REFORMS OF SOCIAL SECURITY SYSTEM:
INTERGENERATIONAL EFFECTS.
CASE OF UKRAINE

by

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Abstract

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Different reform options would have distinct effects on various generations. Usually older generations would prefer debt-financed transition to FF system, while younger generations would favor tax-financed transition. It appears that although tax-financed transition lowers tax burden for the younger generations and increases it for the older generations, bond-financed transition would decrease tax burden more than tax-financed transition for each generation in Ukraine.

This can be explained by population structure and the long duration of the debt-servicing period. On the one hand, there will be an increase in labor for two decade after 2001. Therefore, the young generations of 2001 would prefer to postpone the repayment of the debt, because in several years there will more workers to repay this amount of debt.

On the other hand, the debt is repaid in 50 years beginning from 2001 or even from 2011, while people work on average 45 years. Therefore, it is advantageous for generations to place the largest possible burden to the end of repayment period, so the tax burden is placed not on them, but on future generations. Such a possibility is given by bond-financed transition.

TABLE OF CONTENTS

LIST OF FIGURES

Appendix graphs

ACKNOWLEDGMENTS

GLOSSARY

Demographic Old Age Dependency Ratio (DDR). The number of people 60 years and over divided by people aged between 20 and 59 years.

Fully Funded System. Social security system that is based on individual pension contributions that would be invested by the Pension Fund into securities. Personification provides that the contributions of each employer are recorded in an individual account, and the future pension depends on the contribution made by the worker during her lifetime.

Pay-as-You-Go system (PAYGO) Pension system that uses current contributions into the Pension Fund for paying pension benefits.

Replacement Ratio. The ratio of average pension to average wage in a country.

System Dependency Ratio (SDR). The number of pensioners, including widows, orphans and disability pensioners, divided by number of contributors.

INTRODUCTION

As the share of pensioners in the population increases in developed and developing economies, the issue of how to protect elder population and not to depress growth at the same time has become increasingly important for economists and policymakers. In most countries there is a pay-as-you-go (PAYG) social security system, which means that current workers pay for current retirees. However, as population is aging, higher and higher taxes are needed to keep the system in balance. An alternative to PAYGO is fully funded (FF) social security system. In this case, workers save during their working lives, and consume what they saved during retirement periods.

The transition to FF system may help to avoid high taxes in the future. First, the tax does not depend on population growth, as in the case of PAYGO system. Therefore, aging population would not induce government to raise taxes, because each worker already saved for retirement benefits. Second, workers would consider tax to FF social security system as forced saving, which reduces the overall amount of perceived taxes [Sachs, 1997]. The reason for this is that unlike PAYGO system there is direct link between contributions and benefits under FF system. A decrease in the perceived tax level would reduce labor market distortions, increasing labor supply in the economy. Finally, for the same reason FF social security system is viewed as a powerful incentive for people to work in a formal sector. In other words, FF system may help to reduce the informal sector considerably, because workers would receive pension benefits only if they worked in formal sector of the economy.

However, the transition from PAYGO to FF system creates a large debt to generations, which did not have time to save for their retirement.

I investigate how different modifications of reforms of social security (SS) system may influence welfare of different generations and the whole

population. Having data about the tax burden placed on each generation, the government will be able to decide whether transition is necessary, whether it is sustainable and which social security reform is preferable. Clearly, this decision would depend on whether the government wants to distribute tax payments equally or it prefers to place lower tax burden on current or future generations.

It is usually thought that there are two possibilities of financing the SS transition. Current generations may finance it through the additional taxes or the government may issue bonds to finance debt. [Dornbush, 1996] Both ways have disadvantages. In the first case, excessive taxation may bring a developed economy into a recession. The latter may be fraught with a crowding-out effect.[Mankiw, 1994]

My study investigates different methods of transition for developing economies on the example of Ukraine and evaluate influence of the pension reform options on different generations and the whole population. Usually the retirement age is very low in developing economies. Transition coupled with an increase in retirement age should considerably reduce the amount of debt created.

I find that current PAYGO system of Ukraine will require SS taxes to double during 50 years to be in balance. The next 10 years appears to be a favorable period for reforms. Although any transition coupled with an increase in retirement age will make the situation better off, the largest decrease in tax burden will be achieved if the reform is implemented now, rather than later.

There are intergenerational effects as result of a pension reform. Not each generation will enjoy an increase in net income due to reforming SS system. Typical members of older generations would probably prefer no reform at all to transition to FF system and an increase in retirement age financed by taxes on current generations. These generations should favor debt-financed transition, which decrease tax burden considerably for these generations. Although tax-financed reforms lower the tax burden of younger generations,

debt-financed transition does it even better. It appears that debt-financed transition to FF system may lower tax burden for each generation.

In the first chapter, I present a relevant theory and survey of literature. The second chapter describes a stylized model of a pension system. On the simple example of five generations, I show the effect of different transition options on the tax level and the debt to current generations. This model shows the technique, which is later used in a large 100-generations[1] model of Ukraine. Chapter 4 provides a description of current Ukrainian pension system. Then I describe the data and method used for the model of Ukrainian pension system. Empirical results for Ukraine are presented in the sixth chapter. The last chapter contains conclusions and policy implications.

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[1] 100 generations (birth cohorts) live simultaneously. Each year one (100-years old) generation dies and one generation is born.

THESIS QUESTION, THEORY AND SURVEY OF LITERATURE

1.1 Thesis Question

I want to investigate how different modifications of reforms of Social Security (SS) system may influence tax burden of various generations and a whole population. Having data about the tax burden in each period, the government will be able to decide:

➢ whether SS transition is necessary;

➢ whether it is sustainable;

➢ which social security reform is preferable.

Clearly, this decision would depend on whether the government wants to distribute tax payments equally or prefers to place lower tax burden on current or future generations.

I study the reform options, which are considered by Ukrainian government. There are debates in Ukraine whether to reform the SS system now, or to do this later, and which method of financing to choose. Investigation of the following reform options may give the answer:

➢ Current PAYGO[2]: maintaining status quo;

➢ PAYGO: increase in retirement age in 2001;

➢ An increase in retirement age[3] in 2001, transition to FF[4] system in 2001: transition financed by the current generations;

➢ An increase in retirement age in 2001, transition to FF system in 2001: government issues debt, the same amount of debt is repaid each period;

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[2] See Glossary for the definition

[3] The description of the increase in retirement age is given in Ch.2 *Model, Data and Method*

[4] See Glossary for the definition

➤ An increase in retirement age in 2001, transition to FF system in 2001: government issues debt, repayment of the debt is postponed by 10 years;

➤ Increase in retirement age in 2011, transition to FF system in 2011: transition financed by the current generations;

➤ Increase in retirement age in 2001, transition to FF system in 2011: transition financed by the current generations.

Tax burden is measured by tax payments as a share of wages for 50 years in my analysis. For the reform options with an increase in retirement age, the change in this ratio, ceteris paribus, can be used as a proxy for changes in welfare, since there is no source of wealth other than disposable income and SS benefis in my model.

My hypotheses are the following:

Hypothesis 1.1. Current SS system of Ukraine will require a permanent increase in tax. Privatizing social security coupled with an increase in retirement age will solve this problem. An alternative hypothesis is that transition to FF system will pose even greater tax burden on the Ukrainian population.

Hypothesis 1.2. If the above hypothesis 1.1 holds, then current implementation of SS reform provides a lower tax burden on the population than delayed execution. An alternative hypothesis is that it is advantageous for population to postpone SS reforms.

Hypothesis 2.1. SS tax burden is distinct for various generations in different pension reform options. An alternative statement is that the distribution of tax burden among generations is the same in each scenario. In other words, there are no intergenerational effects of reforms.

Hypothesis 2.2. If the above hypothesis 2.1 holds, I make another hypothesis that young and old generations would prefer different reform scenarios. While bond-financed transition is favorable for older generations, younger

generations would prefer tax-financed transition, if their preferences based solely on the amount of tax burden.

These hypotheses reflect the debates that are hold in Ukraine now. Verifying which of them are held may help the government to make the decision about the way of reforming Ukrainian pension system.

1.2. Theory and Survey of Literature

As populations age, public pension plans consume a large share of total tax revenues. These plans thus have major effects on labor and its productivity, on capital accumulation and its allocation, on the ability of the government to finance public goods and services – and therefore on the growth of the economy.[World Bank, 1996]

A public scheme that is financed through a payroll tax provides incentives for employers to reduce their hiring of labor, for workers to escape to the informal sector, and for covered workers to retire early. PAYGO method of finance breaks the link between benefits and contributions. If benefits were truly contingent on contributions and valued as much, the payroll tax would be viewed as a price, not a tax, and would have fewer distortionary effects on the labor market.[Sachs, 1997]

PAYGO system can hurt savings because of the unanticipated increased consumption of the first generation of eligible retirees and anticipated income transfer in the form of high pensions to the first generation of working age members. Consider possible wealth effects from an increase in retirement benefits, which are financed by higher taxes on workers. Old persons experience an increase in the present value of their security benefits net of taxes. They therefore respond to the increase in wealth by consuming more. Young people face higher taxes, partly offset by the expectation of higher retirement benefits. Because of this offset, the decrease in wealth for the young is smaller in magnitude than the increase for the old. Hence, the decrease in consumer demand by the young tends to be smaller in magnitude than the increase by the old. Aggregate consumer demand therefore tends to

6

rise, or, equivalently, the aggregate of desired saving falls. The real interest rate increases accordingly, and net investment decreases. In the long run, these decrease in investment shows up as a smaller stock of capital. [Barro, 1997] But even if existing PAYGO systems have had little negative impact on saving relative to the no pension state, they are a opportunity lost to increase long-term savings through large mandatory funded plans [World Bank, 1994].

In a PAYGO system, society as a whole does not save for the future. Since contributions are immediately disbursed, no productive capital is created. So, while social security forces some people to "save" who otherwise would not, it also reduces the effectiveness of investment by those who would have saved anyway by a remarkable amount. [World Bank, 1994]

In countries with young populations and immature systems, public pension funds run surpluses that can finance the provision of public goods. However, since the tax is not transparent, the wrong public goods with low social value may be chosen. In countries with older populations and mature systems, public pension funds may reduce the provision of important public goods, because they run deficits covered by the general treasury. [World Bank, 1994]

Transition to FF system may solve these problems. First, privatizing social security can generate major long-run increases in output and living standards. Second, although the long-run gains from privatization are larger if privatization redistributes resources from initial to future generations, the pure efficiency gains from privatization are also substantial. Efficiency gains refer to the welfare improvement available to future generations after existing generations have been fully compensated for their losses from privatization. These results are obtained by using the Auerbach-Kotlikoff Dynamic Life-Cycle Model. [Kotlikoff, 1996].

However, a transition from PAYGO pension system to a privatized social security system would not yield an immediate economic benefit equal to the difference between the returns under fully prefunded (privatized) and PAYGO social security system [Sachs, 1997]. The efficiency gains to

privatization may occur due to the social security tax reduction and improvement in the labor market efficiency, but not because of the higher return of the prefunded system.

To explain this, Sachs proposed the following simplified two-generation model. A worker pays social security contribution SSC during working age and receives social security benefits SSB in the next generation, when he retired. Let R be the market return on saving (equal to the return under a prefunded scheme), and let IRSS be the implicit return under PAYGO system. IRRS is determined by the following equation:

SSC-SSB/(1+IRSS)=0

The argument, why PAYGO system is undesirable, is because IRSS < R, so member of the young generation lose part of their contributions:

SSC-SSB/(1+R) = SSBURDEN > 0, where SSBURDEN presents the present value of the loss to young generation as result of investing into PAYGO system, not to a prefunded one, which yields higher rate of return.

If an immediate economic benefit were equal to the difference between the returns under fully prefunded (privatized) and PAYGO social security system, then SSBURDEN would be eliminated by shifting to a prefunded system. In a PAYGO system, each generation services implicit social security debt, which lowers average returns of this system. In privatized this debt became explicit, but still should be serviced. In a generationally neutral transition, the following holds:

SSBURDEN = Debt servicing burden on Newly Explicit Debt

Therefore, as long as this debt is taken into account, each generation will face the rate of return lower than R even under a prefunded pension system. As result, there is no Pareto improvement only because previously implicit debt becomes explicit.

In some cases debt issuance may have no effect on economic performance. That is what the Ricardian Equivalence Theorem says: government debt is

equivalent to future taxes, and if consumers are sufficiently forward-looking, future taxes are equivalent to current taxes. [Mankiw, 1994]

This is the case in Solow and Ramsey-Cass-Koopmans models, in which people live infinite lives. The reason that Ricardian equivalence is likely not to be correct is that there is turnover in the population. When new individuals are entering the economy, some of the future tax burden associated with a bond issue is borne by individuals who are not alive when the bond is issued. There are two difficulties with objection to Ricardian equivalence. First, a series of individuals with finite lifetimes may behave as if they are a single household. In particular, if individuals altruistically care about welfare of their descendants and if that concern is sufficiently strong that they make positive bequests, the government's financing decisions may be irrelevant. The second difficulty is that although finite, lifetime is long enough to be a good approximation for Ricardian equivalence to hold. [Romer, 1996]

In the Diamond overlapping-generations model, in which individuals live finite lives, taxes and bonds have different effects on consumption, and as result on savings. When the government cut taxes and issues bonds, the taxes to repay those bonds are levied on future generations. Thus the individuals currently alive are better off, and they therefore increase their consumption [Romer, 1996].

The equilibrium in the Diamond model can be Pareto-inefficient. This possibility stems from the fact that the infinity of generations gives a means of providing for the consumption of the old that is not available for the market. If the marginal product of capital is less than labor force growth, PAYGO system is more efficient than saving, and so the welfare can be improved on the decentralized allocation [Romer, 1996].

There may be significant efficiency gains in tightening the connection between marginal social security taxes paid and marginal social security benefits received, in other words from transition to FF system [Auerbach and Kotlikoff, 1995].

Transition to FF system has marked efficiency gains over PAYGO to the extent that : (1) the payroll tax under PAYGO is not viewed as being linked to the level of benefits; while (2) the individualized contribution under the privatized scheme is viewed as fully linked to benefits, and as infra-marginal to overall household saving decisions. In these cases, the transition to a privatized system achieves a reduction in payroll taxation, with resulting gains in the efficiency of the labor market, which is Pareto improving. These gains are likely to be manifested in a smaller black market, greater labor force participation, less early retirement. [Sachs, 1997]

In most cases, the poor living in the steady state improve their welfare when a redistributive but unfunded system is replaced by a funded pension system that is neutral (i.e. non-redistributive), that is no targeted transfer/progressive tax system remains in the long run. However, the steady –state poor are hurt when debt-financing of the transition is large enough.[Valdes-Prieto, 1994]

The collapse of communism brought PAYGO systems in former centrally planned economies under severe fiscal stress. Declining formal sector employment led to reduced collection of payroll levies, while inflating pension rolls. Benefits shrank to near-social assistance levels, and in some countries (Ukraine) were subject to arrears. Demographic trends, notably low fertility and ageing of populations, threatened even greater stress in the future. Reforms in system terms and conditions, beginning with an increase in standard retirement ages are seen as essential, but in many cases are not sufficient. It is argued that pension reforms most favorable to growth are those forging a link between social insurance contributions and benefits, thereby decreasing the perception of payroll contribution as tax. Privatizing social security is viewed as such pension reform. [Gray and Weig, 1999]

There is a range of papers that investigate Ukrainian pension system:

In order to assess the viability of the current pension system, the case of "status quo", and the impact of different types of reforms the series of simulations were run. Under "status quo" the pension system is not appeared

to be fiscally sustainable. It turned out that an increase in retirement age alone does not provide the sustainability of the pension system, and transition to a fully-funded system is necessary. [Riboud and Chu, 1997]

Including informal sector and behavioral equations does not change the results obtained by Riboud and Chu. The reform should be based on the introduction of the prefunded system combined with an increase in retirement age. However, large informal sector complicated the task. Simulations showed that the lower share of the shadow economy, the higher chances to succeed. [Dobronogov, 1999]

C h a p t e r   2

MODEL, DATA AND METHOD

This chapter provides the detailed explanation of the model that is used to calculate intergenerational effects for Ukraine. The method used in the model for Ukraine is based on *Stylized Model* discussed in Appendix 1. The difference is that the model for Ukraine is built on actual data. The data about population structure, labor market participation rate, pension participation rate and assumptions about real interest rate and wage growth are taken from HIID's pension model (HIID,2000).

The simulations are done in Microsoft Excel. The Excel file contains the data about Ukrainian population and economic indicators for each year in period 1998 – 2050. This allows to calculate SS taxes required to keep the SS system in balance, share of the tax payments in total wages for all population and distinct generations.

2.1. Description of the Scenarios

I study intergenerational effects under the following reform options of Ukrainian pension system:

Scenario 1   Current PAYG: maintaining status quo;

Scenario 2   PAYG: increase in retirement age in 2001;

Scenario 3   Increase in retirement age in 2001, privatized in 2001: transition financed by the current generations;

Scenario 4   Increase in retirement age in 2001, privatized in 2001: government issues debt, the same amount of debt is repaid each period;

Scenario 5   Increase in retirement age in 2001, privatized in 2001: government issues debt, repayment of the debt is postponed by 10 years;

Scenario 6   Increase in retirement age in 2011, privatized in 2011: transition financed by the current generations;

Scenario 7   Increase in retirement age in 2001, privatized in 2011: transition financed by the current generations.

These scenarios are chosen in a way that reflects the current debates about a reform of Ukrainian pension system. Comparison among these scenarios allows evaluating of the hypotheses, which are made in this thesis paper. Using them it is possible to determine timing and method of financing the reform that are preferable for any of the generations or the whole population.

2.2. Assumptions

1) The model is for 1998 – 2050. A hundred generations live concurrently. Each year a new generation emerges, so in my model the definition of a generation is equivalent to a birth cohort.

2) Government makes explicit promise to maintain replacement ratio at 30% level of PAYGO and FF systems.

It means that real average benefits are set to be 30% of real formal average wages. The tax under each reform option is set in such a way that benefits remains the same. This assumption allows comparing reform modifications by tax level and by ratio of total tax payments to total income.

Under such assumption, the debt to current generations is not equal to outstanding pension liabilities. While outstanding pension liabilities is the money that a government owes to pensioners, because they contributed to PAYGO system during their working lives, the debt is calculated as promised benefits minus savings made by people who become pensioners this year. It would be less than the outstanding pension liabilities.

3) Real annual rate of the increase of wages, exogenously set: 0% in 2000, 2% in 2001, 4% in 2002-2012 and 3% thereafter [HIID, 2000].

4) Real interest rate is set to be 5%. This rate is used for calculating present value.

5) Formal sector participation is set to be 50% of the economy. This indicator influences linearly SS taxes under different reform options. Although it does affect the magnitude of tax, it does not influence the ratio of taxes under different reform options. (see *Stylized Model* of Appendix 1)

Formal sector participation is set to be 50% of the economy. This indicator influences linearly SS taxes under different reform options. Although it does affect the magnitude of tax, it does not influence the ratio of taxes under different reform options. (see Stylized Model)

The following statistics from HIID's pension model [HIID, 2000] are used in the calculations:

Population: actual and projected population for years 1998-2050 by age and gender. The data is used to calculate number of workers and pensioners.

Labor participation rate: coefficients of labor market participation for each cohort, male and female, for each year.

Table 2.1. *Labor participation rate for men*

Age	0-19	20-24	25-50	51-54	55-59	60-65	65+
Labor participation rate	0	0.8	0.9	0.8	0.7	0.3	0

Table 2.2. *Labor participation rate for women*

Age	0-19	20-50	51-55	56-59	60-65	65+
Labor participation rate	0	0.8	0.7	0.5	0.3	0

Labor participation rate under an increase in retirement age: projected coefficients of labor market participation for each cohort, male and female, for each year if there is an increase in retirement age. The retirement age increases gradually to 65 for both men and women. After that, the following labor market participation rates are assumed:

Table 2.3. *Labor participation rate for men after an increase in retirement age.*

Age	0-19	20-24	25-60	61-64	65-59	60-70	70+
Labor participation rate	0	0.8	0.9	0.8	0.7	0.3	0

Table 2.4. *Labor participation rate for women after an increase in retirement age.*

Age	0-19	20-64	65-55	65-68	68-70	70+
Labor participation rate	0	0.8	0.7	0.5	0.3	0

Pension participation rate: projected coefficients of participation of elderly in the pension system by each cohort, male and female, for each year.

Table 2.5. *Pension participation rate for men.*

Age	0-55	56-59	60+
Pension participation rate	0	0.025	0.9

Table 2.6. *Pension participation rate for women.*

Age	0-50	51-54	55+
Pension participation rate	0	0.025	0.9

Pension participation rate under an increase in retirement age: coefficients of participation of elderly in the pension system by each cohort, male and female, for each year, for each year if there is an increase in retirement age.

Table 2.7. *Pension participation rate for men after an increase in retirement age.*

Age	0-65	65+
Pension participation rate	0	0.9

Table 2.8. *Pension participation rate for women after an increase in retirement age.*

Age	0-65	65+
Pension participation rate	0	0.9

2.3. Calculations

PAYGO tax is calculated as total real benefits per year divided on total real wages per year:

$$t_i^{PAYGO} = \frac{b_i * N_i^p}{w_i * N_i^l}, \text{ where i – index of the year;}$$

b_i – average real benefits;
w_i – average real wages;
N_i^p - number of pensioners;
N_i^l - number of workers.

This is so because of the assumption that SS system should be always in balance.

Tax for FF system is needed to keep FF Social Security system in balance. The calculation is made for the generation, which is 20 in 2001. The tax is equal to 100*PV(total benefits for the generation)/PV(total real wages for the generation) = 100*PV(total average benefits for the generation)/PV(total average real wages for the generation).

$$t^{ff} = \frac{\displaystyle\sum_{i=2001}^{2080} \frac{b_i * N_i^{p,g}}{(1+r)^{i-2000}}}{\displaystyle\sum_{i=2001}^{2080} \frac{w_i * N_i^{l,g}}{(1+r)^{i-2000}}},$$

where $N_i^{p,g}$ – number of pensioners in the generation in year i;

$N_i^{l,g}$ – number of workers in the generation in year i.

This number is an estimate for average tax for FF system. Note, that the summation is for 80 years, because I assume that a generation lives 100 years and begins to work at 21.

PV of debt created per period.

The amount of debt is calculated in the way different from outstanding pension liabilities. We know that each generation saves t^{ff} *100% of income each period. In my model, by the assumption, the government has an obligation to provide each generation with retirement benefits equal to 30% of the total real formal wage. If a person has some savings for the retirement,

the government would pay only difference between savings and promised benefits. Therefore, discounted value of new debt created per period is equal to the difference between known discounted retirement benefits to be paid this period and sum of discounted savings that people retired this period have made:

$$D_i = \frac{b_i * N_i^{p}}{(1+r)^{i-2000}} - \sum_{k=2001}^{i} \frac{t^{ff} * w_k}{(1+r)^{k-2000}} * N_i^{np} \;,$$

where w_k - average wage in kth period,

N_i^{np} - number of new pensioners in year i.

This requires a several simplifying assumptions that as people retires they receive lump-sum payments equal to their savings. Alternatively, it can be seen as a government has an access to SS savings of pensioners and uses them to pay benefits to all other pensioners.

Additional tax to SS system to finance debt

Additional tax should be placed only when there is a debt that should be financed. Clearly, additional tax is not required under PAYGO option and PAYGO with an increase in retirement age option, because no debt is created. However, if we transit to FF system, we should place additional tax burden on workers to finance the debt. The tax depends on the amount of debt financed and number of working people that year. Additional tax that is necessary to finance transition is equal to (debt to be repaid in the period)/ (total real wages in the period):

$$t_i^{ad} = \frac{D_i}{w_i * N_i^{w}}$$

The amount of debt depends on the way of transition. Then if we transit to FF, total tax to social security would be equal to:

Total tax to SS system = tax to FF system + additional tax.

Intergenerational effects.

To compare the cost of reform option for each generation I calculate the ratio of the tax payments made during working life to total wages received by a generation for each reform option: PV(tax payments)/PV(total real wages)

$$h = \frac{\sum w_i * t_i * L_i^j}{\sum w_i * L_i^j}, \text{ where } \tau_i = \tau^{ff} + \tau^{ad}_i,$$

i – index of year;
j-index of generation.

I make the calculations for the generations, which are 20, 30, 40 and 50 in 2001.

EMPIRICAL RESULTS

3.1. Description of SS Tax Paths under Various Reform Options

3.1.1. Current PAYGO: maintaining status quo

I want to check whether the current Ukrainian pension system is sustainable. It could be the case that no reforms are needed at all and the Ukrainian population will enjoy no increase in SS taxes in the foreseeable future. Unfortunately, it does not appear to be the case.

Graph 3.1 shows that if the government keeps its promise to maintain 30 % replacement ratio, then the SS tax should be rising continuously after 2008. While it is 25.7% in 2000, it would reach 51% in 2050. It means that it should double to keep PAYGO system in balance.

Graph 3.1. Tax to PAYGO system
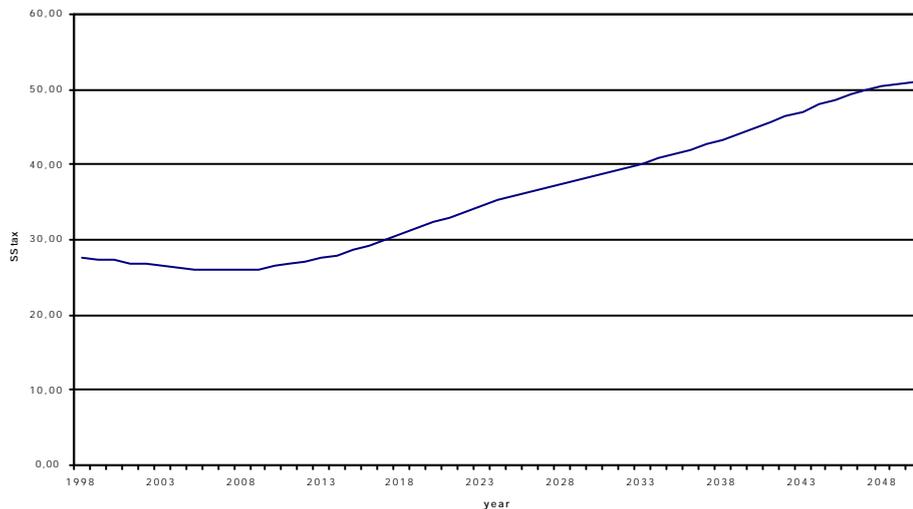
Clearly, such tax level is unsustainable for Ukraine, where the share of informal sector has already been estimated to be 50%. The further increase in tax would lead to increase in this statistic even higher.

However, the SS tax is expected to fall till 2008. The reason for this is a decrease in number of pensioners relative to number for workers. This is the case, because in this period a generation that was born during World War II period retires. This generation is very small, since very few children were born in the wartime. As result, now Ukraine has a time when percentage of pensioners in population is relatively small. Later in this chapter, I will investigate whether this period can be favorable for implementing reforms of SS system.

3.1.2. PAYGO: an increase in retirement age in 2001

The simplest option of reforming current PAYGO systems in transition economies is to increase retirement age. Although it may be difficult to implement from the political point of view, this reform does not require additional funding.

Graph 3.2. Tax to PAYGO: an increase in retirement age
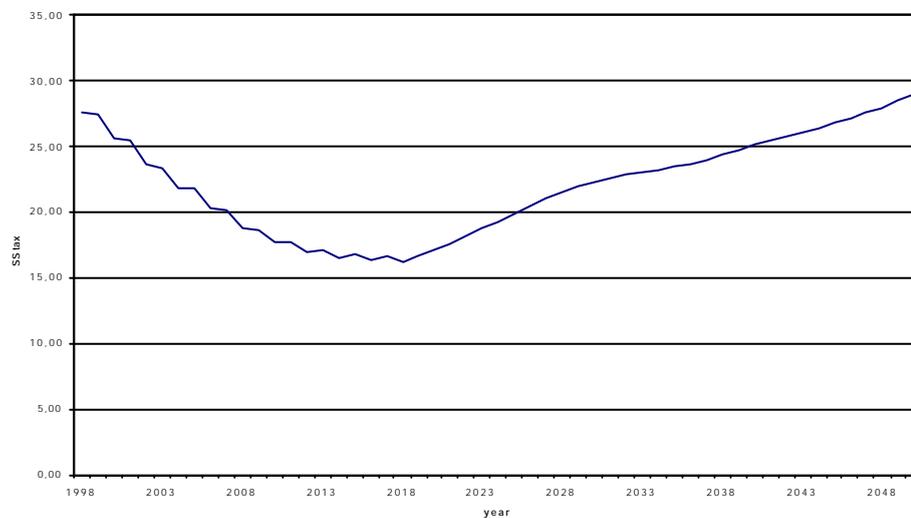
Usually not only effective, but also official retirement age is very low in transition countries relative to developed economies. In Ukraine official retirement age is 55 for women and 60 for men now. It could be increased to 65 for both males and females. The reform will begin in 2001 in my model. I use a scheme of gradual increase in retirement age. This gradual increase in

retirement age explains zigzag shape of the curve for 2001-2018 period on Graph 3.2. This graph shows that an increase in retirement age will cause a considerable fall in the SS tax. It will be decreasing till 2018, when reaches its lowest value of 16.3%. However, after this point, population aging outweighs the increase in retirement age and tax begins to rise steadily. In 2041 it reaches its prereform value, and continues to increase further.

Graph 3.3 compares status quo and an increase in retirement age options. It shows that the latter not only requires lower SS tax, but also the rate of increase in taxes is much less. While for the former total tax payments to total income for 40 years constitutes 32.43%, for latter this coefficient is only 20.21%.

Graph 3.3. Taxes to PAYGO systems:
current system vs. system with an increase in retirement age
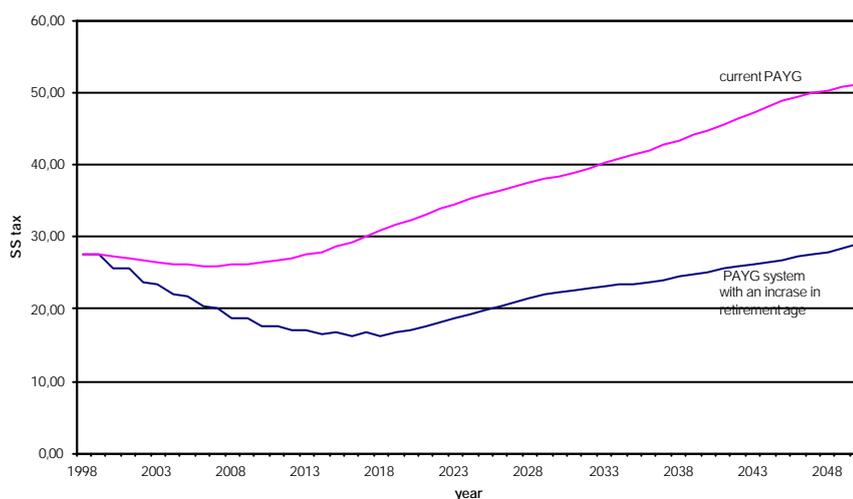
I conclude that if a government has an ability to implement an increase in retirement age, it should do this. Such an action will not only decrease the tax burden on the population, but also will keep the SS tax in sustainable limits for several decades. In case of Ukraine, the tax is projected to be below 30% for 50 years.

Although this measure gives such a good result for taxes, it is not surprising that it is very unpopular. It requires that people now should work longer to

receive the same level for benefits as before. Moreover, the expectancy of life after retirement is also decrease considerably.

It is better to couple an increase in retirement age with a transition to FF system. As will be seen in practice, under FF system people can choose scheme of saving. If a person prefers to work less, but still have retirement benefits on the defined level, she can choose a pension plan with higher rate of saving or more risky one.

3.1.3. The tax to FF system

In my model, I calculate an average SS tax to FF system. The tax can be overestimated. The reasons are following.

First, I assume that there is no decrease in informal sector due to the transition to FF system. However, many economists think that transition to FF system creates powerful incentive for workers to work in formal sector, because it provides a direct link between contributions and benefits [Sachs 1997, World Bank 1996].

Second, the transition reduces labor market distortions by decreasing overall amount of tax perceived. It would increase labor supply in the economy, which should increase GDP in turn.[Sachs 1997]

Finally, it fosters the development of a financial sector of the economy. A huge amount of saving that is created through FF system would be placed into domestic financial institutions. More money will be available for making loans, thus increasing investment and promoting economic growth. [Siedenberg and Lutz,1998]

As always, the amount of benefits per year is assumed equal 30% of wage. The average tax to FF system is estimated for the generation, which is 20 in 2001. The real interest rate, which is paid on workers contributions and on debt created in the economy due to the transition, is assumed to be 5% unless other is specified.

As shown in *Stylized Model* of Appendix 1, the tax is equal to

PV(total benefits for the generation)/PV(total real wages for the generation) or 100*PV(total average benefits for the generation)/PV(total average real wages for the generation).

It is shown that if real wage growth, population growth and real interest rate are constant, then the tax to FF would be the same for each generation. In my model, by assumption, interest rate and real wage growth are constant. Fortunately, population growth is although roughly stable, so it does not cause the required FF tax to change frequently.

The estimated FF tax for Ukraine is 11.7%[5]. It can be on such a level for 50 years. Unlike PAYGO systems, no increase in the tax is necessary as population ages.

Unfortunately, transition from current PAYGO to FF system with an increase in retirement age does not mean that the tax automatically will decrease from 26.88% (the tax to PAYGO system in 2001) to 11.7% (the tax to FF system). The transition creates debt to generations that do not have enough time to save for their retirement via FF scheme. Since the government promises to provide certain amount of the retirement benefits to each generation, the transition creates explicit debt to the current generations. The total tax path to social security depends on the scheme of financing the debt.

3.1.4. Increase in retirement age and privatizing in 2001: tax-financed transition

In this case, the debt that created each year is completely financed by the working population this year. This option places the largest burden on generations that work at the beginning of transition. Graph 3.4 explains why it is so. As can be seen from the graph, the largest debt created per year is at the beginning of transition. It is decreasing for 50 years, and finally will approach zero in 2080 when the generation that was 21 in 2001 will die. From

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[5] The methodology of calculation the tax is given in Ch.2 *Model, Data and Method.*

this point, the transition is complete. After this point, the only tax to SS system is FF tax.

Graph 3.5 shows total tax to social security if the debt is financed by current generations. Immediately after the beginning of the reform, the tax should be raised to 37.2%. However, in 12 years it would match the tax if there were status quo, and fell to 12.6% in 2048.

Table 3.4. Amount of Debt Created Each Year
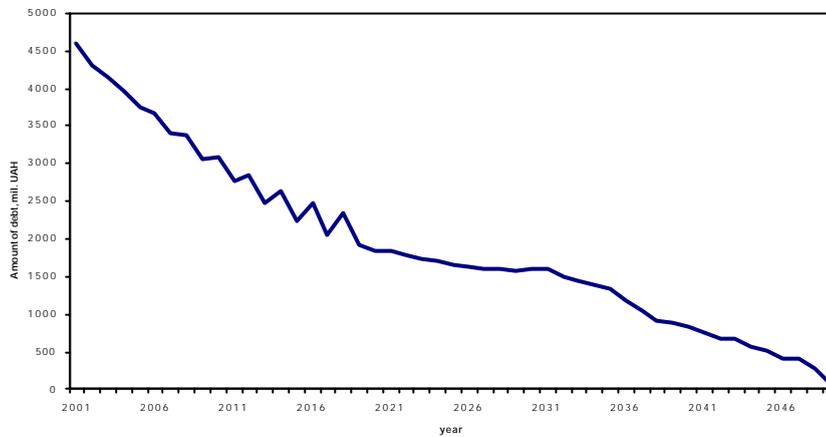
Graph 3.5. Tax to FF system:
transition financed by current generations
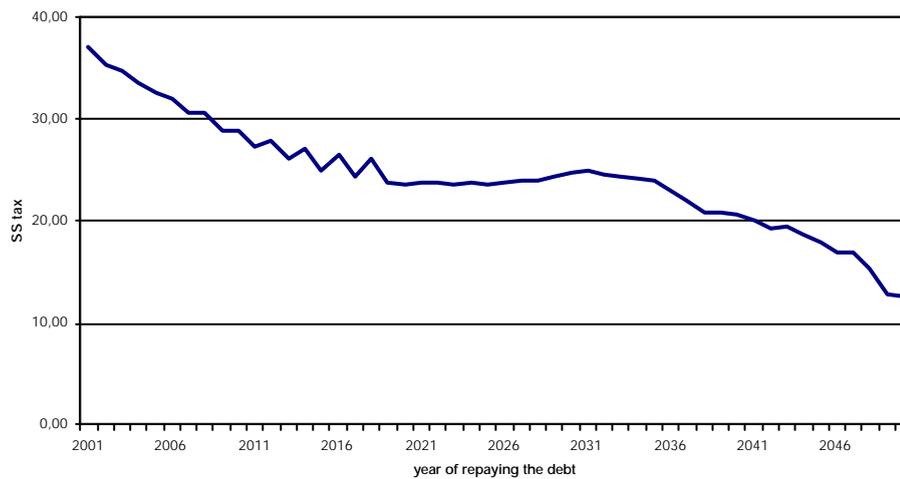
Clearly, such an option may not be considered sustainable due to the high taxes in 2001-2013 years. If there is no other source of financing transition except as through taxes, the government may prefer to smooth debt-financing trough next, for example, 50 years (Scenario 4).

3.1.5. Increase in retirement age and privatizing in 2001: bond-financed transition

This reform implies an increase in retirement age and transition to FF system in 2001: a government issues bonds so that the same amount of debt is repaid each period.

Graph 3.6 shows tax path if the government issues bond to smooth debt repaying. In this case, the amounts of debt to be repaid in terms of value in 2001 are the same for each of 50 years. Repayment begins in 2001 and continues to 2050. After this, the transition is complete and SS tax is equal to FF tax.

Graph 3.6. Tax for FF systems:
transition financed by subsequent generations,
amount of debt to be repaid each year is the same
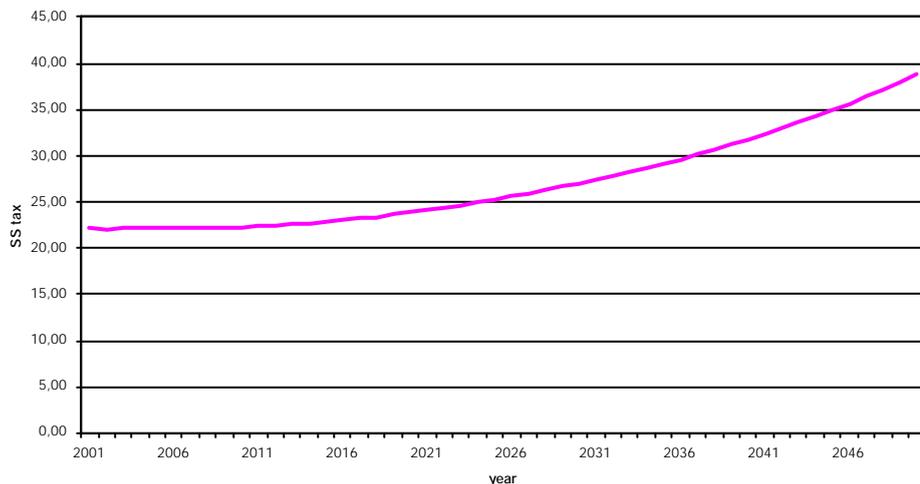
It can be seen that SS tax increases continuously during 50 years of transition, and finally reaches 38.8% in 2050. Two factors cause such an increase.

Interest payments rise each period, while dependency ratio increases considerably.

This reform option is not sustainable for Ukraine. Moreover, the disadvantage of financing the debt trough issuing bonds is the crowding out effect [Mankiw, 1994].

Moreover, in calculating the tax I assume that the government can issue the debt at 5% real interest rate. It may not be the case for Ukraine. It may happen that due to high riskiness of Ukrainian bonds, real interest rate should be set much higher than 5%.

3.1.6. Increase in retirement age and privatizing in 2011: tax-financed transition

It is important for the government to choose the best time for implementing the reform of pension system. Now I want to verify when it is better to reform SS system (transit to FF system <u>and</u> increase retirement age): in 2001 or 2011. In both cases, transition is financed by current generations.

Graph 3.7a. Taxes to FF systems:
reform in 2001 vs. reform in 2011
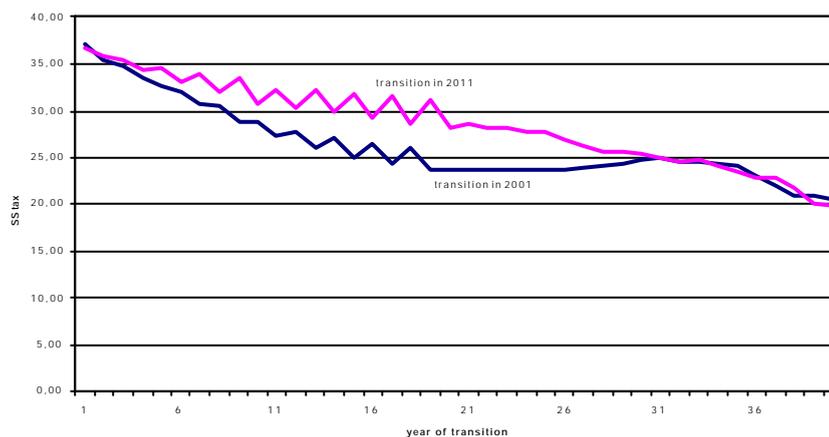
Graph 3.7a shows the tax path for these two options. Note that the x-axis indicates number of years passed from the beginning of transition. It can be seen that it is better to implement the reform in 2001. In this case, tax would be less than if it is done later.

Graph 3.7b differs from graph 3.7a in that x-axis shows the year from 2001 to 2050, not the year of transition. It allows to conclude that the same thing as the previous graph: although delayed implementation of the reform provides lower taxes now, it requires considerably higher taxes in the future.

Graph 3.7b. Taxes for FF systems:
reform in 2001 vs. reform in 2011
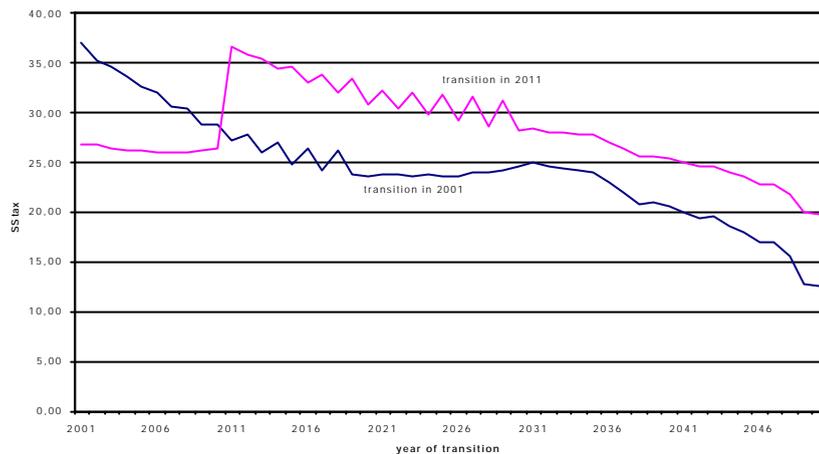
There are debates in Ukraine now, whether it is worth to privatize SS system now and finance it by issuing 10-years bonds, or it is better simply to postpone the reform by 10 years. If these options provide the same tax burden, the former would be preferred, since it may have positive external effect of decreasing share of the informal sector by explicitly linking contribution and benefits.

Graph 3.8a compares Scenario 5 with Scenario 6. It answers the question of whether to transit in 2001 but postpone debt repayment by 10 years or to transit in 2011 and finance debt immediately. For purpose of comparison, I use the following scheme of financing the debt. Debt created in i period is financed in $i+10$ period. Therefore, under both reform options, repayment of the debt begins in 2001. It appears that the answer to when to reform depends on the government preferences. Delayed implementation of the reform requires higher taxes at the beginning, but converges faster to the level of the contributions to FF system. Bond-financed transition provides very low taxes for the first 10 years of the reform, which is advantageous for the

economy. For the next 20 years, the taxes are almost the same in these two cases. However, the latter option requires a higher tax in last two decades of transition.

Graph 3.8a.Taxes to FF system: bond-financed transition in 2001 vs. tax-financed transition and increase in retirement age in 2011
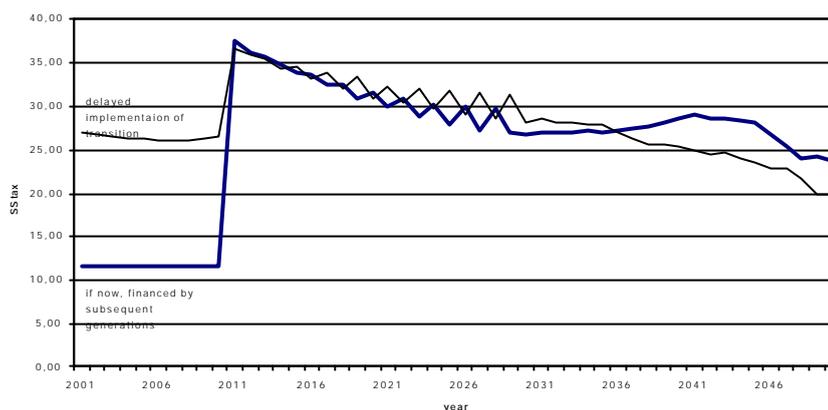
There is certainly a tradeoff. A lower at the beginning tax path under bond-financed transition may lead to a crowding out effect, which slows economic growth. On the other hand, it provides 10-years period of very low taxes that may lead to revival of economic activity and expansion of the formal sector of the economy in Ukraine.

If the interest rate paid on the debt is equal to the rate of real wage growth (what Ukrainian government wants to do), not at the discount rate as was assumed before, the advantage of bond-financing to delayed implementation of the reform becomes apparent. Graph 3.8b illustrates the tax paths for these scenarios, using real wage growth rate for calculating interest payment on the debt.

From this it follows that hypothesis 1.2 holds. Current implementation of SS reform provides a lower tax burden on the population than delayed execution. Although the above graphs illustrate this, accurate comparison of the tax burdens is given in the next section.

**Graph 3.8b. Taxes to FF system: bond-financed transition in 2001
vs. tax-financed transition and increase in retirement age in 2011
Interest rate=real wage growth rate**
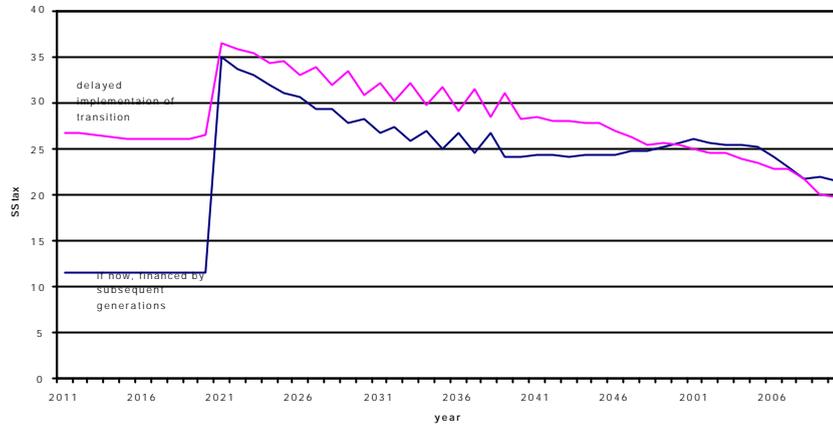
3.1.7. Increase in a retirement age in 2001, privatizing in 2011: tax-financed transition

There is one last reform option I want to investigate: an increase in retirement age in 2001 and transition to FF system in 2011. Graph 3.9 shows the tax path for this scenario. It is not surprising that such a reform option requires the lowest tax increase at the beginning to finance transition. The reason is that we have reduced the number of pensioners before transition to FF system, thus reducing the amount of debt created.

It may be difficult for the government to implement this reform. The reason is that it begins with an increase in retirement age that is a very unpopular measure, and undertakes transition to FF system only in 10 years. It may be easier politically to implement full block of reforms than do it partially. Another danger is that the government may increase retirement age and finish the reform at this point. An increase alone does not solve the problem of population aging, so transition to FF will have to be implemented later in any case. However, favorable time would be lost.

29

Graph 3.9. Tax to SS system:
increase in retirement age in 2001,
tax-financed transition to FF in 2011
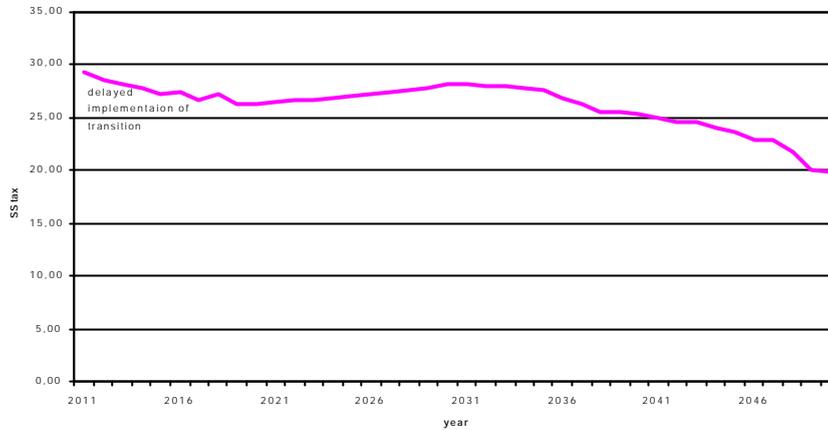
3.1.8. Comparison among the reform options

Table 3.1 shows the cost of each scenario measured as share of tax payments paid by population during 40 years of a reform.

Table 3.1. *Comparison between the reform options that include transition to FF system.*

Scenario	Reform option	PV(taxes)/PV(wages)*
Scenario 3	Increase in retirement age in 2001, FF in 2001: transition financed by the current generations	**26,89**
Scenario 5	Increase in retirement age in 2001, FF in 2001: government issues debt, repayment of the debt is postponed by 10 years;	**29,97**
Scenario 6	Increase in retirement age in 2011, FF in 2011: transition financed by the current generations	**29,69**
Scenario 7	Increase in retirement age in 2001, FF in 2011: transition financed by the current generations	**26,58**

* for 40 years beginning with the first debt repayment

Graph 3.10 compares the total SS tax, beginning from the first period of debt repaying for the scenarios shown in table 3.1.

It can be seen that the cost of reforming is lowest for the Scenario 7 (See table 3.1). The most costly variant appears to be issuing debt (Scenario 5).

The graph shows that it is better for the government to use favorable period of a decrease in relative number of pensioners and to reform the pension

system now, not later. This would provide much lower tax burden than delayed implementation of the reform or issuing debt.

From this point of view, the option of increasing retirement age in 2001 but transiting to FF in 2011 seems to be most attractive. It provides smooth tax path and the lowest cost of transition. However, it may be not acceptable politically. It is very difficult to raise retirement age, to say nothing of coupling it with other more global reforms.

**Graph 3.10. Tax to SS system:
comparison**
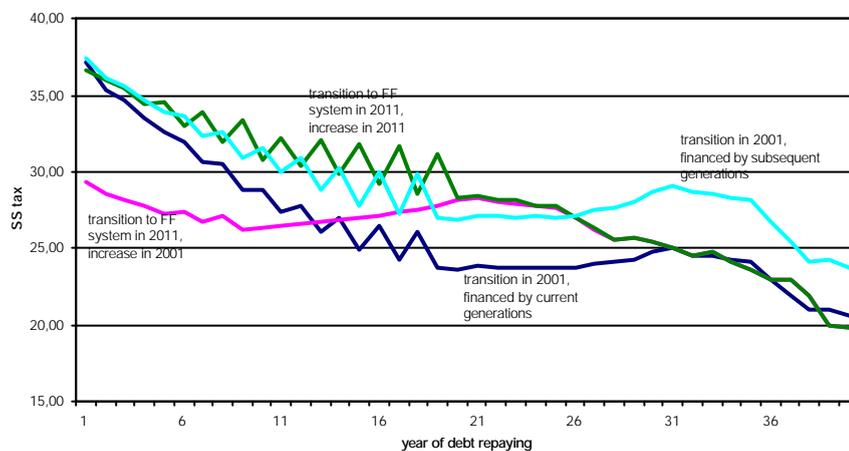
3.2. Intergenerational Effects

Intergenerational effects are measured as a change in wealth of each generation. In my model, wealth is total wages received by a generation. Therefore, change in wealth can be measured as change in tax burden on each generation.

I conclude that hypothesis 1.1 holds. There are different intergenerational effects as result of various pension reform variants in Ukraine. It can be seen from Table 3.2 which generation would prefer which option.

Table 3.2 shows ratio of taxes paid to wages received by each generation for each reform option. Unfortunately, I was not able to run sufficient

projections to compare different generations under one reform option. However, I can measure up wealth of each generation for each scenario in period 2001-2050. A higher share of tax payments means a lower wealth of generation, holding other sources of income constant.

Table 3.2. *Intergenerational effects: share of tax payments in total wages received.*

cohort (2001)	Scenario 1	Scenario 2	Scenario 3	Scenario 4*	Scenario 5	Scenario 6	Scenario 7
20	32,25	20,60	26,34	25,14	24,98	29,21	25,54
30	30,01	19,98	27,33	24,09	24,31	29,71	25,55
40	27,93	19,34	28,36	23,07	23,25	29,92	25,06
50	26,62	19,82	30,34	22,41	19,84	28,55	24,24
population as a whole	32,96	20,60	26,24	25,20	25,11	29,17	25,54

The generation of 50-years old as well as all others would like better the increase in retirement age (Scenario 2), if their preferences based only on the amount of tax burden, and do not depend negatively on duration of working life. For the generation of 50, issuance of the bonds with repayment in 10 years (Scenario 5) is almost equivalent in terms of tax burden to the increase in retirement age option. Bond-financed transition (Scenario 4) and delayed transition (Scenario 7) would also decrease the tax for this generation, although to smaller degree. Nevertheless, it will not choose transition to FF system financed by current generation (Scenario 3) and delayed implementation of the reform (Scenario 6), which increases tax burden compared with current situation.

The situation is similar for the generation of 40-years old. It would also reject the transition proposed by Scenarios 3 and 6. However, after the increase in retirement age option, it would prefer the option of transition financed by issuing bonds, the same amount of debt is repaid each year (Scenario 4). Delayed implementation of the transition (Scenario 7) is the worst acceptable variant for this generation.

Things are different for the young generations. They would prefer any reform option to status quo. The increase in retirement age still provides with the

lowest tax burden. After it, they would prefer bond-financed transition, although generation of 30-years old would choose equally distributed repayment of the debt (Scenario 4), while the youngest generation would prefer to postpone the repayment by 10 years (Scenario 5). The generations have the same preferences to other options: postponed transition (Scenario 7), the reform now financed by current generations (Scenario 3) and, the worst one, delayed implementation of a reform (Scenario 6).

The last hypothesis seems not to hold. It appears that bond-financed transition options provide lower transition burden than tax-financed transition for each generation, not only for older ones. Although transition financed by taxes lowers tax burden of younger generations (unlike older), the effect is smaller than in bond-financed transition.

There are two reasons for this. The first is the structure of population. There will be an increase in labor for two decade after 2001. Therefore, the young generations of 2001 would prefer to postpone the repayment of the debt, because in several years there will more workers to repay this amount of debt.

The second reason is the duration of debt repayment. The debt is repaid in 50 years in Scenario 4, while it is postponed by 10 years in Scenario 6. People work on average 45 years. Therefore, it is advantageous for generations to place the largest possible burden to the end of repayment period, so the tax burden is placed not on them, but on future generations. Such a possibility is given by bond-financed transition.

It can be seen that if government maximizes total welfare, the government should not maintain status quo. The first scenario is the worst one, since it places the highest tax burden on the population. However, generations of 40-years old and 50-years old would prefer status quo to transition to FF system and an increase in retirement age, no matter in 2001 or 2011 (scenarios 3 and 6).

The best option for every generation is appeared to be PAYGO system with an increase in retirement age[6]. However, it is unlikely for the government to choose it. First, it is very unpopular measure. Second, such an option does not solve the problem of population aging.

Transition from current PAYGO to the following reform options decreases the tax burden for each generation:

Scenario 4   Increase in retirement age in 2001, FF in 2001: government issues debt, the same amount of debt is repaid each period;

Scenario 5   Increase in retirement age in 2001, FF in 2001: government issues debt, repayment of the debt is postponed by 10 years;

Scenario 7   Increase in retirement age in 2001, FF in 2011: transition financed by the current generations.

The lowest tax burden for a generation as a whole is achieved by choosing Scenario 5. However, if a government chooses this option, it should take into account negative consequences of issuing the debt, which are not incorporated in this model. First, this is crowding out effect. Second, it is assumed that the government can borrow at 5% real interest rate, which is also discounted rate in my model. However, Ukrainian government may have to pay higher real interest rate, because of high default risk.

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[6] This conclusion is drawn under the assumption that person's utility depends solely on wealth, and not on leisure. Moreover, there is no utility maximization in my model. Such a simplification is a drawback of my research. Therefore, the conclusions should be drawn based not only on the value of coefficients, but also on common sense.

CONCLUSIONS AND POLICY IMPLICATIONS

Ukraine, like many other developing and developed countries, faces the problem of aging population. The dependency ratio for Ukraine will increase drastically in 50 years, which will create a considerable pressure on PAYGO Social Security system.

The current Ukrainian pension system appears to become unsustainable in several decades. To maintain it, the tax should be raised to 40% during next 20 years and to 50% during 35 years. Such a tax increase will not only create additional distortions in the labor market, but will move even more of the economy into informal sector.

To avoid such an increase in the tax burden, I have considered different variants of coupling an increase in retirement with transition to FF system. It appears that any combination of transition to FF system combined with an increase in retirement age lowers tax burden of the population.

An increase in retirement age alone will lead to a substantial decrease in a tax burden. The tax will be in sustainable limits of 15-30% in the next 50 years. However, such a reform option does not solve the problem of aging population for Social Security, but just postpones it.

Such a delay may not be good for Ukraine. The reason is that Ukraine will experience a decrease in the dependency ratio in next 10 years. I have found that current period indeed favorable for reforming. The overall level of taxes would be lower if an increase in retirement age and transition to FF system are both implemented now, but not 10 years later.

A transition to FF system that financed by current generations requires a significant increase in taxes at the beginning of the transition. It may be very

undesirable for developing economies, where the informal sector is already large and further increases in taxes may cause serious damage to the formal sector.

Debt-financed reform is aimed to solve this problem. However, in case of Ukraine, the reform that is financed by issuance debt, equal amount of which should be repaid each year for 50 years, also cannot be seen as sustainable. Although it provides low tax burden at the beginning of the reform, total tax to SS system will reach almost 40% in 2050, the year when all debt is repaid. The cause of this is permanent decrease in working population, as well as real interest rate that is higher than real wage growth.

This problem is partially solved by another scheme of bond financing. If the debt is repaid in 10 years, it provides the period of very low taxes at the beginning of the transition followed by a sharp increase in 10 years, when the debt repayment begins. After this point, the tax is decreasing till reaches FF contribution level. It appears that such scheme of financing places slightly lower tax burden on each generation than simply postponing the reform by 10 years. The difference between them becomes more apparent if the interest rate on bonds is equal to real wage growth rate.

Therefore, it can be concluded that it is preferable to implement reforms of the pension system now, not later. Even if the government wants to defer repayment of the deficit, it is better to reform and issue bonds now, than to postpone the reform.

What was said above assumes that the government cares about the whole population. It is true that if the government maximizes total welfare, it should not maintain status quo. However, if the government has preferences only for some generations, the chosen reform option may be different: I have found that there will be intergenerational effects because of reforming SS system in Ukraine.

Generations of 40 years-old and 50 years-old in 2001 would prefer status quo to transition to FF system <u>and</u> an increase in retirement age, no matter in

2001 or 2011. It appears that although these reforms lower tax burden of the younger generations, bond-financed reforms do this even better. Therefore, the last hypothesis that younger generations would prefer tax-financed transition does not hold for Ukraine.

This can be explained by population structure and the long duration of the debt-servicing period. There will be an increase in labor for two decade after 2001. Therefore, the young generations of 2001 would prefer to postpone the repayment of the debt, because in several years there will more workers to repay this amount of debt.

The second reason is the duration of the debt repayment. While the debt is repaid in 50 years beginning from 2001 or even from 2011, people work on average 45 years. Therefore, it is advantageous for generations to place the largest possible burden to the end of repayment period, so the tax burden is placed not on them, but on future generations. Such a possibility is given by bond-financed transition.

The highest decrease in tax burden for all generations gives PAYGO scheme with an increase in retirement age. However, it is unlikely for the government to choose it. First, it is very unpopular measure. Second, such an option does not solve the problem of population aging.

There are reform options that lower tax burden for each generation. They are:
- an increase in retirement age coupled with transition to FF system in 2001, financed by issuing debt;
- an increase in retirement age in 2001 coupled with transition to FF system in 2011, transition financed by current generations.

The lowest tax burden for the generation as a whole is achieved by increasing retirement age and transitioning to FF system in 2001: the government issues debt, postponing repayment of the debt by 10 years. However, if the government chooses this option, it should take into account negative consequences of issuing the debt, which are not incorporated in this model.

First, this is crowding out effect. Second, Ukrainian government may have to pay very high real interest rate, because of high default risk.

The government can choose among these reform options according its preferences. Any reform of Ukrainian Social Security will lower tax burden of the whole population. However, while several of them lowers tax burden for whole generations, they may increase tax burden for some generations.

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STYLIZED MODEL: PENSION SYSTEM

This section provides a methodology of calculating a tax needed to keep Social Security in balance, which is necessary for evaluating effects of reforms on each generation. The methodology, which is shown here for the stylized model, will be used later in developing a large 100-generations model of Ukrainian pension system.

A1.1. Structure of the Model

I begin with simple model of the economy, which does not have economic or population growth. Then I advance it gradually to the economy close to real: with population and economic growth as well as with different wage structure within among generations. This final model will is to estimate the Social Security tax for PAYGO and FF systems. Since transition from former to latter creates a debt, I also calculate the additional tax needed to finance the created debt or interest payments (if the government issues bonds to finance the debt resulted from transition).

The model is used to determine the required tax to SS system under the following options:

- Keep PAYGO system as current PAYGO system;
- To increase retirement age in PAYGO scheme;
- To increase retirement age, privatize the SS system: transition financed by the current generations ;
- To increase retirement age, privatize the SS system: transition financed by the subsequent generations, government issues debt.

Notations:

W – total real wage of the first generation in the first period;
b – total real retirement benefits received by the first generation in the fourth period;
r – real interest rate;
n – population growth per period;
g – growth rate of real wages per period;
δ – replacement ratio;
ϕ – the share of informal sector in the economy;
τ^{pp} – SS tax to PAYGO system;
τ^{ff} – SS tax to FF system.

A1.1.1. The simplest model

<u>Assumptions:</u>

• 5 generations
• each generation lives 5 periods: it works during first 3 periods and receives retirement benefits during the 4th and 5th period.

Table A1.1 shows income received by each generation in each period:

Table A1.1. *The simplest model.*

		generation				
		1st	2nd	3rd	4th	5th
period	1st	W				
	A1nd	W	W			
	3rd	W	W	W		
	4th	Benefits	W	W	W	
		benefits	W	W	W	W

In this case, there is neither economic growth nor population growth. So the real wage received by each generation in each period is constant.

A1.1.2. Advanced model

I include in the model

a) economic growth: each period real wage grows by g*100 %

b) people of different ages receive different wages.

- 5 generations;
- each generation lives 5 periods: it works during first 3 periods and receives retirement benefits during the 4th and 5th period;
- each period real wages increase by g*100 %, g may be negative as well as positive;
- wage structure within a generation:

Period that generation lives	Wage coefficient
1st	1
2nd	1.5
3rd	1.3
4th	Retirement (if a generation works - 1.2)
5th	Retirement

These coefficients are chosen so to resemble wage structure for the USA.

The model of payment benefits would have the following structure, which is shown in Table A1.2:

Table A1.2. *Economy with economic growth and variable wage (depending on period a generation lives).*

		generation				
		1st	2nd	3rd	4th	5th
period	1st	W				
	2nd	$W(1+g)1.5$	$W(1+g)$			
	3rd	$W(1+g)^2 1.3$	$W(1+g)^2 1.5$	$W(1+g)^2$		
	4th	Benefits	$W(1+g)^3 1.3$	$W(1+g)^3 1.5$	$W(1+g)^3$	
	5th	Benefits	Benefits	$W(1+g)^4 1.3$	$W(1+g)^4 1.5$	$W(1+g)^4$

A1.1.3. Final model

Finally, I want to include population growth and shadow economy in the model. Only official economy pays taxes to Social Security system.

Assumptions:

- 5 generations;
- each generation lives 5 periods: it works during first 3 periods and receives retirement benefits during the 4th and 5th period;
- each period real wages increase by g*100 %;
- wage depends on period a generation lives;

- population growth: each next generation n*100% larger than previous, negative n would reflect a population decline;
- informal economy constitutes ϕ*100% of the economy, $0 \le \phi \le 1$

Table A1.3 shows the structure of wages in the economy that corresponds to above assumptions.

Table A1.3. *Final Economy: with economic growth, different wage in any particular generation and population growth: formal + informal sector.*

		generation				
		1st	2nd	3rd	4th	5th
period	1st	W				
	2nd	W(1+g)1.5	W(1+g)(1+n)			
	3rd	W(1+g)^{2}1.3	W(1+g)^{2}1.5(1+n)	W(1+g)^2(1+n)^2		
	4th	Benefits	W(1+g)^{3}1.3(1+n)	W(1+g)^{3}1.5(1+n)^2	W(1+g) (1+n)^3	
	5th	benefits	benefits	W(1+g)^{4}1.3(1+n)^2	W(1+g)^{4}1.5(1+n)^3	W(1+g)^4(1+n)^4

The system should be in balance in each period. Benefits are set to be equal to 100*δ % of the wage received in the last working period. This model serves to calculate the tax needed for obtaining such benefits.

A1.2. Pay-as-you-go Pension System

A1.2.1. PAYGO system without an increase in retirement age

In this section I want to calculate the tax needed for Social Security system under PAYGO scheme. A generation works for 3 periods, receives retirement benefits for 2 periods.

So, we have : 2 generation on retirement per one period;

unofficial economy constitutes ϕ*100% of the economy;

replacement ratio = 100*δ % from preretirement salary.

Calculation is made for 5th period. In this period, the 1st and the 2nd generations receive retirement benefits.

The 1st generation receives δ % of the wage it receives in 3rd period (PV):

$$\frac{\delta \cdot (1+g)^2 \cdot 1.3 \cdot W}{(1+r)^5}$$

4

The 2nd generation receives δ % of the wage it receives in 4th period (PV):

$$\frac{\delta \cdot (1+g)^3 \cdot 1.3 \cdot (1+n) \cdot W}{(1+r)^5}$$

So, total retirement benefits that should be paid from Social Security System (PV):

$$\frac{\delta \cdot (1+g)^2 \cdot 1.3 \cdot W}{(1+r)^5} + \frac{\delta \cdot (1+g)^3 \cdot 1.3 \cdot (1+n) \cdot W}{(1+r)^5}$$

In this period, 3rd, 4th and 5th generations work and as result pay taxes. Tax revenues to SS system constitute τ^{pp}. Multiplying present value of wages received by 3rd, 4th and 5th generations by SS tax, we receive present value of tax revenues to SS system for 5th period.

$$\frac{\tau^{pp} \cdot W \cdot (1+n)^2 \cdot (1+g)^4 \cdot (1-\phi) \cdot \left[1.3 + (1+n) \cdot 1.5 + (1+n)^2 \right]}{(1+r)^5}$$

Since benefits should be equal to payments made in the period[7]:

$$\frac{\delta \cdot (1+g)^2 \cdot 1.3 \cdot W}{(1+r)^5} + \frac{\delta \cdot (1+g)^3 \cdot 1.3 \cdot (1+n) \cdot W}{(1+r)^5} = \frac{\tau^{pp} \cdot W \cdot (1+n)^2 \cdot (1+g)^4 \cdot (1-\phi) \cdot \left[1.3 + (1+n) \cdot 1.5 + (1+n)^2 \right]}{(1+r)^5}$$

we can calculate the tax needed to achieve δ replacement ratio under PAYGO system:

$$\tau^{pp} := \frac{\delta \cdot 1.3 \cdot (1 + (1+g) \cdot (1+n))}{(1-\phi) \cdot (1+n)^2 \cdot (1+g)^2 \cdot \left[1.3 + 1.5 \cdot (1+n) + (1+n)^2 \right]}$$

This equation shows relation of the PAYGO tax with share of the informal sector in the economy, population growth and economic growth. As long as these parameters are constant, the tax to PAYGO does not have to be changed.

Therefore, we can conclude that if there is stable rate of population decline, PAYGO system remains sustainable. Only if there is increasing rate of decline

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[7] By our assumption, SS system is always in balance.

in population, i.e. an increase in dependency ratio, PAYGO system may become unsustainable.

Graph A1.1 shows the relation between PAYGO tax and population growth if there is 4% economic growth, 30% replacement ratio and 50% informal sector. There is negative relationship between population growth and tax for PAYGO system.

Graph A1.1. *Relation between PAYGO tax and population growth.*
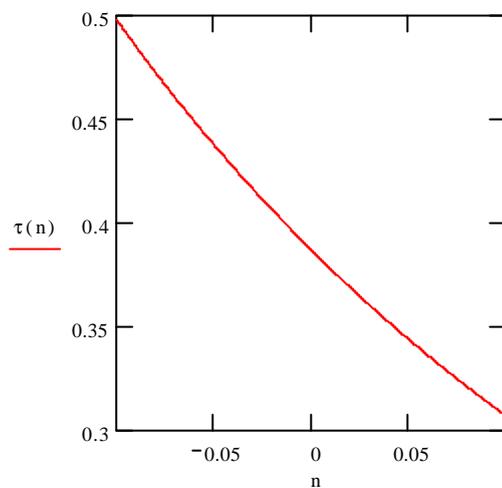
Let τ^{pp}_0 to be PAYGO tax , when there is no informal sector. Then there is the following linear relation between τ^{pp} and τ^{pp}_0 :

$$\boldsymbol{t}^{pp} = \frac{1}{1-\boldsymbol{f}} * \boldsymbol{t}^{pp}_0 .$$

Graph A1.2 shows the relation between tax and informal sector. It can be seen that an increase in informal sector leads to an increase in tax. Moreover, this positive relation is not linear.

Graph A1.2. Relation between SS tax and informal sector.
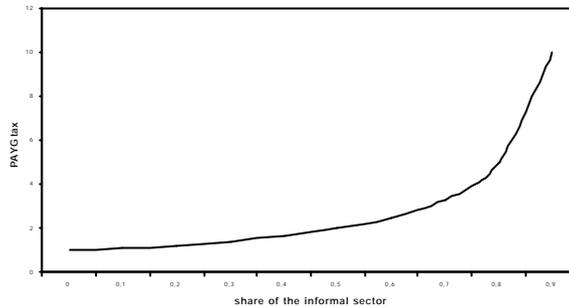
A1.2.2. PAYGO System with an increase in retirement age

In the majority of the developing economies retirement age is very low. Many reform packages include an increase in retirement age.

Such an increased can be shown in our model. Now a generation works for 4 periods, receives retirement benefits for 1 period. The goal is to calculate SS tax.

So, we have: 1 generation on retirement per one period;

unofficial economy constitutes ϕ*100% of the economy;

replacement ratio = 100*δ % from preretirement salary.

As previously, calculation is made for 5th period, so we will be able compare outcomes of this and previous models.

Table A1.4 shows the structure of the economy after an increase in retirement age.

Table A1.4. *Final Economy: an increase in retirement age.*

	generation				
		1st	2nd	3rd	4th	5th
period	1st	W				
	2nd	W(1+g)1.5	W(1+g)(1+n)			
	3rd	W(1+g)^{2}1.3	W(1+g)^{2}1.5(1+n)	W(1+g)^2(1+n)^2		
	4th	W(1+g)^{3}1.2	W(1+g)^{3}1.3(1+n)	W(1+g)^{3}1.5(1+n)^2	W(1+g) (1+n)^3	
	5th	benefits	W(1+g)^{4}1.2(1+n)	W(1+g)^{4}1.3(1+n)^2	W(1+g)^{4}1.5(1+n)^3	W(1+g)^4(1+n)^4

7

The tax is calculated in a way similar to previous model. Now only 1st generation receives retirement benefits, which is equal to δ % of the wage it receives in 4th period (PV):

$$\frac{\delta \cdot (1+g)^3 \cdot 1.2 \cdot W}{(1+r)^5}$$

4 generations (2nd-5th) pay taxes to Social Security System. It is equal to tax multiplied on PV of wages received by these generations in 5th period:

$$\frac{\tau^P \cdot W \cdot (1+n) \cdot (1+g)^4 \cdot (1-\phi) \cdot \left[1.2 + (1+n) \cdot 1.3 + (1+n)^2 \cdot 1.5 + (1+n)^3\right]}{(1+r)^5}$$

The system should be in balance: retirement benefits = tax payments to SS system:

$$\delta \cdot (1+g)^3 \cdot 1.2 \cdot W = \tau^P \cdot W \cdot (1+n) \cdot (1+g)^4 \cdot (1-\phi) \cdot \left[1.2 + (1+n) \cdot 1.3 + (1+n)^2 \cdot 1.5 + (1+n)^3\right]$$

From this equation we can calculate tax needed to achieve δ replacement ratio under PAYGO system with an increase in retirement age:

$$\tau^P = \frac{\delta \cdot 1.2}{(1+n) \cdot (1+g) \cdot (1-\phi) \cdot \left[1.2 + (1+n) \cdot 1.3 + (1+n)^2 \cdot 1.5 + (1+n)^3\right]}$$

Graph A1.3 compares tax for PAYGO system ($\tau(n)$) with tax for PAYGO system with an increase in retirement age ($f(n)$) and the difference between them ($\tau(n) - f(n)$). It can be seen that a higher population decline makes an increase in retirement age more effective for decreasing SS tax.

Graph A1.3 *Tax to PAYGO system vs. tax for PAYGO system with an increase in retirement age.*
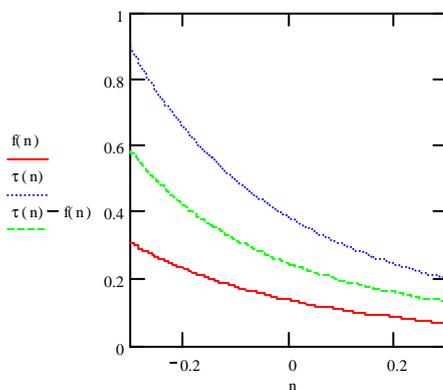
A1.3. Transition to Fully Funded Pension System

A1.3.1. Contribution (Tax) to FF system

Calculation of the tax under FF system requires a little bit different approach. First, I make simplifying assumption that does not affect the basic results. Suppose that FF eliminates shadow economy, which simplifies the model. There are reasons for this in real world. FF system provides direct links between payments made during working life and retirement benefits. The social security tax under FF can be considered by population as forced saving, so reducing overall level of perceived taxes. This, in turn, reduces labor market distortions and increases official economy. [Sachs, 1997].

However, this assumption does not change our result in principle. If we want to include a shadow sector in our model, we should just divide an estimated tax by $(1-\phi)$, which is the percentage that the official economy constitutes.

Assumptions: Increase in retirement age: 1 generation on retirement per period;

unofficial economy is eliminated;

replacement ratio = $100*\delta$ % from preretirement salary;

interest rate equal $100*r$ %.

Calculations are made for 5th period.

As in the model with an increase in retirement age under PAYGO system, retirement benefits for the 1st generation is equal to $100*\delta$ % of the wage it receives in 4th period (PV):

$$\frac{\delta \cdot (1+g)^3 \cdot 1.2 \cdot W}{(1+r)^5}$$

Now each generation saves for the retirement. People in the generation save $\tau^{ff}*100\%$ of their wages each period during the working lives. The present value of these payments is:

$$\frac{\tau^{\text{ff}} \cdot W}{1+r} + \frac{\tau^{\text{ff}} \cdot W \cdot 1.5 \cdot (1+g)}{(1+r)^2} + \frac{\tau^{\text{ff}} \cdot W \cdot 1.3 \cdot (1+g)^2}{(1+r)^3} + \frac{\delta \cdot (1+g)^3 \cdot 1.2 \cdot W}{(1+r)^4}$$

SS system should be in balance, so discounted value of payments = discounted value of benefits:

$$\frac{\tau^{\text{ff}} \cdot W}{1+r} + \frac{\tau^{\text{ff}} \cdot W \cdot 1.5 \cdot (1+g)}{(1+r)^2} + \frac{\tau^{\text{ff}} \cdot W \cdot 1.3 \cdot (1+g)^2}{(1+r)^3} + \frac{\tau^{\text{ff}} \cdot W \cdot (1+g)^3 \cdot 1.2}{(1+r)^4} = \frac{\delta \cdot (1+g)^3 \cdot 1.2 \cdot W}{(1+r)^5}$$

Equilibrium tax for FF system can be found from this equation:

$$\tau^{\text{ff}} := \frac{\delta \cdot (1+g)^3 \cdot 1.2}{(1+r) \cdot \left[1.2 \cdot (1+g)^3 + 1.3 \cdot (1+g)^2 \cdot (1+r) + 1.5 \cdot (1+g) \cdot (1+r)^2 + (1+r)^3 \right]}$$

Note that as long as the rate of real wage growth and real interest rate do not change, the tax needed for any generation to keep system in balance remains the same. This equation shows that the tax does not depend on population growth, so transition to FF system solves the problem of SS security due to population aging. There is negative relationship between interest rate and FF tax: higher interest rate leads to lower required tax.

Graph A1.4 *Relationship between tax to FF and economic growth.*
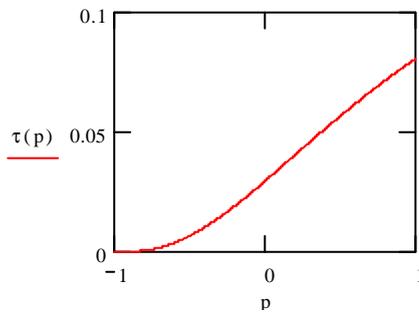
Graph A1.4 shows positive relationship between tax to FF system ($\tau(p)$) and the growth rate (named p in this graph). Such a relationship can be explained by the assumption of our model that average retirement benefits are equal to $\delta*100\%$ of average wage.

A1.3.2. Calculation of the Deficit Created due to the Transition

The transition from PAYGO to FF system creates a large debt to generations, which did not have time to save for their retirement. For example, in our

model only 5th and subsequent generations will have time to save fully for their retirement benefits. Therefore, additional funds are required to cover the debt created and to keep the Social Security system in balance.

I calculate the amount of debt that emerges each period as result of the transition from PAYGO to FF coupled with an increase in retirement age. Transition begins in 5th period.

In the first period of transition (5th period) only 1st generation is on retirement. It did not have time to save for retirement at all. In this case, the total amount of benefits for 1st generation in 5th period is an amount of debt.

In the second period of transition (6th period) 2nd generation retires. It had some time to save for retirement, but not fully. It saves in 5th period. The amount of saving, which equal to the tax under FF system multiplied on the wage 2nd generation received in 5th period, should be subtracted from total amount of benefits that the 2nd generation will receive. This will be the amount of debt created in second period of transition.

Table A1.5. *Present value of the debt created by transition.*

Number of period	Period of transition		Discounted Value of the Debt
5th	1st	D_1	$\dfrac{\delta \cdot (1+g)^3 \cdot 1.2 \cdot W}{(1+r)^5}$
6th	2nd	D_2	$\dfrac{\delta \cdot (1+g)^4 \cdot 1.2 \cdot (1+n) \cdot W}{(1+r)^6} - \dfrac{\tau^f \cdot W \cdot (1+g)^4 \cdot (1+n) \cdot 1.2}{(1+r)^5}$
7th	3rd	D_3	$\dfrac{\delta \cdot (1+g)^5 \cdot 1.2 \cdot (1+n)^2 \cdot W}{(1+r)^7} - \dfrac{\tau^f \cdot W \cdot (1+g)^4 \cdot (1+n)^2 \cdot 1.2}{(1+r)^6} - \dfrac{\tau^f \cdot W \cdot (1+g)^4 \cdot (1+n)^2 \cdot 1.3}{(1+r)^5}$
8th	4th	D_4	$\dfrac{\delta \cdot (1+g)^6 \cdot 1.2(1+n)^3 \cdot W}{(1+r)^8} - \dfrac{\tau^f \cdot W \cdot (1+g)^5 \cdot (1+n)^3 \cdot 1.2}{(1+r)^7} - \dfrac{\tau^f \cdot W \cdot (1+g)^4 \cdot (1+n)^3 \cdot 1.3}{(1+r)^6} - \dfrac{\tau^f \cdot W \cdot (1+g)^4 \cdot (1+n)^3 \cdot 1.5}{(1+r)^5}$
9th	5th	D_5	0

3rd generation will save for 2 periods, 4th – for 3 periods, and finally 5th will save fully for retirement for 4 periods. All these calculations are shown in

table A1.5.

It can be seen that the discounted amount of the debt created each period decreases. This happens because each subsequent generation have more time to save than a preceding one. After 4th generation dies, no further debt will be created: 5th and subsequent generations will have enough time to save for the retirement completely.

The following example illustrates this. Let

$$\delta := 0.3 \qquad n := -0.03 \qquad g := 0.04$$
$$W := 100 \qquad r := 0.05$$

Then tax to FF system be

$$\frac{\delta \cdot (1+g)^3 \cdot 1.2}{(1+r) \cdot \left[1.2 \cdot (1+g)^3 + 1.3 \cdot (1+g)^2 \cdot (1+r) + 1.5 \cdot (1+g) \cdot (1+r)^2 + (1+r)^3 \right]} = 0.068$$

Discounted value of the debt would be equal:

$D_1 = 31.73$, $D_2 = 23.23$, $D_3 = 14.96$, $D_4 = 6.12$, $D_5 = 0$.

While debt first is high, it falls sharply during 3 periods and finally reaches 0.

A1.3.3. The tax to SS System under a Tax-Financed Transition

If there is no bond-financed system and transition should be financed immediately as debt created, then the burden lies on current generations. In our case, if transition is performed in the 5th period, then generations that live in 5th – 8th periods will pay not only FF tax, but also additional tax to support those retirees, who do not have time to save fully for FF system.

In the 5th period (1st period of transition) the total tax would be:

fully-funded tax + additional tax to cover the debt.

Additional tax (τ^P) should be sufficient to finance debt D_1.

So,

$$\tau^P = \frac{D_1}{\text{income}}$$

where *income* of the working generations in 5th period equal to:

$$\frac{W \cdot (1+n) \cdot (1+g)^4 \cdot \left[1.2 + (1+n) \cdot 1.3 + (1+n)^2 \cdot 1.5 + (1+n)^3 \right]}{(1+r)^5}$$

The taxes for 6th – 8th are calculated in the similar way. After the 8th period, the debt is fully paid off and additional component of the tax disappears, so tax paid is equal to FF tax. Table A1.6 shows the taxes required during the transition financed by current generations.

Table A1.6. *Taxes: transition financed by the current generations.*

Number of period	Period of transition	Total Social Security tax
5th	1st	$\tau^{ff} + \dfrac{D_1 \cdot (1+r)^5}{W \cdot (1+n) \cdot (1+g)^4 \cdot \left[1.2 + (1+n) \cdot 1.3 + (1+n)^2 \cdot 1.5 + (1+n)^3 \right]}$
6th	2nd	$\tau^{ff} + \dfrac{D_2 \cdot (1+r)^6}{W \cdot (1+n)^2 \cdot (1+g)^5 \cdot \left[1.2 + (1+n) \cdot 1.3 + (1+n)^2 \cdot 1.5 + (1+n)^3 \right]}$
7th	3rd	$\tau^{ff} + \dfrac{D_3 \cdot (1+r)^7}{W \cdot (1+n)^3 \cdot (1+g)^6 \cdot \left[1.2 + (1+n) \cdot 1.3 + (1+n)^2 \cdot 1.5 + (1+n)^3 \right]}$
8th	4th	$\tau^{ff} + \dfrac{D_4 \cdot (1+r)^8}{W \cdot (1+n)^4 \cdot (1+g)^7 \cdot \left[1.2 + (1+n) \cdot 1.3 + (1+n)^2 \cdot 1.5 + (1+n)^3 \right]}$

As debt becomes lower each period, the additional tax also decreases. To illustrate this, we can calculate additional tax, taking the data from previous example:

$\tau_1^{total} = 14.3\%$, $\tau_2^{total} = 12.5\%$, $\tau_3^{total} = 10.6\%$, $\tau_4^{total} = 8.4\%$, $\tau_5^{total} = 6.8\%$.

Although the total tax is twice as much as tax to FF system in the first period, it decreases to its normal value in 4 periods.

A1.3.4. Tax to SS System under the Bond-Financed Transition

In this case, the transition financed by the subsequent generations, since the government issues bonds to cover the debt. It allows to repay the debt during any desired number of periods.

Suppose, the government decides to repay debt during 25 periods. It pays interest rate equals to r*100%.

Discounted value of the debt is equal to $D = D_1 + D_2 + D_3 + D_4$.

Discounted value of the debt per period is equal to D/25.

Therefore, the tax needed to keep the system in balance would be:

$$\boldsymbol{t}^{ff} + \frac{D}{25} * \frac{1}{PV(income)}$$

where PV(income per period) =

$$\frac{W \cdot (1+n)^{i-4} \cdot (1+g)^{i-1} \cdot \left[1.2 + (1+n) \cdot 1.3 + (1+n)^2 \cdot 1.5 + (1+n)^3 \right]}{(1+r)^i}$$

where i = index of period.

As can be seen, this additional tax can be calculated for any number of periods, not just 25.

To continue our example, total tax under this option can be calculated:

$\tau_1^{total} = 7.5\%$, $\tau_2^{total} = 7.5\%$, $\tau_3^{total} = 7.6\%$, $\tau_4^{total} = 7.6\%$, $\tau_5^{total} = 7.7\%$…

It can be seen that the tax path is much smoother if transition is debt financed. Total tax increases gradually, because in our example we take negative population growth. As result, less working people each period have to repay the same value of the debt.

In this Stylized Model, I assume that the transition to FF system does not influence economic growth and shadow economy. However, as argued in Chapter 1, it may also promote economic growth and reduce informal sector considerably. In this case, tax to FF system would be overestimated by this model.

In this chapter, I have developed a methodology required for constructing the model of Ukrainian pension system. It is shown that stable population decline

does not cause tax to SS system to increase. Only continuously falling population growth causes a rise in SS taxes.

An increase in retirement age is confirmed to be an effective measure in decreasing population burden. Moreover, the effectiveness of this measure depends on rate of population growth. The lower this rate is, the higher there is a fall in SS tax due to an increase in retirement age.

A tax to FF system depends negatively on real interest rate and positively on economic growth. Population growth does not influence a tax to FF system, so consistent fall in population growth rate will not lead to an increase in SS tax, as this was in PAYGO scheme.

Tax path depends on a way of financing the transition to FF system. The debt is created in each period of transition, though its amount is decreasing drastically as transition is approaching to the end. This debt determines tax path if the transition is financed by current generations. Although the tax to SS system should be increased considerably at the beginning of transition, it is falling continuously until reaches the level of FF tax.

Bond-financed transition provides smoother tax path. However, the tax to SS system increases during the transition in this case, if we consider the case of negative population growth. The reason is that amount of labor force, which repays the same amount of debt each year, decreases.

DESCRIPTION OF UKRAINIAN PENSION SYSTEM

A2.1. Introduction to *Ukrainian pension system*

The avowed goal of the Ukrainian pension system is to protect pensioners from poverty while avoiding making excessive demands upon the economy. The current pension system, which is based on pay-as-you-go (PAYGO) model, does not meet these requirements. While social security tax is 33%[8], Pension Fund of Ukraine does not have sufficient funds to pay all pensions. Although the replacement ratio[9], which shows how much welfare of retirees corresponds to welfare of working population, is high enough for Ukraine (Graph A2.1), it is also responsible for a high level of spending for pensions.

Graph A2.1   **Average Replacement Ratio**
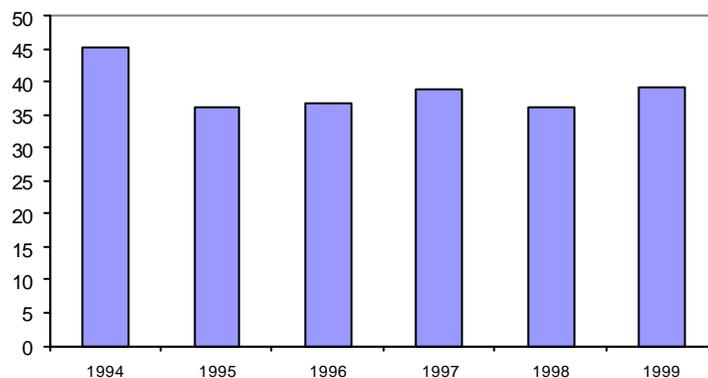
Source: State Statistics Committee

Graph A2.2 shows the share of pension payments in GDP. As can be seen from the graph, pension payments grew on average 1% more of GDP each

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[8] According to the Social Security Law of 1992, employers must contribute 32% of the total wages of their companies to the Pension Fund (if employees of the company have a right to preferential treatment, i.e. right to receive a higher pension benefit,
 this rate is higher), employees contribute 1% of the wage, and self-employed workers and lawyers pay 32% of their earnings.

year from 1994 to 1997, and rose from 9% to 13% of GDP during this period. The decrease in 1998 can be explained by an increase in pension arrears of the Pension Fund to pensioners. [Yatsenko, 1998]

Graph A2.2. **Pension Component as % of GDP**
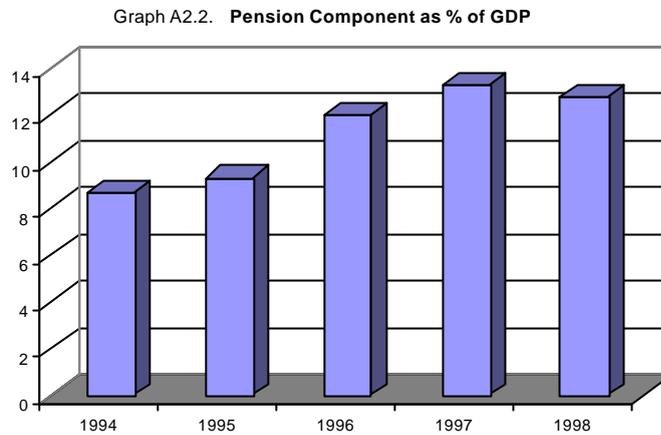
The factors responsible for these problems stem from three main sources: imperfections of the Social Security System, unfavorable economic conditions and unfavorable demographic situations[PADCO, 1998].

A2.2. Imperfection of the Social Security Structure: Payments side

Generous eligibility conditions. The most pressing problems confronting the social pension system of Ukraine stem from faulty design issues and structural factors that are independent of the progressive demographic aging. Ukraine, like other Central and Eastern European countries, has a much higher system dependency ratio than demographic dependency ratio.[10][Estelle and Vittas, 1994]. While the demographic dependency ratio is only 39.31%, the system dependency ratio is 49.77%. This discrepancy between the two ratios is caused by inclusion of surviving spouse and orphans among the beneficiaries; by early retirement provisions for selected

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[9] The ratio of average pension to average wage in a country

[10] System Dependency Ratio (SDR) is the number of pensioners, including widows, orphans and disability pensioners, divided by number of contributors.
Demographic Old Age Dependency Ratio (DDR) is the number of people 60 years and over divided by people aged between 20 and 59 years.

17

occupations or industries (miners, heavy industry, etc.); by special provisions for working women; by lax certification of disability pensions. [Estelle and Ferrier, 1999] Thus, only 78.9% of pensioners were over age 55 (women) and 60 (men) in 1999.[11] Graph A2.3 shows that compensation, which is paid for beneficiaries, amounted for a large share of total pension payments. The extremely large share of compensation in 1995 is not surprising taking into account that there were Presidential elections in 1995.

Graph A2.3 **Pension Components (as % of total payments)**
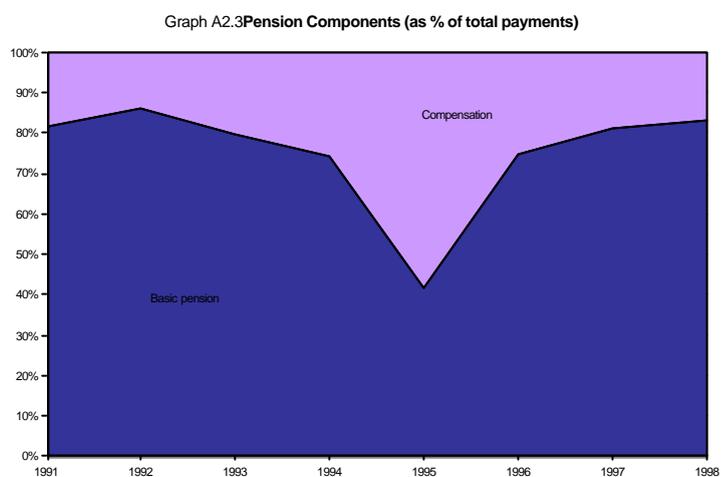
Source: Pension Fund of Ukraine

Low retirement age. The official retirement age is 60 for men and 55 for women. The problem of low retirement age is further compounded by the decrease in retirement age for those workers viewed to have a dangerous job. For those workers the retirement age is decreased to 55 years for men and 50 years of women. Also, according to current laws, the periods when a person does not contribute to the Pension Fund due to engagement into military service, studying at university, childcare are also included in working record. [Yatsenko, 1998]

Inadequate benefits. The pension system of Ukraine has considerable disadvantages from the viewpoint of equity and fairness. First, this system does not provide the necessary correlation between work itself and its

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[11] Source: State Statistics Committee. 1999. *Ukrainian Pension System.*

18

benefits. The working record requirements that should be fulfilled to get a full pension are too generous. To calculate a pension level, the average monthly wages over short period of time (last 2 years) are taken into account. The differentiation of pension levels is socially unfair: on the one hand, the disadvantages of legislation resulted in very small difference between maximum and minimum pension levels; on the other hand, according to "status" laws of Ukraine, certain categories of people can get pensions that are several times higher than the usual pension level.[Dobronogov, 1998]

Inefficient administration. The administration of the pension system of Ukraine is inefficient, because administrative functions are split between the Pension Fund and Ministry of Labor and Social Policy, and because the system is run as a series of local systems rather than as a single national system [PADCO,1998]. The Ministry of Labor and Social Policy is responsible for setting state policy and developing drafts of laws in the field of pension system, assignment and calculating the pension level according to legislative regulations, controlling the use of the funds of the Pension Fund of Ukraine, while the Pension Fund collects the social security contributions into the fund through its regional branches and keeps them on account in a special postal-pension bank.[InvestGazeta, 1999] There is often a lack of coordination between actions of the organizations.

Absence of strict delimitation between funds of the Pension Fund and the State Budget. The pensions or bonuses for some retirees, who do not fully contribute to the Pension Fund (state employees, military men, individuals that suffered from the Chornobyl catastrophe), are paid from the State Budget. However, the State Budget does not transfer the necessary funds either completely or in time. As a result, there is consistent fund deficit of transfer payments due from the State Budget. This deficit places further burden on an already underfunded system.

Low correlation between contributions and pension level. There are no individual records of payment of an employee made during his working life, and the amount of pension is calculated on the basis of the wage received during last 2 years. So, since payments are not based on overall contributions over one's working lifetime, this creates an incentive to avoid the system until pre-retirement. [PADCO, 1998]

Growing deficit. The contraction of the tax base, the low contributions rate of enterprises and individuals and the increase in the number of retirees resulted in growing deficit of the Pension Fund. Consequently, the current pension system is no longer able to provide all pensioners with adequate benefits.

A2.3. Unfavorable Economic Conditions: Revenue Side

The sharp economic contraction since independence has put great strains on the social protection system – and in particular on the pension system. While the number of beneficiaries has continued to grow, the revenues have declined sharply as a result of significant changes in labor market.

First of all, real wages have fallen by 8.7%[12] since 1995 that led to the decline of the wage bill, tax base of the pension system. Second, total employment fell by 5.7% from 1995 to 1998[13].

Moreover, only about 89%[14] of legally required contributions are paid into Pension Fund. The primary reasons are the large share of the gray economy, which is estimated to be 50% [Kauffman and Kaliberda, 1995], and the financial difficulties of many state enterprises.

All these factors have led to a decrease in the real value of the pension contributions.

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[12] Source: State Statistics Committee. 1999. *Ukrainian Pension System.*
[13] Source: State Statistics Committee. 1999. *Ukrainian Pension System.*
[14] Estimated by arrears of enterprises, shadow economy does not included.

High social security tax rate. A high social security tax rate, which is 33%, bolsters people to leave the official economy, and to enter the unofficial sector of the economy, where salary is not subject to taxes. This leads to contraction of the tax base and insufficient funds to finance current pension system of Ukraine.

### A2.4. Unfavorable Demographic Situation: the Future

The unfavorable demographic situation will intensify the financial strains on pension system of Ukraine. Under PAYGO system, the contributions of current workers are used to pay pensions to current retirees. So, the ratio of the number of retirees to working population becomes extremely important for providing the elderly population with social benefits. Since this ratio is influenced by birth rate, mortality rate and migration processes, as well as eligibility rules, these indicators affect efficiency of social security system. Now the demographic situation in Ukraine pushes this ratio up.

In 1991, the first time the total number of births was lower than the total number of deaths, and 2 years later the population began to decline in Ukraine (migration process became less than natural losses). In 1994, Ukraine became the country a emigration. [National Academy of Sciences of Ukraine, 1998]

Graph A2.4.   **Birth rate in Ukraine, % of population**
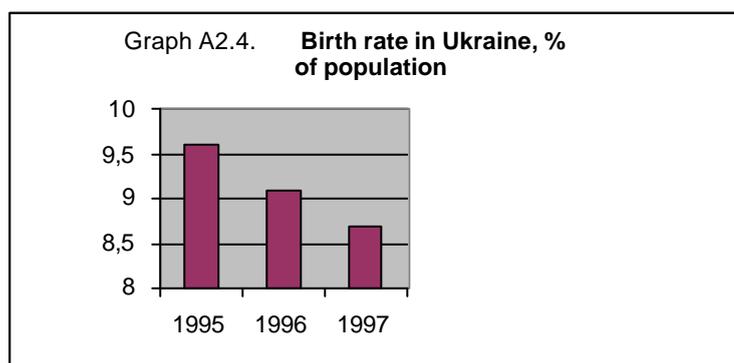
Source: State Statistics Committee

As can be seen from graph A2.4, the birth rate is falling. On the one hand, the contraction of birth rate in Ukraine reflects a world tendency that is influenced by political, economic, social and biological factors. On the other hand, this fall is partially the result of the deep economic crisis in Ukraine. Since 1989, almost all age groups of women have had fewer children than respective groups in previous years. The largest decrease is for women between 25-35 years (30%) and 30-39 (35%), which is evidence of refusal to have a second or third child. At the same time, there is a slight decrease in the mortality rate. Although the average life expectancy is low, it has been rising since 1996. The migration processes into Ukraine have decreased as a result of economic crises and deterioration of the living standards.[National Academy of Sciences of Ukraine, 1998]

Graph A2.5 . **Demographic Old Age Dependency Ratio**
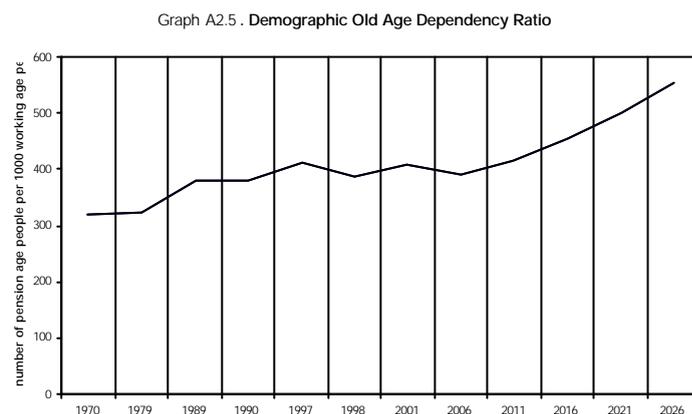
Source: Source: State Statistics Committee. Forecast: National Academy of Sciences of Ukraine

All these trends increase the share of pensioners in the population. Graph 5 shows demographic burden on working population as number of pensioners per 1000 working people.[15] As can be seen from graph A2.5, after 2020 there will be one retiree per two workers. PAYGO system will not be able to sustain such burden without an increase in taxes.

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[15] All-Union population census, Forecast: National Academy of Sciences