Effect of pension reform on tax evasion: Russian case

Shikalova Maria
maria.chikalova@econ.uio.no
Department of Economics University of Oslo
P O Box 1095 Blindern N-0317 Oslo, Norway

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Abstract

According to Russian State Committee on statistics, around 30% of wage is paid in black cash. The main factors, explaining low compliance, are high taxes on labour income weak auditing system. Additional factor is weak individual motivation to comply. Individuals do not expect to get any return on paid taxes, for example in the form of public good provision or social security provision.

One of the arguments in favour of transformation of pension system from defined benefit to defined contribution is an intrinsic feature of the latter to establish a clear link between contribution and benefits. By doing so it brings about additional incentives, in terms of higher future pensions, for individuals to reveal wage.

The paper aims to estimate magnitude of the decrease in tax evasion, caused by such pension reform, and its welfare benefits.

By means of overlapping generation model, I show that the reform brings about 2-5% increase in tax compliance. The size depends on the demographic and macroeconomic scenarios. Welfare benefits of the reform are higher if the increase in tax compliance makes it possible to reduce non-pension labour tax rates.

1 Introduction

Projections for future pensions in Russia demonstrate reduction of real pension benefits on 55% by year 2050 if current pension system remains unchanged (see Iakushev 1999). One reason for this decline is population aging, augmented by drop in fertility during the transitional years. Another reason is tax evasion. Weak auditing system and non-transparancy create favorable conditions for tax evasion. To avoid taxes on labour income, which consists of payroll taxes 39,5%

and individual income tax 13%, part of wages is paid in black cash. According to the Russian State Committee on Statistics (Goskomstat), in the end of 90-s, around 30% of wages is paid in black cash. Tax evasion causes solvency problem for the main provider of pension benefits, the State Pension Fund, because it is financed mainly by payroll tax.

To manage this problem pension reform was launched in 2001. An inherited from Soviet times pension system was defined benefit one. Its feature is that benefits do not depend on contributions. After the reform pension system was transformed into partly defined contribution. Half of the contributions is taken into account when calculating accumulated part of pension benefits. By establishing a clear link between benefits and contributions, defined contribution increases returns on white wage in terms of higher future pension benefits. It encourages tax compliance. Another part of pension benefits, called "basic", is a minimum pension benefit paid to everybody whose tenure is at least 5 years. In 2003 the size of the basic minimum was 20% of the minimum living income. Low size of basic pension implies that accumulated part will determine the size of pension benefits.

Another dimension of the pension reform is a transformation of the pension system from pay as you go to partly funded. In the reformed system up to 20% of the contributions will be financed (the percentage depends on the age during transitional years and will be gradually increased to 20% for everybody). Clearly, this dimension may also influence tax compliance. In case of aging population fully funded system provides higher return on contributions, and hence on white wage payment [references Feldstein]. However, fully funded system is prone to financial risks, which may be significant in Russia with its immature financial market. Advantage of higher return on the contributions in the funded system may be outweighed by the disadvantage of high risks. The net effect of this dimension on tax compliance is not clear. At the same time, its inclusion in the model would lead to a significant complication of the model. The inclusion needs reliable prognoses of the financial market development in Russia, reliable estimation of risk-aversion characteristics of individuals and an introduction of the uncertainty in the model. Such analysis, indeed, may cast the light on tax evasion response to the pension reform for different scenarios of financial market development. But the results would be dependent on the assumed risk-aversion characteristics. Since the advantage of the inclusion of the second dimension is not clear, I will focus only on the first dimension.

By means of overlapping generations model (OLG) framework, I estimate the effect of transition of pension system from defined benefit to partly defined contribution one on tax compliance [done]. I run different scenarios for different macroeconomic and demographic projections and estimate welfare effect of the reform. Transition path to new pension system is modelled according to the rules of current pension reform [to be done]. I then construct an optimal payroll tax, which finances pension benefits and exogenous government spending in the presence of tax evasion.[to be done].

The results show that transition to the partly defined contribution system causes 2-5% of reduction in tax evasion depending on the macroeconomic and

demographic scenario. Individuals are better off if increase in tax compliance is used to reduce non-pension tax on labour income.

The rest of the paper is structured as follows. In the second section I present theoretical OLG model used for the analysis. Third section provides discussion on the data used for analysis and calibration of the model. Fourth section contains numerical results. Fifth one concludes.

2 Model

2.1 Households

I use three period OLG. There are N_h identical individuals born in period h. They are referred to as cohort h. Individuals live for three periods, two active and one retirement. Length of one period is taken to be 15 years because individual is assumed to start working at 20 and live up to the age of 65. According to World Bank demographic projection tables, life expectancy at birth in Russia is 65,8 years in 2000-2004 and will increase up to 74,3 by 2040-2045[1].

Individuals work in two active periods and retire in the third. In each active period individual has one unit of labour, which is supplied inelastically. The labour unit is divided between officially registered (l) and unofficial sectors ($1-l$). Only income from officially registered job is reported to the officials. Labour income tax is paid only on the reported income. An evading individual may be caught and penalized. Expected punishment in each period depends on individual evasion behavior only in this period, but not on previous or future periods' behavior. The assumption is justified by large number of years (15) in one period.

In the initial model individuals do not leave any bequest. However, for considered scenarios the model results in too low long-run capital and unreasonably high rates of return, 25% annually. Such high rate of return biases the resulting effect of pension reform on tax evasion. To increase amount of capital I introduce bequest in the model. Bequest is invested in the end of the last period of life. Inheritor receives the bequested amount plus return on it in the first period of life.

Individuals of each cohort maximize life-time utility function, which is time separable CRRA. They choose consumption path and labour allocation between official and unofficial sectors.[2].

[1] See http://devdata.worldbank.org/hnpstats/DPselection.asp

[2] In model with bequest individuals choose bequested amount in addition to consumption and laour allocations. I employ bequest-as-consumption motive. Though the choice of the bequest motivation is not crucial for the purpose of the paper. Under bequest-as-consumption, bequested amount is introduced as an additional term in life time utility function. An individual problem is then:

$$U_h = \frac{{C_{1,h}}^{1-\mu}}{1-\mu} + \beta\frac{{C_{2,h}}^{1-\mu}}{1-\mu} + \beta^2\frac{{C_{3,h}}^{1-\mu}}{1-\mu} \tag{1}$$

subject to budget constraints:

$$C_{1,h} = w_h e_1(1-\tau l_{1,h}) - s_{1,h} - D_{1,h}$$

$$C_{2,h} = w_{h+1} e_2(1-\tau l_{2,h}) + (1+r_{h+1})s_{1,h} - s_{2,h} - D_{2,h}$$

$$C_{3,h} = b_{h+2} + (1+r_{h+2})s_{2,h}$$

where

$C_{j,h}-$ consumption in period j=1,2,3 for individual of cohort h.

$l_{j,h}-$ part of labour employed in officially registered sector in period j=1,2 for individual of cohort h.

w_h - before-tax wage in period h,

e_j- parameter, which is introduced to capture increasing life-earning profile, j=1,2. In period h before-tax wage for individuals of cohort h is $w_h e_1$, while for individuals of cohort h-1 it is $w_h e_2$. Parameters e_j may be interpreted as labour efficiency parameter. Labour efficiency is increasing with the age because of experience accumulation or learning by doing, $e_2 > e_1$.

b_{h+2} - retirement benefits paid to the individual of cohort h in period h+2.

$D_{j,h}$ - expected punishment for evasion in period j for individual of cohort h.

Expected punishment is assumed to have the following form

$D_{j,h} = f_{j,h}P_{j,h}$

where

$f_{j,h}-$ penalty paid by individual of cohort h in period j=1,2, after she has been caught for evasion, it is assumed here that penalty consists of only fixed amount F.

$P_{j,h}-$ probability to be caught for evasion for individual of cohort h in period j=1,2. It increases with income earned in unofficial sector.

$$P_{j,h} = \frac{1}{C}\left[w_{h+j-1}(1-l_{j,h})\right]^{\gamma} \tag{2}$$

where γ, C - parameters to be calibrated.

$$U_h = \frac{{C_{1,h}}^{1-\mu}}{1-\mu} + \beta\frac{{C_{2,h}}^{1-\mu}}{1-\mu} + \beta^2\frac{{C_{3,h}}^{1-\mu}}{1-\mu} + \psi\frac{{Beq_h}^{1-\mu}}{1-\mu}$$

subject to budget constraints:

$$C_{1,h} = w_h e_1(1-\tau l_{1,h}) - s_{1,h} - D_{1,h} + Beq_{h-2}(1+r_1),$$

$$C_{2,h} = w_{h+1} e_2(1-\tau l_{2,h}) + (1+r_{h+1})s_{1,h} - s_{2,h} - D_{2,h},$$

$$C_{3,h} = b_{h+2} + (1+r_{h+2})s_{2,h} - Beq_h,$$

where Beq_h - is a bequest left by cohort h.

Thus

$$D_{j,h} = \frac{F}{C}\left[w_{h+j-1}(1-l_{j,h})\right]^{\gamma} \tag{3}$$

According to Russian tax legislation [references], penalty depends on the amount of hidden taxes plus some fixed amount. Thus it has the following form

$$f_{j,h} = F + d\tau w_{h+j-1}(1-l_{j,h}), \tag{4}$$

where $\tau-$tax on labour income and d=1,4.

The reason, why I assumed penalty consisting only from the fixed payment is follows. Since the beginning of 90-s, the period for which we observe development of tax evasion, there was only one change in labour taxation. In 2001 progressive income tax (with progression steps 12%, 20% and 30%) was replaced by flat tax (13%). At the same time payroll tax for enterprises was reduced by 3,9%.The reduction of labour taxes caused a reduction in the share of black wages in total wages from 35% (in 2000) to 30,5% (in 2002). The estimation of share of black wage is done by the State Committee on Statistics (see Goskomstat, 2002). Thus, I have only two pairs for labour taxes and evasion: before and after the tax reform. Thus only two unknown parameters in the function of expected punishment can be calibrated to match these two pairs. There are three parameters F, C and γ for any of these two model specifications: $f_{j,h} = F$ or $f_{j,h} = F + d\tau w_{h+j-1}(1-l_{j,h})$. Hopefully, under the model specification with only fixed penalty for the purpose of the analysis it is enough to know ratio $\frac{F}{C}$, but not F and C separately. With the form of penalty corresponding to Russian legislation (4) I would need to estimate F and C separately. as it was said above, it is not possible because of few(two) reference points. To resolve it I might tie fixed payment F to wage level w_h. But it needs further assumption about the form of the tie. In order not to make the results too prone to this assumption I include only fixed amount in the penalty.

Probability to be caught, determined by function $P_{j,h}$, is equal to zero if either individual either does not work ($w_{h+j-1} = 0$)or he does not evade($l_{j,h} = 1$) . It is not however obvious that probability to be caught is equal to one if individual gets whole labour income in black cash. The probability in this case depends on the parameters F,C and γ.

2.2 Pension benefits

As it was stated earlier, the question of the paper is how the intrinsic feature of defined contribution system (versus defined benefit one) may be used to reduce tax evasion.

I consider defined benefit and defined contribution systems. Both have distributive pay as you go character. Recall that I omit the transformation of the pay as you go system to partly funded one.

Under defined benefit system pension benefits are determined by

$$b_{h+2}N_h = \tau^p w_{h+2}\left[e_1 l_{1,h+2}N_{h+2} + e_2 l_{2,h+1}N_{h+1}\right]$$

With n -growth rate of the population

$$b_{h+2} = \tau^p w_{h+2}\left[e_1 l_{1,h+2}(1+n)^2 + e_2 l_{2,h+1}(1+n)\right] \tag{5}$$

where τ^p- pension tax.

Under defined contribution system pension benefits for individual are equal to the sum of her contributions made in the first period indexed with θ_1 and contributions of the second period indexed with θ_2.

$$b_{h+2} = \tau^p\left[\theta_1 e_1 l_{1,h} w_h + \theta_2 e_2 l_{2,h} w_{h+1}\right] \tag{6}$$

Since the purpose of the paper is to show how tax evasion is influenced by the establishment of the link between contribution and benefits, rather than by the difference of the size of pension benefits between the two pension systems, it is assumed that $\theta_1 = (1+n)^2$ and $\theta_2 = (1+n)$. Such indexation rule brings about identical pension formulas for the two pension systems in the long-run equilibrium. The difference in absolute values of pension benefits between the two equilibrium is driven solely by their difference in tax compliance.

2.3 Labour allocation

From the first order conditions of the individual problem we derive condition for labour allocation between officially and unofficial sectors. The rule for allocation differs between defined benefit and defined contribution systems. Defined contribution brings about additional advantage to be employed as officially registered by linking future pension benefits to contributions.

Under defined benefit system labour allocation conditions for individual of cohort h are

$$\tau = \gamma\frac{F}{C}(e_1 w_h)^{\gamma-1}(1-l_{1,h})^{\gamma-1} \tag{7}$$

$$\tau = \gamma\frac{F}{C}(e_2 w_{h+1})^{\gamma-1}(1-l_{2,h})^{\gamma-1} \tag{8}$$

Left-hand side of the equation is a marginal cost of reduction of hidden income by one additional unit. It is equal to tax rate. Right-hand side is a marginal benefits of reduction of tax evasion. It is a reduction of expected punishment for evasion. From equations (7) and (8) obtain condition for age-evasion profile

$$\frac{1-l_{1,h}}{1-l_{2,h}} = \frac{e_2}{e_1} \tag{9}$$

It means that the reduction in share of evaded income with the age is equal to increase in earnings. To check, whether this simple model delivers plausible results, I estimated both side of the equation using data from Russia Longitudinal Monitoring Survey (RLMS)[3]. The survey contains detailed information at individual and household levels. It covers period from 1992 to 2002. Detailed discussion of the data is provided in the section Data and Calibration.

The estimation based on RLMS data shows that left-hand side of (9) is 35-40% larger than the right-hand side. It means that an increase in income in the second working period of life can not totally explain a large decrease in share of income paid in black cash, when individuals become older. One possible explanation may be that decrease in tax evasion does not depend on increase in income linearly. Another explanation is that RLMS estimation is biased by cohort effect. Small enterprises, appeared in the beginning of 90-s, are often accused in tax evasion. If small enterprises prefer to employ young workers, there will be a strong cohort effect in the estimation of evasion shares in age groups. In addition to the two explanations high shares of evaders among young workers may driven by self selection. Tax evasion implies that working contract either not signed at all or fictitious. It places worker in a more risky situation, as she is not protected by labour legislation. In general, young people take this risk easier than old workers. Thus the share of evaders would be higher among the young workers. An importance of the social security system for individual (for example, medical care and pension provision) increases when agent becomes older. An access to and size of social security benefits depend on taxes paid. For example, up to 2001 the size of pension benefits depended on income of last two working years. [Alternative explanations: income heterogeneity. Income inequality grows in life-cycle. When getting older – reputation matters more. Evasion hurts higher on senior positions, which are often occupied by older workers].

Under defined contribution system conditions for evasion allocation for individual in cohort h is:

$$\tau = \gamma \frac{F}{C}(e_1 w_h)^{\gamma-1}(1-l_{1,h})^{\gamma-1} + \frac{\theta_1}{(1+r_{h+1})(1+r_{h+2})}\tau^A \qquad (10)$$

and

$$\tau = \gamma \frac{F}{C}(e_2 w_{h+1})^{\gamma-1}(1-l_{2,h})^{\gamma-1} + \frac{\theta_2}{1+r_{h+2}}\tau^A, \qquad (11)$$

where τ^A- is a part of social tax which is accounted for future pension. In the reformed Russian pension system it is 14% of the payroll (half of the pension contributions).

[3]Information on survey may be found on the web page http://www.cpc.unc.edu/projects/rlms/

Comparison of the evasion allocations between two pension systems (7) – (8) and (10) – (11) shows that conditions for defined contribution system has additional terms on the right hand side. It is additional marginal benefits to reveal income, that comes from an increase in future pension benefits linked to white contributions.

2.4 Production

Production in period h is described by constant return to scale technology (Cobb-Douglas form) with efficient labour (L_h) and capital (K_h) inputs.

$Y_h = K_h^a L_h^{1-\alpha}$,

where efficient labour $L_h = e_1 N_h + e_2 N_{h-1}$.

Producer has two opportunities to employ labour: officially or unofficially. Official and unofficial wage rates are equal. The framework with one production technology for registered and unregistered workers rather then two-sector (black and white) model was chosen to purify the effect of pension reform on evasion behavior. In a two-sector model the first order reform driven change in labour allocation between the two sector would cause additional effect through the general equilibrium adjustment. Another reason for choice of one sector model is that it is common practice in Russia when worker gets wage partly in black cash and partly in white cash. The black and white shares are earned at the same enterprises with the same technology and productivity.

It is assumed that only worker is punished for evasion but not an employer. According to Russian tax regulation, employer is punished for evasion from payroll taxes and worker is punished for hiding from labour income tax. However for the resulting effect of pension reform on tax evasion, it is not crucial who pays punishment. An introduction of the punishment for both of them in the model would lead to additional parameters to be estimated. Recall, that I only have two points for calibration of the parameters of interest, and hence I am bounded from expansion of the model in this direction.

2.5 Equilibrium conditions

Labour, capital and product markets are perfectly competitive. Production has constant return to scale. Hence factor prices are equal to their marginal productivity. Price of consumption good is chosen to be numeriare. Real wage and rate of return are determined by (12) and (13)

$$w_h = (1-\alpha){k_h}^{\alpha} \tag{12}$$

$$r_h + \delta = \alpha \left(k_h\right)^{\alpha-1} \tag{13}$$

where k_h - is a capital per efficient labour unit, determined by $k_h = \frac{K_h}{e_1 N_h + e_2 N_{h-1}}$.

Capital depreciates from one period to another with rate δ. Capital dynamics is described by

$$K_{h+1} = I_h + (1-\delta)K_h, \tag{14}$$

where I_h- is investment in period h.

Savings are accumulated and invested in the next period.

$$I_h = s_{1,h} N_h + s_{2,h-1} N_{h-1} \tag{15}$$

Thus, capital per efficient labour evolves as follows:[4]

$$k_{h+1} = \frac{s_{1,h} + s_{2,h-1}/(1+n)}{e_1(1+n) + e_2} + \frac{(1-\delta)k_h}{1+n} \tag{16}$$

Conditions for long-run equilibrium in the presence of defined benefit system

are derived from the Euler equations for the individual problem (1), equations for labour allocation (7) and (8) and equations (12),(13) and (16). To find a long run equilibrium in the presence of defined contribution system one has to replace equation (7) − (8) in the system of equation with (10) − (11) in the above system of equations. It is not possible to solve the systems analytically. Solutions are derived numerically.

3 Data and Calibration

3.1 Demography

Currently population growth rate in Russia is negative. According to Goskomstat (2002), annual growth rate of population in 2002 is -0,33%. However, this low value may be a result of negative influence of transition period. For the purpose of my analysis I use long-run projections for 2000-2050 made by the Center for Demography and Human Ecology at Institute of Economic Forecasting, Russian Academy of Science (for details see Visnevsky and Andreev, 2000). They designed 12 scenarios with various values for fertility, death and migration rates. Projections for annual population growth in these scenarios vary from -0,5% to 0,74%. I use two scenarios for the border of the range. Since every period in the model consists of 15 years, the corresponding period growth rates (n) are -7% and 11,5%. I call the first scenario "pessimistic" and the second "optimistic".

[4] In the model with bequest motive capital investment in period h includes also bequest left by cohort h-2

$I_h = s_{1,h} N_h + s_{2,h-1} N_{h-1} + Beq_{h-2} N_{h-2}$.

Then capital evolves according to the following condition:

$k_{h+1} = \frac{s_{1,h} + s_{2,h-1}/(1+n) + Beq_{h-2}/(1-n)^2}{e_1(1+n)+e_2} + \frac{(1-\delta)k_h}{1+n}$

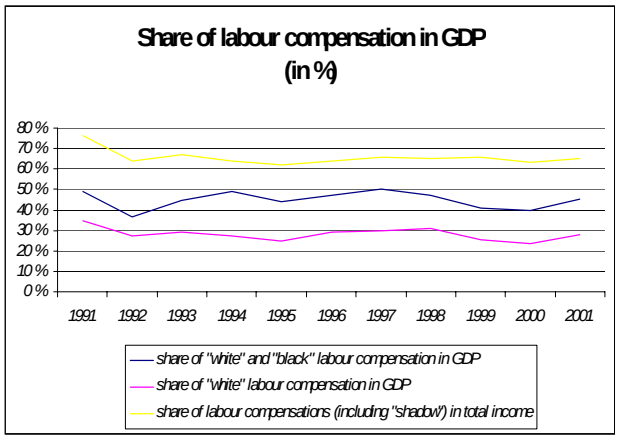

Figure 1: Share of labour compensation in GDP, in %. Source: Goskomstat (2002).

3.2 Production

To estimate labour share parameter $(1-\alpha)$ I use data on share of labour compensation, including shadow/black part, in total incomes (see Figure 1). The value varies from 0,62 to 0,74 in the period from 1990 to 2001. For the model I use $(1-\alpha)$ to be equal 0,6.

To estimate depreciation rate (δ) I assume that current economy is in long-run steady state. From equation (16) in the steady state obtain

$$n + \delta = \frac{i}{k} \tag{17}$$

where i is long run equilibrium investment per capita.

Equation (17) delivers depreciation rate for steady state investment-capital ratio. The State Committee on Statistic (Goskomstat) gives inaccurate estimation of capital stock, which prohibits us from estimating the ratio $\frac{i}{k}$. There are several reasons for it. First, large part of the capital stock used in the soviet economy was not profitable at world prices. After Russian economy has been opened for import, large part of the capital was not used, but still included in the official statistics. Second, there are serious flaws in accounting methods used for re-evaluations of capital stocks after 1991. The evidence of the inaccuracy of the official accounting may be the fact that official estimation of capital stock shows no decline over the transition period despite of fall in GDP (for further discussion see Voskoboynikov, 2003; Hall and Basdevant,2002; Goskomstat, 1997).

There are several studies conducted on estimation of the capital stock in Russia. Hall and Basdevant (2002) propose technique for estimation of effective capital stock [5] in Russia based on Kalman Filter. They demonstrate graduate decline of the effective capital stock for the period 1994 - 1998 with a sharp fall in 1998. They also report estimation for depreciation rates. Voskoboynikov (2003) uses several statistical models of capital survival to derive estimation of capital stock, free from the re-evaluation errors in the period 1989-2001. Assuming that capital depreciation is caused only by its physical depreciation, he estimates parameters in the survival models using data for the period 1961-1989. To capture transitional production fall in 1991-1994 he uses Cobb-Douglas production function to produce econometric estimation of effective capital stock in this period. He assumes that the fall is passed after 1994. The author returns to survival model to estimate capital stock in 1995-2001. Voskoboynikov's (2003) model replicates the same number as were reported by Goskomstat: average annual investment-capital ratios are around 11% for the period 1959-1974 and around 8,5% for the period 1974-1989. After 1989 the model produces slightly higher values, than ones reported by Goskomstat. Model's values are around 3,72% and 1,6% in 1990-1994 and 1995-2001, versus 3,56% and 1,3% reported by Goskomstat for the same periods.

For my numerical model I assume Voskoboynikov's (2003) estimation for the last period 1995-2001 (1,6%) is a steady state investment-capital ratio. Corresponding investment-output ratio for the 15-year period is 24%. Together with the assumption of -7% growth rate of population it produces rate of depreciation 17%. It corresponds to annual depreciation of 1,1%. Values n=-7%, δ=17% and $\frac{i}{k}$=24% construct "pessimistic" scenario.

The steady state investment-capital ratio 1,6% is lower than that of developed countries. Cooley (1994), for example, reports this ratio to be 7,6% for USA[6]. It is plausible that lower estimation of Voskoboynikov (2003) may be a result of negative factors that were particular for transitional period. So I use 5% investment-capital ratio to design another scenario, called "optimistic". The optimistic scenario is described by n=11,5%, $\frac{i}{k}$=75%. Corresponding periodic depreciation ratio δ is 63,5%, or 3,3% annually.

3.3 Data at individual level

The data at individual level are drawn from Russia Longitudinal Monitoring Survey (RLMS)[7]. The survey represents the whole population. It has detailed information on the individual working activity at the primary, second and additional jobs. For the purpose of the analysis particular important are the questions about official registration at job, included in the survey in 1998, 2000 and 2002. The data for the three years are used to calculate individual labour income and tax evasion. Below I discuss it more thoroughly.

[5] Effective capital is a capital which is used for production of goods demanded on the market.

[6] See Cooley (1994), pp. 21.

[7] http://www.cpc.unc.edu/projects/rlms/

3.4 Individual preferences

Intertemporal elasticity of substitution $\frac{1}{\mu}$ is set to be 0,25 [for references see Auerbach and Kotlikoff]. Sensitivity analysis demonstrates that change in this parameter has insignificant effect on the results of the analysis.

I use Euler equation for steady state $\beta(1+r) = \left(\frac{C_{h+1}}{C_h}\right)^{\mu}$ to estimate discount factor β. Individual consumption profile, estimated from RLMS, is downward slopping. For the three period model the ratio $\frac{C_{h+1}}{C_h}$ is around 0,85. Together with targeted r (5% annually) it gives $\beta = 0,24$.

3.5 Bequest motive

Since the only reason for introduction of bequest motive in the model is to derive reasonable values for capital/rate of return, parameter ψ is calibrated to obtain annual rate of return of 5%. It differs between scenarios and is reported together with numerical results.

3.6 Labour income

RLMS data contain information on labour income, earned in the last 30 days at primary, secondary and additional jobs. By summing them up for each individual, I calculate total labour income. To check the reliability of RLMS data on labour income, I calculate the shares of labour income earned by each of five income groups. The first group consists of the first 20% of workers with lowest labour income, the second group - from the next 20% of workers and so on up to the fifth group. The same numbers are calculated once again after I have excluded all unregistered incomes. The results for the three years are reported on Figure 2. The third column for each year is data provided by the State Committee of Statistics (Goskomstat Rossii 2002). A comparison of the calculated values with official ones shows, that the share of incomes earned by 20% of individuals with highest labour income is overestimated in RLMS data. One possible explanation is may be that RLMS contains information on both registered and unregistered incomes, while official statistics has information only on registered incomes. Hidden higher wage contributes more in the share of wage of the group with high earnings than hidden low wage in the share of low earners group. Indirect evidence in favor of the explanation is that RLMS estimation is lower than official for low income group and higher than official for high income group. Exclusion of the unregistered incomes makes RLMS values closer to official. Since RLMS data do not contain information on those who registered on the job, but reports only part of the income, I am not able to exclude all unreported incomes. Discussion of procedure employed to obtain, at least partly, information on tax evasion behavior of the individuals from RLMS is provided below in the section on tax evasion.

RLMS data demonstrate that labour income of the workers in the first active working period (20-37 years old) is only 2-4% lower then that of workers in the

	1998			2000			2002		
Labour Income group	RLMS Labour income	RLMS Registered Labour income	GKS Labour income	RLMS Labour income	RLMS Registered Labour income	GKS Labour income	RLMS Labour income	RLMS Registered Labour income	GKS Labour income
1-st(20% lowest)	0.03	0.03	0.06	0.03	0.03	0.06	0.03	0.04	0.06
2-nd	0.07	0.08	0.10	0.08	0.08	0.10	0.09	0.09	0.10
3-d	0.12	0.13	0.15	0.13	0.13	0.15	0.14	0.15	0.15
4-th	0.21	0.22	0.21	0.22	0.22	0.22	0.22	0.22	0.22
5-th(20% highest)	0.56	0.54	0.48	0.55	0.54	0.47	0.51	0.50	0.47

Figure 2: Share of labour income earned by the 20% groups

second period (37-57). However, for calibration it is taken to be 30% to deliver evasion profile corresponding to RLMS data (see below). In the model age-evasion profile is determined by (9) and hence dependent on assumed age-income profile.

3.7 Tax evasion

There are few surveys at individual level on tax evasion in Russia. Most surveys are at enterprises level. In these surveys respondents are usually employers/managers at high levels[references to both strands of literature and surveys]. Since I focus on the effect of pension reform, which influence tax evasion through building up individual motivation, I use surveys at individual level.

For the purpose of such analysis RLMS data is a valuable source of information. Its main advantage is a provision of detailed information on working activity of individuals, their health condition, social and educational background. Its drawback is that respondents were not asked directly whether they evaded. However, in three rounds, in 1998, 2000 and 2002 respondents were asked whether they are registered at primary and secondary jobs. I consider all those, who respond negatively to this question, to be evaders. Respondents were also asked about additional job to these two jobs. In 2000 and 2002 respondents were asked about official registration at the additional job. 82% of respondents, who have additional jobs, were not registered there. Because the ratio of not registered among the additional job holders is so high, for the year 1998 all those who have additional jobs are considered to be evaders. This criterion allows to capture only those who does not report the whole amount of earnings from either main or secondary or additional job. It results in 8.2% of evaders among workers in RLMS. The criterion is not able to capture those who registered at job but do not report part of earnings. According to survey conducted by Public Opinion Foundation (FOM) in 2001 and 2003[8], 7% of the

[8] FOM (2001).Wages: Pay Sheets and Pay Envelopes
http://bd.english.fom.ru/report/cat/humdrum/income/before-tax_contributions__/etb012507

workers get the whole amount of wage in a black cash, while 9% of the workers get part of their wage in the black cash.

One possible way to figure out this type of tax evasion in RLMS data is to look at the workers who have a contract at their primary job but do not have possibility to use paid sick leave or paid annual vacation[9]. According to the labour legislation in Russia, all employees have a right for paid sick leave. Tenure of at least sixth month at the job gives right for annual paid vacation. A negative answer to this question is considered as a sign of false contract. "False" in a sense that such contract does not serve as a means to regulate employer-employee relations. Working conditions are agreed by the informal talk. False contract does not guarantee any right to employee. It is likely contain lower then actual wage rate to reduce payroll taxes. Of course, this method does not allow to estimate the size of income hidden by the holder of false contract, but does allow to capture some incidence of the partial evasion.

The question about the right for paid sick leave and paid annual vacation was included into the questionnaires only in 2000 and 2002. Correction for partly evaders is made only for these years, but not for 1998. After the inclusion of partly evaders, the share of evaders is increased up to 10,6% among the RLMS respondents.

It might be argued that those who registered at job and do not have a right for paid sick leave and paid vacation are part-time workers. I check it by comparison of the average number of hours worked in ordinary working day, ordinary working week, last week and last month between those, who are officially registered at job and have right for paid sick leave/vacations, and those, who are officially registered at job and do not have right for paid sick leave/vacations. The estimations were done for 2000 and 2002, and give similar results. Numbers for the latter are even slightly higher than for the former. The difference, though, is not statistically significant. Thus part-time job does not appeared to be a good explanation for this phenomenon. Another piece of evidence is that holders of false contracts have age structure similar to nonregistered at job. It is demonstrated on Figure 3.

Since I used an indirect evidence of tax evasion, it is necessary to check the reliability of the obtained tax evasion. I compare age structure of the obtained evasion, with that of reported by Public Opinion Foundation(FOM).The result is shown on Figure 4. Both FOM and RLMS estimations demonstrate declining evasion share with the age. FOM estimations for evasion for 18-35 group are twice as large as for the group between 36 and 50. According to RLMS, the evasion among 18-35 age group is only 30% higher than that of 36-50 group. This age-evasion profile is calibrated in the model.

The indirect way, employed here to obtain information on tax evasion, under-

FOM (2003) A New Pension System
http://bd.english.fom.ru/report/cat/humdrum/income/before-tax_contributions__/pensionary_reform/etb034006

[9]Respondents were asked: "Can you, if you need, take a paid sick leave or paid annual vacation".

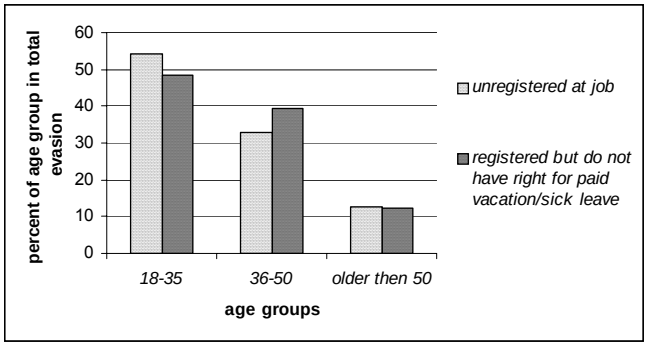

Figure 3: Age structure of unregistered at job and holders of false contracts in RLMS.

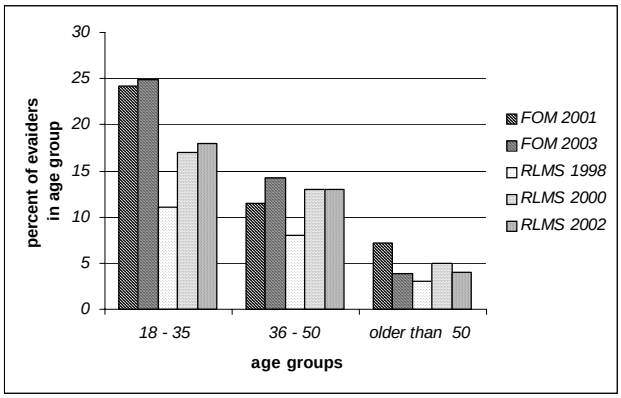

Figure 4: Evasion in age group, RLMS and FOM.

estimates evasion (10,6% of workers). According to FOM the share of evaders is 15% of the workers, while according to Russian State Committee on Statistics, it is 13% in 2002 [reference to GKS]. Both estimations are higher then the one obtained from RLMS. But for the purpose of the paper, it is not an absolute value, but age structure of evasion, matters. The underestimation is not likely to be biased toward individuals of particular age group.

Calibration of parameters γ and $\frac{F}{C}$ in the punishment function (3) is done so that the model delivers absolute total share of tax evasion corresponding to estimation of the State Committee on Statistics. According to the Committee, in 2000, when aggregate tax on labour income[10] was 52,5%, share of black wage in total wage was 35%. In 2002, after the aggregate tax was reduced to 48,6%, the share of black wage drop to 30,5%.

4 Results

For convenience calibrated and estimated parameters are reported in the table below

Parameter	Description	Value
n	annual population growth rate	-0,5%(pessimistic); 0,74% (optimistic)
δ	annual depreciation rate	1,1%(pessimistic); 3,3% (optimistic)
α	production parameter	0,4
$1/\mu$	intertemporal elasticity of substitution	0,25
β	discount factor for 3 period OLG	0,24
$\frac{e_2}{e_1}$	growth of life-cycle labour income	1,30
τ	aggregate labour income tax	48,6%
τ^p	pension tax	28%
τ^A	accumulated tax	14%

Other parameters are calibrated for every scenario and reported below.

First, I report results for long-run equilibrium. Then I consider transitional path from equilibrium with defined benefit system to the one with defined contribution and, finally, discuss an optimal tax on labour in the presence of evasion.

4.1 Long-run equilibria

Results for long run equilibria for model with defined benefit and defined contribution pension systems are reported on Figure 5 for optimistic scenario and on Figure 6 for pessimistic scenario. The lower parts of the tables show the results for the model, where non-pension part of payroll taxes is used to finance non-pension government spending, and may be interpreted as state budget. The share of state budget in GDP is around 20%. According to the State Committee on Statistic, the share of state budget in GDP is around 30% in late 90-s. An increase in tax compliance, caused by reform of the pension system, makes it

[10] Aggregate tax on labour income includes payroll taxes and individual labour tax.

possible to reduce non-pension part of payroll tax used to finance exogenously given government spending. The reduced tax rates are reported in the tables.

Parameters $\gamma, \frac{F}{C}$ and ψ are calibrated for each scenario. Parameter γ is especially important for the interpretations of the results, since it determines the shape of punishment function, which is a central mechanism driving the results on tax evasion[11]. Parameter γ does not differ much for different scenarios and variations of the model, i.e. introduction of bequest motive and introduction of possibility to reduce non-pension labour tax. For all scenarios calibrated γ is higher then unity. From (2) it means that probability to be caught is an increasing and convex function in black income. Intuitively it seems clear that it is more difficult to hide higher income. So tax evasion decreases when labour income increases. That is why upward slopping wage profile delivers decreasing life-cycle evasion profile.

Reform of pension system from defined benefit to defined contribution pension system reduces aggregate evasion[12] in the economy. The magnitude of reduction depends on the scenario. It also depends on an introduction of bequest motive. It is worth to note that the introduction is only an instrument to get reasonable annual rate of returns. In the system without bequest the annual rates are too high, e.g. 25% annually in optimistic scenario. With so large rate of returns individuals place higher weight on private savings and hardly react on the change on the pension system. This effect is captured by equations $(10) - (11)$. Additional benefits from revealing labour income imposed by the pension reform (the second terms in the right-hand side) decrease with an increase in rates of return. Numerical results provide an evidence for this fact. For both, pessimistic and optimistic, scenarios model with bequest provides higher response (in terms of increased tax compliance) then the model without bequest. The lowest response (less then 0,1% in aggregate evasion) is in optimistic scenario without bequest with the largest annual rate of return.

Since the model with a bequest motive is more reasonable in terms of sensible rates of return, further discussion of the effect of pension reform is based on this modification of the original model. Reduction in tax evasion is higher for optimistic scenario (with growing population). It is explained by the indexation rule of the accumulating contributions ($\theta_1 = (1+n)^2$ and $\theta_2 = 1+n$), which by definition is higher for optimistic scenario. Equivalent variation[13] of the reform, is positive only in optimistic scenario with tax reduction opportunity. One possible explanation is that increased tax compliance reduces individual after tax income. In the model taxes are not given back to individuals, e.g. through provision of public good or lump-sum transfers. A reduction in a non-pension labour tax, which is possible after the reform has increased tax compliance,

[11] Ratio $\frac{F}{C}$ plays scaling role.

[12] Aggregate evasion share for period h is calculated by the formular $\frac{w_h(1-l_{1,h})N_h+e_2w_h(1-l_{2,h-1})N_{h-1}}{w_hN_h+e_2w_hN_{h-1}} = \frac{(1-l_{1,h})(1+n)+e_2(1-l_{2,h-1})}{(1+n)+e_2}$.

[13] Equivalent variation here is an increase in consumption goods in all three periods of life under defined benefit system, which allows consumer to reach the same utility level as in the economy with defined contribution system. Equivalent variation is reported in percentage increase.

Figure 5: Long-run equilibria under defined benefit and defined contribution systems. Optimistic scenario n=11,5%, δ=63,5%.

		Without bequest		With bequest	
		DB	DC	DB	DC
Benchmark model	Share of black wage in the first working period	34,7	34,7	34,7	30
	Percent of black wage in the second working period	26,1	26,3	26,7	20
	Aggregate share of black wage in total wage (in %)	27,7	26,9	27,1	22,1
	Annual rate of return on capital (in %)	25	25	5	5
	Equivalent variation (in %)	-0,08		-2,7	
Labour taxes are reduced because of higher tax compliance	Percent of black wage in the first working period	34,7	34,6	34,7	27,2
	Percent of black wage in the second working period	26,7	26,2	26,7	18
	Aggregate share of black wage in total wage	27,1	26,8	27,1	20
	Annual rate of return on capital (in %)	25	25	5	5
	Tax on labour income	48,6	48,5	48,6	46,42
	Equivalent variation (in %)	0,05		1,92	
	Share of government budget in GDP (in %)	21		21	
	Γ	1,66		1,56	
	F/C	5,30		1,29	
	Weight on bequest (Ψ)	-		0,005	

and hence tax base, brings about additional benefits for individuals. It holds for both optimistic and pessimistic scenarios. In optimistic scenario with the highest increase in compliance (5-7%) possibilities for reduction of non-pension tax rate are the largest among considered scenarios. It explains the highest equivalent variation for the optimistic scenario with an option to reduce non-pension tax rate.

4.2 Transition path

[to be done]

4.3 Optimal taxation

[to be done]

5 Concluding remarks

Figure 6: Long-run equilibria under defined benefit and defined contribution systems. Pessimistic scenario n=-7%, δ=17%.

		Without bequest		With bequest	
		DB	DC	DB	DC
Benchmark model	Percent of black wage in the first working period	34,3	34,2	34,3	31,9
	Percent of black wage in the second working period	26,4	26,2	26,4	21,4
	Aggregate share of black wage in total wage (in %)	26,1	25,2	25,3	23,6
	Annual rate of return on capital (in %)	11,3	11,3	5	5
	Equivalent variation (in %)	-1		-2,8	
Labour taxes are reduced because of higher tax compliance	Percent of black wage in the first working period	34,3	34	34,3	30,9
	Percent of black wage in the second working period	26,4	24,1	26,4	20,6
	Aggregate share of black wage in total wage (in %)	25,3	24,2	25,3	27,8
	Annual rate of return on capital (in %)	11,3	11,4	5	5
	Tax on labour income	48,6	48,45	48,6	47,80
	Equivalent variation (in %)	-1		1,92	
	Share of government budget in GDP (in %)	19		19	
	Γ	1,54		1,56	
	F/C	1,71		1,16	
	Weight on bequest (Ψ)	-		around 0	

Numerical results show that the intrinsic feature of defined contribution system reduces tax evasion by 2% (pessimistic scenario) or 5-7 % (optimistic scenario). Individuals are better off if increase in tax compliance is used to reduce non-pension tax on labour income. Response would be larger in the model with elastic labour supply.

An increase in tax compliance is an additional source for financing of state budget and the state Pension Fund. It may help to manage its solvency problem. Especially in the case where other ways to restore solvency, such as reduction of benefits or increase of tax rates, are not possible. Both ways are not politically popular. In Russia further reduction in pension benefits is unfavorable because of low current pension benefits. Further increase in labour income tax rates is precluded by its current high rat. It may negatively affect tax revenues because of expansion of tax evasion and labour supply distortion. It may augment the solvency problem for the State Pension fund.

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[14] "Goskomstat" is an abbreviation for the State Committee of the Russian Federation on Statistics