2 s_t^t && (6.12)\\ c_t^{t-1} &= (1-\tau)w - (1+\mu)s_t^{t-1} && (6.13)\\ c_{t+1}^{t-1} &= P(\tau,n) + (1+r)s_t^{t-1} + (1+r)^2 s_{t-1}^{t-1} && (6.14)\\ c_t^{t-2} &= P(\tau,n) + (1+r)s_t^{t-2} + (1+r)^2 s_{t-2}^{t-2} && (6.15) \end{aligned}$$

The households in this case decide only about their savings, the contribution rate is decided solely by the government. Nevertheless the household take the contribution rate into consideration and adjust their savings given the size of obligatory state pension scheme. The budget is balanced and thus the state pension is given by:

$$P(\tau,n) = \left((1+n) + (1+n)^2\right) w\tau = Nw\tau. \tag{6.16}$$

6.4 Political Economy Equilibrium

Timing To make the model clearer let me define the timing of the actions:

1. The lobbyist offer government set of preferred policies τ, which they want to be implemented in exchange for respective contributions $C_{i,t}$
2. The government decides on the policy τ according to his objective function and expected reaction of the households
3. The households decide about their savings

The political economy equilibrium will be described by the same F.O.C. as in original Kemmerling & Neugart (2009):

$$\lambda \frac{dW(\tau,s)}{d\tau} + (1-\lambda)\sum_i \mu \frac{dS_{i,t}}{d\tau} = 0 \tag{6.17}$$

and because all the firms on the capital market gets the same share we can take them altogether as a one industry and rewrite 6.17 without the sum:

$$\lambda \frac{dW(\tau, s)}{d\tau} + (1-\lambda)\mu \frac{dS_t}{d\tau} = 0 \tag{6.18}$$

Even though we do not see any β in the equation it is already present in the second term which describe the reaction of savings. The savings of the consumers are affected by myopia.

6.4.1 Effect on Savings

I will now analyze the second part of 6.18. In this part there is significant role of myopia, because consumers decide about their optimal savings which are for them difficult to control. The F.O.C.s with the respect to savings for the youngest generation:

$$\left[s_t^t\right] \quad : \quad -\frac{\partial u_t^t(\cdot)}{\partial c_t^t}(1+\mu) + (1+r)^2\beta \frac{\partial u_{t+2}^t(\cdot)}{\partial c_{t+2}^t} = 0 \tag{6.19}$$

$$\left[s_{t+1}^t\right] \quad : \quad -\frac{\partial u_{t+1}^t(\cdot)}{\partial c_{t+1}^t}(1+\mu) + (1+r)\beta \frac{\partial u_{t+2}^t(\cdot)}{\partial c_{t+2}^t} = 0 \tag{6.20}$$

Using 6.19 and 6.20 and implicit function theorem we will again get the reaction of the savings on the change in the social contribution rate τ:

$$\frac{\partial s_t^t}{\partial \tau} = -\frac{u_t^{t''}(1+\mu) + ((N)\,w)\,\beta u_{t+2}^{t''}}{u_t^{t''}(1+\mu)^2 + \beta(1+r)^4 u_{t+2}^{t''}} < 0 \tag{6.21}$$

$$\frac{\partial s_{t+1}^t}{\partial \tau} = -\frac{u_{t+1}^{t''}(1+\mu) + ((N)\,w)\,\beta u_{t+2}^{t''}}{u_{t+1}^{t''}(1+\mu)^2 + \beta(1+r)^2 u_{t+2}^{t''}} < 0 \tag{6.22}$$

We see that the effect of higher contribution rate for the youngest generation is weaker for the savings in the first period s_t^t. It is given by the fact that the contribution from the first period have higher effective savings rate and the cost are the same for both periods. We also again clearly see that the change in savings is again negative (decreasing marginal utility). So the crowding out effect is present.

Interesting question might be how does the reaction of savings to the contribution rate $\frac{\partial s_t^t}{\partial \tau}$ and $\frac{\partial s_{t+1}^t}{\partial \tau}$ changes with the degree of myopia. Let me

denote the reactions as $Q_1 = -\frac{\partial s_t^t}{\partial \tau}$ and $Q_2 = -\frac{\partial s_{t+1}^t}{\partial \tau}$. So the Q_i denotes the size of the effect of the change of contribution rate on savings. So we want to know whether the myopia multiplies or mitigates this effect. The answer will give us differentiation:

$$\frac{\partial Q_1}{\partial \beta} = w(1+r)^2(1+\mu)u_t^{t\prime\prime}u_{t+2}^{t}{}^{\prime\prime}\frac{N(1+\mu)-(1+r)^2}{\left(u_t^{t\prime\prime}(1+\mu)^2+\beta(1+r)^4u_{t+2}^{t\prime\prime}\right)^2} \quad (6.23)$$

$$\frac{\partial Q_2}{\partial \beta} = w(1+r)(1+\mu)u_{t+1}^{t}{}^{\prime\prime}u_{t+2}^{t}{}^{\prime\prime}\frac{N(1+\mu)-(1+r)}{\left(u_{t+1}^{t}{}^{\prime\prime}(1+\mu)^2+\beta(1+r)^2u_{t+2}^{t\prime\prime}\right)^2} \quad (6.24)$$

We see that myopia has boosting effect on the change of savings related to rise in contribution rate in these cases:

$$N(1+\mu) > (1+r)^2 \quad (6.25)$$

$$N(1+\mu) > (1+r) \quad (6.26)$$

The 6.25 holds for the savings in the first period. It very much resembles the Dynamic inefficiency condition. As well for the second generation the myopia has boosting effect on the savings in the second period only in the case the return on saved asset is higher then the return from higher state contribution which is to be seen in 6.26. This means that if 6.25 or 6.26 holds and the government increases the contribution rate then savings in the first and/or the second period respectively decreases. The decrease is higher by myopic agents than by those who do not suffer with shortsightedness. In the opposite case the myopia would mitigate the crowding out effect. This very much determines the activity of capital markets, because the government decides about the contribution rate indirectly based on this crowding out effect. The effect on the middle generation's savings is very similar as in the case of the second period young generation:

$$\frac{\partial s_t^{t-1}}{\partial \tau} = -\frac{u_t^{t-1\prime\prime}(1+\mu)+(Nw)\,\beta u_{t+1}^{t-1\prime\prime}}{u_t^{t-1\prime\prime}(1+\mu)^2+\beta(1+r)^2u_{t+1}^{t-1\prime\prime}} < 0 \quad (6.27)$$

and $Q_3 = -\frac{\partial s_t^{t-1}}{\partial \tau}$. The reaction of Q_3 on β thus looks like:

$$\frac{\partial Q_3}{\partial \beta} = w(1+r)(1+\mu)u_t^{t-1\prime\prime}u_{t+1}^{t-1\prime\prime}\frac{N(1+\mu)-(1+r)}{\left(u_t^{t-1\prime\prime}(1+\mu)^2+\beta(1+r)^2u_{t+1}^{t-1\prime\prime}\right)^2} \tag{6.28}$$

and the condition remains as in 6.26.
The oldest generation cannot suffer from myopia and thus there are no conditions for the oldest generation.

All in all we can see that, from the household point of view the myopia might both help the capital market as well damage them it all depends on the parameters of the economy. Nevertheless the activity of the capital markets will depend also on the type of the government it faces.

6.4.2 Direct Effect on Consumers

I will now analyze the direct effect of higher contribution rate on the consumers which is described by 6.18. I have introduced two different government behaviors and the equilibrium conditions slightly differ for each of them. Let me divide the the first term from 6.18 into three parts:

$$\frac{dW(\tau,s)}{d\tau} = O_t + M_t + Y_t \tag{6.29}$$

Where these represents the direct marginal effects of the change of the contribution rate on the respective generations.
When the government is paternalistic but opportunistic, does not count with the myopia of the households. The government uses his discount factor (governments $\beta = 1$). Nevertheless he maximizes the current welfare of all three generations because it is opportunistic. The reaction changes to the models in the chapter 4 because we allow the saving rate to change with respect to the contribution rate as was shown in chapter 5. We begin with the youngest generation again (the subscript *po* stays for paternalistic opportunistic):

$$\begin{aligned} Y_{t,po} &= \frac{\partial u_t^t(\cdot)}{\partial c_t^t}\left(-w-(1+\mu)\frac{\partial s_t^t}{\partial \tau}\right)+\frac{\partial u_{t+1}^t(\cdot)}{\partial c_{t+1}^t}\left(-w-(1+\mu)\frac{\partial s_{t+1}^t}{\partial \tau}\right)+ \\ &+ \frac{\partial u_{t+2}^t(\cdot)}{\partial c_{t+2}^t}\left((1+r)^2\frac{\partial s_t^t}{\partial \tau}+(1+r)\frac{\partial s_{t+1}^t}{\partial \tau}+Nw\right), \end{aligned} \tag{6.30}$$

where $N = (1+n) + (1+n)^2$. As we can expect the $\frac{ds_i}{d\tau} < 0 \; \forall i$ in the first period there is the marginal effect of increased consumption multiplied by the decrease the funds due to taxation (w) and in the other direction affecting change of the savings $(1+\mu)\frac{ds_t^t}{d\tau}$, because $\frac{ds_t^t}{d\tau}$ is assumed to be negative and thus the consumer leaves more for current consumption). In the last period there is only positive utility from higher contributions of younger generations.

The middle generation is already bit less complicated and the direct marginal effect of the change in the contribution rate is:

$$\begin{aligned} M_{t,po} &= \frac{\partial u_t^{t-1}(\cdot)}{\partial c_t^{t-1}} \left(-w - (1+\mu)\frac{\partial s_t^{t-1}}{\partial \tau} \right) + \\ &+ \frac{\partial u_{t+1}^{t-1}(\cdot)}{\partial c_{t+1}^{t-1}} \left((1+r)^2 s_{t-1}^{t-1} + (1+r)\frac{\partial s_t^{t-1}}{\partial \tau} + Nw \right) \end{aligned} \tag{6.31}$$

The interpretation of these terms is the same as in the case of the youngest generation.

The oldest generation is straight-forward as in has only the positive utility from contributions of younger generations:

$$O_{t,po} = \frac{u_t^{t-2}(\cdot)}{c_t^{t-2}} (Nw) \tag{6.32}$$

The second type of the government is the quasi social welfare maximizer. As for $W(\tau)$, it takes into account only life long utility of the youngest agents, moreover it adjusts it for myopia. In his case there is only effect on the youngest generation and this effect is same as by $Y_{t,po}$. We have then that $Y_{t,so} = Y_{t,po}$ and $M_{t,so} = 0$ and $O_{t,so} = 0$.
To determine in which case the $\frac{dW(\tau,s)}{d\tau}$ is highest (and thus the least convenient for the capital markets) we use analogy to what we have in chapter 4. Y_t will be positive only in the case when $N(1+\mu) > (1+r)^2$. In this case also M_t is positive. Because we have $\beta < 1$ than value of $\frac{dW(\tau,s)}{d\tau}$ is highest by the opportunistic paternalistic government. In the opposite case (and more likely case) $N(1+\mu) < (1+r)^2$ the capital markets would be least successful by the social maximizing government. Wee see again the importance of the parameters of the economy and again we see one more modification

of the dynamic efficiency condition.

6.4.3 Value of Contribution

The relation of the weight the government puts on welfare of its consumers and the social contribution rate does not differs only indirectly compared to the original in the paper Kemmerling & Neugart (2009). I will use the F.O.C. of the government 6.17 and denote it by H. Recall that:

$$H = \lambda \frac{dW(\tau, s)}{d\tau} + (1 - \lambda)\mu \frac{dS}{d\tau} = 0 \tag{6.33}$$

and thus using implicit function theorem we would have:

$$\frac{\partial \tau}{\partial \lambda} = -\frac{\frac{\partial H}{\partial \lambda}}{\frac{\partial H}{\partial \tau}} \tag{6.34}$$

where the numerator is:

$$\frac{\partial H}{\partial \lambda} = \frac{dW(\tau, s)}{d\tau} - \mu \frac{dS}{d\tau} \tag{6.35}$$

which is always positive because $\frac{dW(\tau,s)}{d\tau}$ is positive and $\mu \frac{dS}{d\tau}$ was shown is negative. The denominator is:

$$\frac{\partial H}{\partial \tau} = \lambda \left(\frac{\partial Y_t}{\partial \tau} + \frac{\partial M_t}{\partial \tau} + \frac{\partial O_t}{\partial \tau} \right) + (1 - \lambda)\mu \frac{\partial}{\partial \tau} \frac{\partial S}{\partial \tau}. \tag{6.36}$$

Because of linear linear savings behavior the second term is zero and it is straight forward that $\frac{\partial Y_t}{\partial \tau} < 0$, $\frac{\partial M_t}{\partial \tau} < 0$ $\frac{\partial O_t}{\partial \tau} < 0$ because of decreasing marginal utility. The effect of λ on τ did not qualitatively change (the sign remains same. It only changed slightly through the change in $\frac{\partial S}{\partial \tau}$.

In this chapter, I showed that the Myopia changes the extent of activity of the interest group composed by the firms on the capital market. However, we cannot determine the direction of the change. This depends on the parameters of the economy. What we can determine is, that the capital market lobby has more chances to be successful (and thus we can expect more lobbying) when the government believes that the policy which helps him to

be re-elected is to be social welfare maximizer. Opportunistic governments tend to higher obligatory contribution rates.

Conclusion

The thesis presented political economic equilibria of pension system when the agents are myopic and evaluated thus the political sustainability of pensions system. Myopia was introduced as a type of time inconsistent preferences where the consumers are able to prepare time optimal consumption plan, but they are not able to behave in accordance with such a plan and instead they pursue immediate gratification. In the first parts of the thesis I provided background information about pension systems and I presented basic literature review. In the fourth chapter, I adjusted the basic 3 generations overlapping model for the presence of classical myopia, when the consumers could commit themselves to obligatory contribution into public pension system or they have to rely on their ability to save. The biggest advantage of the public pension system in this setting is, that it serves as a commitment device for the myopic consumers, which helps them to overcome their time inconsistency. Myopia effect adjusted the classical dynamic efficiency condition more in favor of PAYG systems in the cases when the median voter is present in the youngest or middle generation (no gerontocracy). Afterwards I also discussed the effect of pension pessimism. This is also one of the form of myopia, when the consumers suffer from irrational idea that the government will not fulfill its commitment. In this case the model moved the dynamic efficiency condition in the opposite direction then the classical myopia. Both the models showed that the household only choose one way to save for their pensions. Either they save in state run contribution system or they save on their own. No mixing strategy was possible. This was given because of constant returns on savings.

To overcome the problem with constant return on savings I introduced production function in the fifth chapter. After simplifications on the consumer side I was able to show the crowding out effect (the increase of contribution rate decreases the total amount of capital in the economy). However this was only one step (moreover myopia independent) to show that the

myopic consumer in a dynamic efficient economy may prefer a mix of both means of saving for his retirement (state run system together with private pensions), but only when he is myopic enough.

Both results from the fifth chapters, the crowding out effect and possibility of mixing, lead to the role of capital markets in the economy. The capital markets work with the savings of the households and as the government crowds out private investment when the public social system expands, the capital markets are damaged. It is clear that they will try to persuade the government to imply such a policy that they can increase their profits. For the purpose of this thesis, I adjusted a simple lobbying model from Kemmerling & Neugart (2009) to show how the interaction with the government and capital markets may look like. I found out that the extent of activity of capital markets very much depends whether the government behaves as a social welfare maximizer or is opportunistic and maximizes the aggregate welfare of all currently living generations or whether it shares myopia with households.

Bibliography

ANDERSEN, T. & J. BHATTACHARYA (2008): "On Myopia as Rationale for Social Security." *Economic Theory* pp. 1–24.

BARR, N. & P. DIAMOND (2006): "The economics of pensions." *Oxford Review of Economic Policy* **22(1)**: p. 15.

BECKER, G. (1983): "A theory of competition among pressure groups for political influence." *The Quarterly Journal of Economics* **98(3)**: p. 371.

BECKER, G. (1985): "Public policies, pressure groups, and dead weight costs." *Journal of public economics* **28(3)**: pp. 329–347.

BOADWAY, R. & D. WILDASIN (1989): "A median voter model of social security." *International Economic Review* **30(2)**: pp. 307–328.

BOLDRIN, M. & A. RUSTICHINI (2000): "Political equilibria with social security." *Review of Economic Dynamics* **3(1)**: pp. 41–78.

BREYER, F. & W. BUCHHOLZ (2008): *Ökonomie des Sozialstaats*. Springer.

BROWNING, E. (1975): "Why the social insurance budget is too large in a democracy." *Economic inquiry* **13(3)**: pp. 373–388.

CAMPBELL, J. & N. MANKIW (1989): "Consumption, income and interest rates: Reinterpreting the time series evidence." *NBER Macroeconomics Annual* **4**.

CASAMATTA, G., H. CREMER, & P. PESTIEAU (2000): "The political economy of social security." *Scandinavian Journal of Economics* **(102)**: pp. 503–522.

COOLEY, T. & J. SOARES (1999): "A positive theory of social security based on reputation." *Journal of Political Economy* pp. 135–160.

CREMER, H. & P. PESTIEAU (2010): "Myopia, redistribution and pensions." *European Economic Review* .

D'AMATO, M. & V. GALASSO (2010): "Political intergenerational risk sharing." *Journal of Public Economics* **94(9-10)**: pp. 628–637.

DOWNS, A. (1957): "An economic theory of political action in a democracy." *The Journal of Political Economy* **65(2)**: pp. 135–150.

FELDSTEIN, M. (1985): "The optimal level of social security benefits." *The Quarterly Journal of Economics* **100(2)**: p. 303.

GALASSO, V. & P. PROFETA (2002): "The political economy of social security: a survey." *European Journal of Political Economy* **18(1)**: pp. 1–29.

GROSSMAN, G. & E. HELPMAN (1998): "Intergenerational Redistribution with Short-lived Governments." *The Economic Journal* **108(450)**: pp. 1299–1329.

HANSSON, I. & C. STUART (1989): "Social security as trade among living generations." *The American Economic Review* **79(5)**: pp. 1182–1195.

HU, S. (1982): "Social security, majority-voting equilibrium and dynamic efficiency." *International Economic Review* **23(2)**: pp. 269–287.

KAPLOW, L. (2010): *The theory of taxation and public economics*. Princeton Univ Press.

KEMMERLING, A. & M. NEUGART (2009): "Financial market lobbies and pension reform." *European Journal of Political Economy* **25(2)**: pp. 163–173.

MULLIGAN, C. & X. S. I MARTIN (1999): "Gerontocracy, retirement, and social security." *NBER Working Paper No. 7117* .

O'DONOGHUE, T. & M. RABIN (1999): "Procrastination in Preparing for Retirement." *Behavioral dimensions of retirement economics* p. 125.

O'DONOGHUE, T. & M. RABIN (2000): "The economics of immediate gratification." *Journal of Behavioral Decision Making* **13(2)**: pp. 233–250.

PERSSON, T. & G. TABELLINI (2002): *Political economics: explaining economic policy*. The MIT press.

PHELPS, E. & R. POLLACK (1968): "Myopia and inconsistency in dynamic utility maximization." *Review of Economic Studies* **25**: pp. 201–208.

SAMUELSON, P. (1958): "An exact consumption-loan model of interest with or without the social contrivance of money." *The journal of political economy* **66(6)**: pp. 467–482.

SAMUELSON, P. (1975): "Optimum social security in a life-cycle growth model." *International Economic Review* **16(3)**: pp. 539–544.

SJOBLOM, K. (1985): "Voting for social security." *Public Choice* **45(3)**: p. 225240.

TABELLINI, G. (2000): "A positive theory of social security." *Scandinavian Journal of Economics* **102(3)**: pp. 523–545.

VEALL, M. (1986): "Public pensions as optimal social contracts." *Journal of Public Economics* **31(2)**: pp. 237–251.