Ways of improvement in the Russian labour market with emphasis on the shadow employment

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Introduction

Since the beginning of the 1990s Russia's labour market has experienced a period of painful transformation. The old Soviet system with full employment, equalised wage setting and the state as the single employer was abolished. This market transition created tremendous challenges for the Russian workers because of the loss of state-guaranteed employment and the appearance of a wide range of private employers with significantly varying wages and labour conditions.

The transition of the Russian labour market from a centralised system differs from what happened in the other former socialist countries of Eastern and Central Europe. Despite a sharp drop in industrial production, the level of employment remained high, but the price for that was a very low level of labour compensation and widespread wage arrears.[1]

Part of the excessive manufacturing labour force has been absorbed by the shadow economy and the public sector. The public sector employment has grown considerably from the Soviet time despite the shrinking role of the state.[2]

The labour income distribution, very even in the Soviet Union, has become extremely unequal. Some companies pay high labour compensations, complying with tax and labour legislation, while most workers receive wage close to or even below subsistence level. However, officially registered labour incomes are this low partly due to widespread tax evasion and shadow labour relationships.

Shadow activities are inherent for the majority of Russian private enterprises, so that informal employment is closely connected not only to unregistered work in its entirety, but also to the partial evasion of labour tax payments. Unregistered employment and labour compensation are prevalent and morally justified in society. Tax evasion and work without labour contracts became the survival strategy for many Russian companies and individuals. Despite the fact that shadow relationships generate numerous acute social problems, they help dampen the problems of the population's employment and incomes, and perhaps also to create the base for small business development. The extent of the shadow labour market is determined by a number of factors, including the extent of the shadow economy and tax evasion as a whole, the development of labour legislation, and the social security of the labour market institutions.

This report considers a developed urban economy with a closed regional labour market with different employment opportunities for a worker. It is represented by three sectors: the honest (advanced) sector, the shadow (hidden) sector and the public sector, since the traditional division of the Russian labour market between "old" (former Soviet enterprises) and "new" (newly emerged firms) working places gradually becomes less and less meaningful.

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1   Blanchard (1997).
2   Russia in figures (2001).

Due to efficiency wage considerations, firms that belong to the advanced sector pay their workers more than the clearing wage in the market, and hence ration employment. The only source of the wages for the public sector's employees is taxes paid by the advanced sector, and therefore payrolls in the two sectors are directly connected. Wages in the shadow sector are determined by employment there, but wage promises are uncertain, and workers take this uncertainty into account in their employment decisions. Unlike the public sector workers, workers in the shadow sector have an opportunity of being hired by a firm from the advanced sector. Also employees in the honest sector can count on maximum pension, while workers in the remaining two sectors should be satisfied with the minimum one. Migration between the public and shadow sectors is free, and therefore the sectors' incomes are equalised in equilibrium. This setting is captured by the three-sectoral model in the Harris-Todaro tradition, that allows showing the causes and consequences of labour redistribution. It is basically a static model: workers make the employment decision once and for good.

A solution to the model provides us with the opportunity to make some predictions concerning labour market behaviour in the changing environment; in particular, how basic characteristics of the market respond to different policies that can be implemented by the government. It has been shown in the model that expansion of the advanced sector is accompanied by enlargement of the shadow sector, and it imposes some restrictions on government policy. The model demonstrates that better technologies reduce employment in the advanced sector at the expense of the public sector and increase incomes in both sectors. Higher tax retards the advanced sector's development and keeps the wages there on a high level, and increases shadow sector and income inequality between the workers in the various sectors.

The most topical reforms on the Russian government agenda, e.g. administrative, pension and tax, affect directly the labour market. The model provides us with the possibility to make some predictions concerning the consequences of the main measures of the reforms. Retirement pension may be presented and valued as a specific non-marketable call option position, with wage as a basic asset. Realisation of this option and consequently a worker's employment and savings behaviour depend upon the pension system parameters. It is shown that the higher the pension parameters the higher the value of employment in every sector, with lowest growth in the public one, whereas increase in the pension differential makes work in the advanced sector more rewarding and consequently the shadow sector's employment rises due to the increased value of an opportunity of being employed in the advanced sector. Higher minimum pension and higher retirement age will increase the size of the shadow sector, while the pension differential, as well as a higher replacement ratio will decrease it.

Throughout the 1990s the government tended to emphasise the significance of proper administrative measures against the shadow sector. The model shows that punitive measures against the shadow sector decrease shadow employment and the level of production there, but simultaneously lead to lower incomes in both the shadow and public sectors, and hence higher income inequality in the economy. Therefore, this kind of policies

may be applied in practice only on a rather limited scale. It is also worth to emphasise the importance of the co-ordination problem between various branches and levels of the government responsible for realisation of different policies.

The report is organised as follows. The first part aims to highlight the main aspects of the Russian labour market development and some peculiarities of the shadow employment in Russia. The second part presents the model, and applications of possible government policies for the labour market are discussed in the third part. The last part concludes.

A labour market in transition

Key features of the Russian labour market of the 1990s

The economic transition of the 1990s was very painful for the majority of Russians. Guaranteed employment, a high level of social protection and equalised labour incomes gave place to wild market challenges such as employment insecurity and huge income inequality. The contraction of the economy and structural shifts made a lot of labour skills obsolete and created an extremely uneven development of industries and regions. Although this pattern was observed in every transition economy, the way of adaptation of Russia's labour market was quite different and featured as follows:

- *A relatively high level of employment despite sharp drops in industrial production.*[3] Excessive employment before the radical market reforms in combination with the shrinkage of the economic activity produced much less unemployment than in other former socialist countries. Figure 1 illustrates this phenomenon: unemployment does not grow with falling production.
- *A low level of officially registered labour incomes.* The strong contraction of the labour compensation cannot be a sole explanation. Different sources show that the decline in the registered wage was reflected in the huge growth of hidden remuneration, determined by a burdensome labour legislation and an excessive payroll taxation.
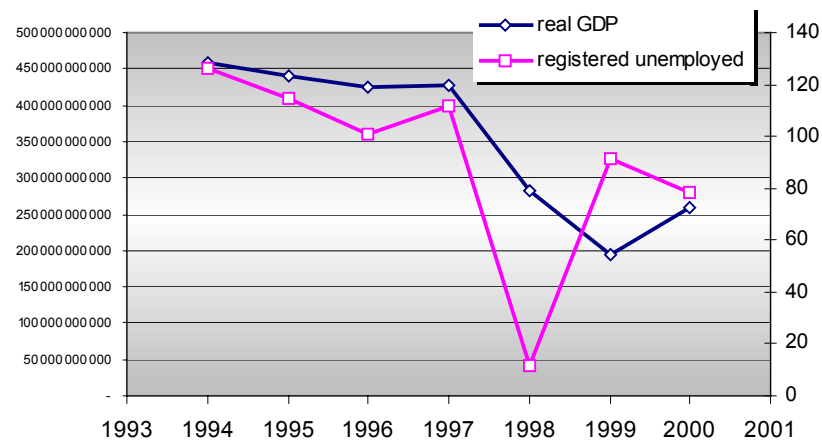

Figure 1: Registered unemployment (thou. persons) and GDP (in USD).

Source: Russia in figures (2001)

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3   See Clarke (1998).

- *Growth in informal employment.* The relationships of the worker and the employer changed after the reform started. Often only the verbal contract is used, and the worker is not only deprived of the pension and other benefits entitlements but also cannot certify her[4] qualification and the wage.

- *A large differential in registered compensation across companies.* Some companies in Russia prefer to pay much higher labour compensation than what is necessary to attract workers with similar levels of qualification and therefore ration their employment.[5] Companies of this group not only take the higher direct labour costs, but also sign the official labour contracts and bear all corresponding indirect costs (payroll taxes, labour turnover costs etc.). The group consists of the technologically advanced firms, often with foreign capital, and the companies of the export-oriented petroleum and metallurgical sectors. For the former their profitability crucially depends on the high quality of production and hence small negligence by the workers may turn out to be disastrous for the firms' reputation and profits. Since control is costly or impossible to implement, such firms offer a premium relative to the wage in the rest of the economy in order to motivate their workers to show a highest possible level of diligence. Besides that, large Russian companies heavily depend on the relationships with the authorities, and being also too big to avoid scrutiny in the form of the tax and labour inspections, have to comply with the regulations.

- *A huge growth in the public sector employment.* The data shows significant growth in the regional public sector employment, especially those of the regional authorities. Real necessities of the authorities hardly explain this growth, but at the same time the following political and social explanations by experts look quite plausible. The local governments care for employment in the region and try to buy the loyalty of public servants, and thus tend to increase public employment. A relatively low level of salaries accompanies the resulting overemployment in Russia's public sector.

Issues of hidden employment

Labour market background

The central government in the Soviet Union was the sole employer and strictly controlled labour relationships by regulating the size and structure of the workforce, as well as wages for every enterprise.[6] The labour legislation stipulated high and costly protection of an employee. The wage rates were set according to the unified system of tariffs, aimed to equalise wages and thereby compress the differentiation in population incomes. Enterprises were not able to set high wages but always offered their employees a wide array of cheap or free services in the form of kindergartens, sport and recreation

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4   For pure convenience here and in the following text *she* for a worker and *he* for an employer are used.
5   Mikhalev and Bjergsten (1995).
6   About the Soviet social contract, see Cook (1993).

facilities, support in education and so on. Hence the direct pay was often considered only as the minor part of the whole compensation package. Full employment was proclaimed as the crucial achievement of socialism, but actually was possible only in a situation of soft budget constraints for enterprises.

It was commonplace in the Soviet Union that full employment was sustained artificially. The excessive character of employment and the shrinkage of Russia's economy due to the market reforms have caused considerable unemployment and official recognition of it is a social problem. A massive drop in industrial production made labour market experts expect tremendous growth in unemployment after the radical market reforms started. That was the case in Central and Eastern European (CEE) countries but did not happen in Russia: the scale of exposed unemployment turned out to be less than labour market experts expected, and much lower than in other transition countries.[7] From 1991 to 1999 employment in the Russian economy fell from 74 million individuals to 63.2 million, a decline of about 15 per cent, whereas the average output plunged by more than 50 per cent[8].

Yet in the CEE economies output declined by only 20-30 per cent and unemployment sharply rose to a double-digit level. Empirically, the response in the unemployment level in Eastern Europe was much more pronounced to the output fall than in Russia.

Researchers emphasise the paradoxical development of the Russian labour market and that the way of adaptation of Russia's labour market during the transition period differs from their peers in Eastern Europe. Russian enterprises prefer to adjust through wage correction, not through the number of employed. The data concerning the dynamics of wages in transitional countries indicates a substantial fall in real wages across all former socialist economies, but the magnitude of this fall varies between Eastern European countries and Russia. While real wages in the Czech Republic, Hungary, Poland and Slovakia fell by only 30 per cent, in Russia they fell by almost 70 per cent.[9] Considering the fact that around 70 per cent of the workers in Russia report that their employers owe them wage arrears, that drop is even deeper. Layard and Richter, in the middle of the 1990s, referred to the 'Russian way' of adjustment, and they wrote that Russia in effect had much more real wage flexibility than many other countries, due to more factors than solely hyperinflation. Despite the shrinkage in economic activity, the rate of hiring remained rather high, and outflow into unemployment was relatively modest.

Huge wage arrears became an important display of this flexibility. Although the reforms removed the administrative constraints on the enterprises' personnel policy and at the same time introduced hard budget constraints, companies often preferred to keep more workers than the current level of production demanded and simultaneously accumulated wage arrears, since dismissal of redundant workers is legally difficult and associated with high severance payments, hiring costs are high, while wage arrears are

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7   See e.g. Commander, McHale, Yemtsov (1995).
8   Rossiisky Statisticheskii Yezhegodnik (1999).
9   Kuddo (1999).

almost not penalised. The companies anticipating higher demand for their production may choose such a behaviour.

The share of labour income in GDP and in the total incomes of individuals decreased considerably throughout the 1990s.[10] The drop in wages was partly compensated by the emancipation of other legal sources of incomes (entrepreneurship incomes, rentals etc.). This tendency was common for all transition economies, but while in Eastern European countries the share of labour incomes declined by only 5-10 per cent, Russia experienced the two-fold drop. It provides reason to believe that labour compensation is not declared in full.

According to some surveys,[11] new Russian enterprises are very flexible in setting their wage rates. These firms are often engaged in semiformal employment where only a small fraction of compensation is recorded. Some of them constitute a privileged sector of the economy with extremely high labour compensations. For employees of such companies their wages are reckoned to be as much as ten to twenty times greater than the average wage in the country. The gap is much wider than in any other transitional or developed economies, including the USA. The difference in skills alone cannot explain why identical jobs are compensated so differently, and usually labour economists explain this phenomenon by union bargaining. This explanation is hardly applicable to Russia since unions are weak and often consider themselves a part of the administration. However, companies in some industries enjoy a substantial degree of market power or can extract rents from natural resources, and we will have to explain why managers are interested in sharing rents with their workers.

Brainerd (1995) believes this is so because Russia's privatisation strategy resulted in insider ownership for a majority of privatised enterprises, and therefore workers' wages also include (explicitly or implicitly) incomes from stock ownership. It could be a part of the explanation if the rights of minor shareholders in Russia were protected. Managers and major shareholders do not reckon with workers as well as with other minor shareholders, and there were numerous cases of how wage arrears were arranged (by the administration) purposely in order to make workers sell the shares they got during the privatisation.[12] Thus, wages may even suffer because of stock ownership.

On the other hand, Brainerd asserts that some of the employees with especially high compensations possess residual or unobservable 'skills' beyond measurable human capital endowments. They include readiness to take risks, connections, and the luck of being in the right place at the right time among other elements. In some senses, she writes, the Russian economy is like a lottery, with large rents accruing to those well positioned to take the advantage of opportunities – but also with substantial losses for those who draw a losing number. We can observe a drastic variation in wages across the economy, which indicates that the labour market does not work properly. As Gimpelson and Lippold (2000) point out, the transition economy in Russia with limited competition, poor regulation and other distortions offered an environment ripe for all types of rent seeking. Although such rents could

10 Russian Economic Barometer (1999).
11 See, e.g., V.Gimpelson, D.Lippold (2001).
12 Denisova, Friebel, Sadovnikova (1998).

potentially erode as arbitrage effects developed along with some increases in competition, this did not happen on a large scale. The limited mobility of the population and the huge physical area of the country slow the process of wage levelling across the economy as a whole, and we can consider the labour market of a particular region without loss of generality.

Public employment

Many observers noticed a particular feature of the Russian labour market – sharp growth of public employment in the 1990s despite the economic crisis and tremendous privatisation. Employment in the state-owned enterprises fell from more than four-fifths of total employment in 1990 to little more than one-third in 1998. Whereas total employment dropped by 12 per cent, employment in the public administration (i.e. an additional 1.2 million employees[13]) and in education and health care grew contrary to all expectations. Even employment in government administration at the federal level has fallen in Russia since the beginning of the transition, and the growth of regional government employment was considerably higher than just to compensate for this fall,[14] ranging from 19.5 per cent in Tyumen Oblast to 54 per cent in Ingushetia. Between 1990 and 1998 registered growth in education, culture and art was rather modest, from 9.6 per cent of the total to 11.2 per cent, while in health care, sports and social protection employment increased remarkably. This tendency, illustrated by Figure 2, opposes downsizing in public health and education in most transition countries. Growth in employment has been accompanied by a sharp fall in the level of real salaries. In the cited paper, Gimpelson and others assert the following determinants of the public employment size:

- Contrary to Wagner's law, there is even negative correlation between development (measured either by per capita gross regional product or urbanisation) and public employment, so the poorest Russian regions have the highest level of public employment.
- Public employment in a given region is affected by regional political events (gubernatorial or other elections).
- Regional authorities try to absorb an excessive labour force due to the growth in local unemployment, despite their limited financial abilities. According to an analysis by Gimpelson, Treisman and Monusova, "in regions with higher unemployment rates and especially in those that had suffered a particularly sharp increase in unemployment that year, public employment increased significantly. A one percentage point jump in unemployment in a given year was associated with 0.09 percentage point increase in public employment, other things equal". The matter concerns extra employment in education, culture, art, science, health care, sports and social protection, but also public administration.

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13 All preceding figures are from Gimpelson, Treisman and Monusova (2000).
14 According to Rossiisky Statistichesky Yezhegodnik 1999, employment in public administration in regions other than Moscow grew by about 1.25 million workers between 1992 and 1998.

- The level of public employment is also determined by budget con-
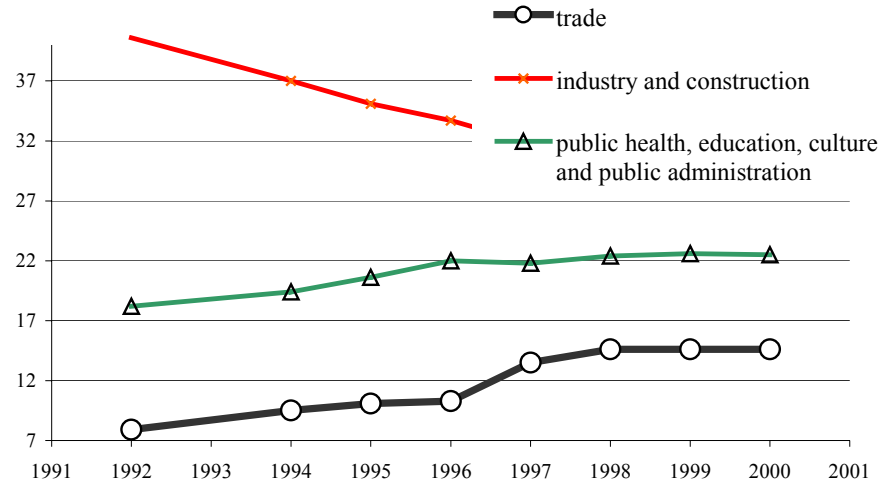 straints – financial opportunities of the regional authorities.

Figure 2: Employment in different sectors (as a share of total employment).

Source: Russia in figures 2001.

The underground sector and shadow employment

There are numerous opportunities for Russian companies to operate illegally,
and most of them are discussed in the investigation "Neformalnyi Sektor v
Rossiyskoi Ekonomike".[15] Almost all companies are involved in various
forms of unregistered economic activities, tax evasion and breach of labour
law requirements. [16] Economic activity without official registration was
abundantly present in the Soviet Union long before the market reforms, and
remains in modern Russia. Recent figures show that medical services in state
clinics are paid informally by 25 per cent of the respondents, repairing of
apartments by 55 per cent, funeral services by 61 per cent.[17]

According to Schneider and Enste (1998), every unregistered economic
activity involves the labour market to some extent: directly (i.e. a rise in the
number of hidden workers) or indirectly (i.e. tax evasion). The shadow
labour market includes all cases where an employee occupies a shadow
economy position regardless of whether she has a legal position as well.

In the informal sector of the labour market I include workers having un-
registered primary/secondary job, being self-employed and employees of
small business units[18] that avoid registration and do not pay taxes. A person
may work without a labour contract (unofficially) due to either the type of
economic activity of the employing firm or the absence of a work permit

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15 Dolgopiatova (1998).
16 Notice that apart from tax crimes we do no consider criminal activities.
17 Survey by the Centre for Studies of Illegal Economic Activity (1999).
18 Household-owned enterprises or small firms within large companies are the most
    widespread ones.

(e.g. military men[19] or immigrants). Informal labour relationships may take different forms but since the wage received by an unregistered worker and the unregistered wage received by a registered worker are very similar I propose to use only one single criterion: obtaining a hidden income from labour activity.

Unregistered employment is not reflected in the companies' reporting, but can be revealed by surveys conducted by independent sociological organisations. I presume that respondents have fewer incentives to conceal this kind of information from non-government institutions than from the government agency Goskomstat, and I have more trust in this data.

Income constraints make people seek an additional job, and the secondary employment is an important feature of the Russian labour market. About 30 per cent of the adult population indicate in the surveys that they have an additional job.[20] Non-governmental institutions such as RCIPO and ISITO studied the characteristics of employment and showed that the attitudes of workers with respectively primary and secondary employment are different. Whereas only approximately 4-5 per cent of all employed are not registered at their principal working places,[21] the number of unregistered employed among those with secondary employment is prevalent: about 78 per cent of them (near 25 million people). Nevertheless, a number of the interviewed persons may prefer to conceal information from whomsoever.

Kapeliushnikov (1998) suggested an indirect method of hidden employment assessment based on the assumption that the participation rate of men in the labour force does not change much over time. If the data from the end of the 1980s is adjusted according to the new share of retired and students in the population, a rough estimation of the hypothetical size of hidden employment may be obtained, which comes to 1.5 - 2 million people (about 2.5 - 3 per cent of the total employment). These estimations embrace only those people that are not registered as workers altogether. We see that this type of hidden employment does not prevail in Russia.

However, informal employment may correspond not only to the unregistered work in its entirety but also to the partial evasion of labour tax payments. In this case we are interested not only in the number of such workers but also in the non-reported share of labour income. Russia's Ministry of Taxation[22] has conducted estimations of households' unreported incomes based on the results of the companies expenditures and the results of tax inspections. They show that about 40 per cent of total household incomes (including shadow trades and capital incomes) are untaxed, about 75 per cent of unreported incomes are from the informal employment and the hidden pay in the formal sector (30 per cent of total incomes), and about 30 million people (30 per cent of the adult population) are to some extent involved in informal employment.[23]

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19 According to Russia's labour legislation, military men cannot be employed in civilian jobs.
20 Sindiashkina (1999).
21 Sinyagin (1998).
22 Russian Economic Barometer (1998).
23 Estimations from Kapeliushnikov (1999) are in conformity with these estimates.

In 1993 Goskomstat of Russia (GKS) started to adjust labour incomes statistics from the hidden form of labour compensation.[24] If in 1993 hidden labour payment constituted 5.3 per cent of GDP, in 1995-97 it was already 10-15 per cent[25]. The ratio of the hidden labour payments to the declared wage was about 0.2 in 1993, and increased to 0.45-0.46 in 1995-97. So, we see again that approximately one-third of labour force compensation is informal. The degree of involvement of the population into the informal sector in Russia is as high as in the developing countries.

We can distinguish between two main types of the shadow compensation:

- *Wages paid by means of other types of personal income*[26] (e.g. fictitious life insurance policies by affiliated insurance companies or pension funds, loan-deposit schemes in affiliated banks and so on). The schemes of this type are quasi-legal and create a tax savings effect since tax regimes differ for different types of personal incomes. The national statistics provides data on these incomes but treats them as non-labour earnings.
- *Payments to labour without any registration*[27] (i.e. so-called 'black cash' payments). In this case a firm states the labour costs as material outlays, using fictitious contracts and the offshore firms-intermediates. The tax saving in this case is very high and significantly exceeds associated expenses. The 'black cash' funds may replace the legal payroll but usually complements it. These funds are also used to bribe officials and to get better terms from suppliers. 'Black cash' transactions have become an essential part of the economic activity of almost all Russian firms, regardless of size, industry or type of ownership.

A verbal informal spot labour contract has become the prevailing type of employment contracts in Russia, stipulating minimum responsibilities for the employer. In contradiction with labour legislation the worker does not get severance pay, sick pay and paid leave. A potential worker is aware that the wage size is not credible and may be conditioned on the company's financial situation and the size of the labour force, and the worker may be dismissed at any time. In the case of bankruptcy the worker cannot claim wage arrears. In the chaotic business environment firms try to survive from day to day and do not plan their long-run activity. They do not care about their reputations and meet their commitments (e.g. pay the wage) only if it is profitable to do so in the short run.

High job-searching and mobility costs along with strict budget constraints for households prevent people from being engaged in a time-consuming search for an appropriate labour contract and they are likely to accept one of the first job offers. As a worker also is not significantly constrained under the verbal contract she can quit without delay if something better crops up. To prevent quitting an employer can either choose to pay the wage not below the reasonable market level or "attach" the worker somehow. Among ways

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24 They use the discrepancy regarding households' expenditures and reported incomes to make these assessments.
25 Russian Economic Barometer (1998).
26 Gimpelson (1997).
27 See Ponomarenko and Danishevskaya (1997).

of attachment some authors considered such specific features of the Russian labour market as gigantic wage arrears[28] and the widespread payments in kind.[29] However, the employer may pay low wages and disregard possible quitting if he believes that workers can be almost costlessly replaced. These factors can explain the high turnover in the Russian labour market and why the informal sector is not considered reliable.

Determinants of the shadow labour market

What are the possible reasons for companies and workers to prefer non-registered labour relationships? If businesses are deep-rooted into the underground economy but employ workers legally, they will reveal their hidden activities and sources of generated cash flows, as it is difficult to have legal expenses without showing revenues. Thus, labour relationships are usually kept informal. At the same time, employees who do not get a job in the advanced sector, have to agree to these conditions if they prefer the commercial sector to the public one.

Since the size of the unofficial sector in the economy influences the size of informal employment, tax evasion considerations affect labour relations both directly, via the terms of personal taxation, and indirectly, through the scope of unofficial economic activities as a whole.

Companies "go underground" (i.e. become engaged in unregistered economic activities) or/and avoid taxes through financial manipulation, the non-disclosure of capital or financial incomes, overstatement of tax deductions or misstatements of individual circumstances[30] since they consider that it is relatively advantageous for them comparing with the risk related to such a behaviour. The number of factors, both fundamental and organisational, determines the level of tax evasion in the country. Fundamental factors deal with the intrinsic taxpayer's readiness to pay and include taxation policy as well as government expenditure policy. The organisational factors are represented by the enforcement mechanism, which makes evasion riskier or more costly. Willingness to comply with the existing tax system depends not only on the tax burden itself but also on the efficiency of the government expenditures. With the state performing inefficiently, tax evasion may prove to be the optimal behavioural option not only for each individual but also for society as a whole.

Comparative investigations of tax evasion determinants show that attitudes toward tax evasion in society are generally not negative. For example, a survey by the Centre of Illegal Economic Activity Studies[31] captures the views of Russians on questions about taxes and the underground economy. The investigation was aimed at discovering both the personal participation in informal economic activity and attitudes towards informal economic activity in general. It revealed a high level of involvement of the population in illegal activity and a high tolerance towards such a phenomenon. According to the survey, 47 per cent of the respondents are tolerant or at least benevolent to

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28 Earle, Saribyanova (1999).
29 Guriev, Friebel (1999).
30 Kesselman (1999).
31 Report by the Centre of Illegal Economic Activity Studies (2000).

unregistered wage payment, while they have a more negative attitude towards tax evasion practised by managers and businessmen (e.g. 43 per cent of the respondents regard 'with tolerance' tax evasion by individuals and only 22 per cent have the same attitude towards the enterprises' managers). However, the 'conditional' question (tax evasion in favour of the firm and the workers) showed that 44 per cent approved of such behaviour.

The Russian tax system remains in the eyes of taxpayers unjust and un-predictable, stifling legal economic activities despite relatively low marginal tax rates. The inefficient tax-collecting system produces small evasion costs, and the marginal rates, acceptable for a taxpayer, are lower in Russia than abroad because of high corruption on all levels and a poorly functioning state machine (legal system, police etc.).

The tax burden directly connected with payroll influences the labour market most significantly. In this case the declared but broken connection between taxes paid and presupposed benefits from taxation makes the payer especially reluctant to pay. The social welfare system creates strong disincentives for beneficiaries to work in the official economy because of extremely weak links between taxes and benefits. The major part of the payroll taxation is represented by the compulsory contribution to the state Pension Fund of the Russian Federation (PFRF). The PFRF system operates separately from the federal budget and its governance is highly criticised. It is accused of mismanagement, resource wasting and non-transparency. According to the current pension law, a retiree gets the maximum pension by declaring earnings in the size of about 70 per cent of the country's registered average wage within the last five years before retirement, if the length of service is at least 25 (20 for women) years. The levelling pension benefit formula severely penalises middle- and high- paid workers, thus discouraging them from participation. The ageing of the population makes present workers expect even lower return on their contributions. The efficiency of other social security funds is hardly higher than that of the PFRF. Therefore, the incentives to pay contributions are very low among the prevalent part of Russian taxpayers.

The labour market institutions: regulatory framework and trade unions

In Russia an employment policy is to a certain extent a response to the inadequate labour legislation that has been only partially reformed since the Soviet era of total employment. The Labour Code imposes on the employer a heavy burden of employment costs, considerably increasing total labour costs, especially associated with employment of low-paid and the specially protected categories of workers, provides for very scarce opportunities to hire workers on fixed-term contracts and makes it very hard to dismiss a worker even if she is completely unqualified. Therefore, employers try to keep employment as flexible as possible.[32] Many enterprises prefer to labour contracts either civil law contracts, or completely informal labour relationships. For instance, moonlighters are usually hired on verbal informal contracts.

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32 See Garibaldi and Brixiova (1997) about labour market institutions in transition countries.

Some authors[33] point out that the formally very high level of restrictions imposed by the Soviet-style labour legislation does not hinder the flexibility of Russia's labour market and does not actually mean over-regulation of the market. I suppose nevertheless that such a flexibility is achieved mainly through informal institutions and the underground economy adjustment mechanism, and actually creates additional distortions of behaviour of the market agents. Typically, an employer tries to avoid the following settings of the labour law that are particularly costly for him:

Severance payments. A company must pay the worker three months' salary in case of discharge. This clause of a standard labour contract is broken very often, especially during mass firings by loss-making enterprises. Obviously, if this requirement were operational, the high turnover rate in Russia would be much lower. I tend to treat the low level of registered labour compensations as, besides other factors, a peculiar form of insurance against unforeseen and significant firing expenses in the case of a company restructuring.

Paid leave. Workers have a right to paid vacation, but employers often do not let them to go on leave and do not pay compensation for the lost leave. If a worker is employed by a verbal contract, it is especially hard for her to claim her right to paid leave.

Payment when on sick leave. The source of these payments is the governmental Social Insurance Fund, which is build on the contributions of employers for their registered labour force. Therefore, unregistered workers are not entitled to payments from the Fund.

Unhealthy or dangerous job. If working conditions are recognised to be unhealthy or dangerous, the employer must bear a burden of supplementary social commitments, for example grant workers additional leave and secure sound working conditions.

There are special regulations concerning some categories of workers, namely young workers and women, providing numerous privileges for them and therefore making employers especially reluctant to hire them legally. The most pronounced are:

Pregnancy leave and accompanying benefits. The Social Insurance Fund and the employer share these expenses, and if the worker is unregistered, she is entitled only to the minimum benefit from the Fund. By law, the employer should pay direct allowance, which amounts to a 140-day wage. Certainly, the unregistered part cannot be counted for the calculation and thus decreases the allowance paid to the worker.

Academic leave. Everybody has a right to a part-time study at a college or university while working and to go on paid leave during examinations (40-50 calendar days per year). In practice employers are reluctant to grant such a leave, and at best provide it without pay.

While a legal framework for labour relationships exists in nowadays Russia and is quite favourable for employees, the importance of the legislation is undermined by the weak enforcement mechanism. There are no specialised courts examining labour conflicts, and the existing courts do not do this job well. Workers neither are used to take legal advantage of the legislation in labour conflicts nor do they exploit this possibility due to the informal kind

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33 See Layard and Richter (1994), Commander and Tolstopiatenko (1997).

of labour relations. Moreover, they do not have an active support from the unions.

The Soviet trade unions behaved as the specialised branch of the Communist Party responsible for labour relationships, workers recreation etc. Membership was compulsory and the unionisation rate approached 100 per cent. After the revolution of 1991 trade unions lost a significant part of their influence. The unionisation rate in the Russian economy is gradually declining. Despite the fact that the reformed old trade unions (renamed the Federation of Independent Trade Unions, FNPR) still claim around 60 million members, active membership is much smaller.

The FNPR keeps up into presence in a majority of state-owned and privatised enterprises, but the managers of the newly emerged firms managed to prevent a substantial unionisation of their workers. Traditionally, the old-fashioned union leaders considered themselves to be part of the administration. The Labour Code requires that workers be dismissed only with the consent of the labour union, and unions have extensive rights to arrange strikes, formally giving them an extremely strong bargaining position. Therefore the company managers try to tame the present union leaders so that the unions do not exercise their bargaining power and they oppose penetration by new aggressive unions. A right to go on strike has made the new "wild" trade unions a handy tool in corporate conflicts. There are numerous cases when the unions were also used for blackmailing competitors or to overthrow the management by a rivalling group of shareholders.[34] Nevertheless, trade unions in Russia very rarely try to utilise their influence to promote employees' interests. Enterprises that have been emerging since the beginning of the reforms are almost non-unionised and unions virtually do not exist in the "old economy". Therefore, unlike other countries, the impact of trade unions on wages in Russia is negligible.

The state of economic development and therefore the demand for labour differ by regions but migration of the labour force within the country is impeded by relatively high migration costs in comparison with potential gains, especially for low-skilled workers. The country's magnitude makes the transportation costs a significant factor and conservation of the Soviet registration system increases settlers' costs due to bribes. All this makes the regional labour markets practically closed. "This implies that the alternative wage faced by a worker in a firm will be the wage in alternative employment in a similar firm in the same region of Russia."[35]

The legal requirement to pay a minimum monthly wage is not a pronounced determinant of hidden employment in Russia unlike the countries of Eastern and Central Europe.[36] The wage that the employer is obliged to pay the full-time worker does not exceed 5 USD (i.e. it is slightly above 12 per cent of the registered average wage and approximately 15 per cent of the subsistence level). Therefore, unregistered wages below the minimum threshold simply do not exist.

As a result of the hidden nature of labour relationships, information about jobs is often not available for job seekers; so a worker does not know exactly

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34 Lehmann, Wadswortth and Acquisti (1998).
35 Luke and Schaffer (2000).
36 See Barr (1994).

how much she will receive beyond the official pay, if any. A combination of hidden labour compensation and wage arrears creates multiple hardships for outside observers, like other employers, job seekers, government agencies, researchers and investors. Thus, information about the quality of working places becomes a private good for insiders. Sociological surveys show that the level of compensation varies considerably across companies of the same industry due to the financial opportunities of a certain company. This information, remained private, does not influence the level of compensation in other companies.

The size of the underground economy is conditioned by the balance of the benefits versus the costs of moving into that sector. The benefits include taxes evaded, while costs include uncertainty in labour relationships, expenses of concealment and potential penalties, as well as moral costs. Western literature tends to treat underground labour market participants as less averse to risk, relative to their counterparts above ground, less fair, more efficient at concealment, and/or employed in those occupations or industries that are most amenable to tax evasion.[37] I do not believe that is the case for Russia. First of all, since an employer is responsible for the payment of taxes and observance of labour legislation, he usually makes the decision concerning a form of employment or the degree of tax compliance. This decision is closely connected with the type of business, the whole tax evasion strategy and does not depend on the preferences of the workers. The presence or a type of labour contract, a share of the displayed labour compensation etc. do not normally become a subject of negotiations between employers and workers.

Second, we do not have particular reasons to believe that the higher degree of individual risk aversion would make workers avoid hidden labour relationships. When hidden employment is the overwhelming phenomenon, it is safer for a single worker to participate in this system as well.

Therefore I believe that the heterogeneity of the labour force does not help us in explaining the phenomenon of Russia's hidden employment and hence I use a model where all the workers are equally skilled and risk-neutral, but nevertheless receive different wages and work in different sectors.

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37 See Alexeev (1999) for the consideration on the model with different levels of risk-aversion and skills of concealment as the explanation of shadow employment.

A model of the labour market

The primary purpose of our analysis is to model three principal sectors of the labour market, namely the public sector and two commercial sectors: advanced and shadow, and to study changes in labour incomes and employment there. The choice of the three-sector model in the Harris-Todaro tradition[38] is justified by the features of the Russian labour market, particularly in the large industrial cities, discussed above. I do not include agriculture because it is a rather insignificant sector (about 5 per cent of the country's GDP) with low productivity and heavy subsidies from the government.

It is convenient to use a three-sectoral static model with labour rigidity in one of them to analyse the mutual influences of labour incomes and employments and to consider the consequences of different government policies on the labour market characteristics. The aim of the government is to increase employment and production in the advanced sector by means of the following policies:

- Wages paid by means of other types of personal income[39] (e.g. fictitious life insurance policies by affiliated insurance companies or pension funds, loan-deposit schemes in affiliated banks and so on). The schemes of this type are quasi-legal and create a tax savings effect since tax regimes differ for different types of personal incomes. The national statistics provides data on these incomes but treats them as non-labour earnings.
- adjusting the tax rate;
- promoting investments in modern technologies by subsidising or tax shields;
- intensifying inspections of firms;
- changing pension parameters.

The model's set-up and assumptions

The total labour force is distributed between these three sectors: honest, or advanced (H), shadow, or hidden (S), and public (P):

$$L = L_H + L_S + L_P = L_S + (1+k)L_P \tag{1}$$

where k is a ratio of H-sector employment to P-sector employment.

The H-sector consists of foreign companies and respectable Russian companies that comply with legislation (i.e. labour, taxation etc.) and seldom use any semi-legal schemes of tax planning or shadow employment, even if such behaviour may be profitable and almost unpunished in the short run. H-

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38 See Harris and Todaro (1970), Moene (1988).
39 Gimpelson (1997).

sector firms' compliance may be explained by their technological peculiarities. Their technologies provide them with high labour productivity and low costs, and the economy of scale requires that the company be large and well established, so that discontinuance in production is extremely costly. But due to their size these companies are highly exposed to the risks of the tax and labour authorities' inspections. Hence, the first sector companies cannot escape registration of the workers and have to sign labour contracts with them. Higher efficiency gives them the possibility to bear labour costs related to the legal labour contract.

At the same time, numerous shadow sector companies constitute the main part of Russian economy. They produce the same goods or services as the H-sector, but they almost do not use capital and their productivity is low. The level of production depends on the size of the present labour force (with constant return to scale). It resembles self-employment, and for such companies the difference between employees, managers and owners is insufficient. In this sector labour contracts are informal and fulfilment of wage promises depends on the surviving of the firms.

For the sake of simplicity we assume that firms here do not pay any taxes. As no taxes are paid this sector behaves neither as recipient nor as beneficiary of redistribution within the economy, and thus is virtually self-subsistent. The firms do not bear any costs related to tax evasion and may be easily detected. In case of detection a big fine is imposed, that the firm owners prefer to proclaim bankruptcy and close down the company. A worker knows that under such circumstances wage promises would not be fulfilled. Nevertheless, the probability of such an outcome is sensibly small due to the large number of firms and the low frequency of inspections.

The H-sector employment is determined by profit maximisation and total demand for labour is a function of the wage, the technological factor E and the tax rate t:

$$L_H = g(w_H, t, E); \qquad g_1 < 0, \ g_2 < 0, \ g_3 < 0, \tag{2}$$

The demand for labour is a decreasing function of payroll tax, wage and technology. We assume that better technologies make production less labour-intensive and thus reduce the demand for labour.

H-sector firms are interested in motivating their workers to work diligently and hence pay them higher wages than in the rest of the economy. As in the standard Harris-Todaro model wages in one of the sectors are higher than in the rest of the economy, but here I use the efficiency wage approach to explain this. H-sector firms set the wages higher than the workers' outside option to counterbalance the disutility from the concentrated and demanding job and to create incentives for a worker.

The average product of labour is highest in this sector of the economy and the firms there are especially interested in motivating their workers to work hard since:

- Higher diligence of employees and higher intensity of labour are required by the H-sector technology;
- An H-sector company does not employ people from the non-commercial sector. At the same time hiring workers from the S-sector is associated with full uncertainty about their diligence and ability to work hard, and so creates "recognition costs" for the company. Therefore, the company tends to avoid costly turnover and tries to keep its present workers.

The H-sector firms should pay a certain wage premium with respect to the public sector wage. This employment premium is increasing in the technological parameter E since better technology demands higher effort and is decreasing in k since a higher fraction of workers in the H-sector "washes away" the particularity of the sector:

$$w_H = w_P + R(k, E) \quad R_1 < 0 \quad R_2 > 0 \tag{3}$$

Nevertheless, the premium is inelastic with respect to k as H-sector firms do not adjust wages much with changing structure of employment:

$$\vartheta \equiv \frac{k}{R} \left| \frac{\partial R}{\partial k} \right| \in (0;1)$$

where ϑ is defined as the elasticity of the employment premium w.r.t. ratio k.

All the companies are levied only payroll tax (the compulsory payment linearly related to the company's wage payments), but only firms from the H-sector pay taxes.

The shadow sector can be represented by small trade, services and manufacturing firms, and most of them are basically individual entrepreneurs. Labour is the sole production factor in this sector. Everybody can be employed in this sector as it is close to self-employment, but income per worker decreases with the growth of the sector. The sector's wage depends only on the employment there:

$$w_S = f(L_S) \qquad f' < 0 \tag{4}$$

The third sector (public) includes all the public companies or governmental institutions.

Regional governments collect taxes from the H-sector and use them to pay wages to the workers in the public sector. The size of the wage of the P-sector's workers is determined by the transformed budget constraint of the government:

$$w_p = \frac{w_H L_H t}{L_P} = w_H k t , \tag{5}$$

Remuneration in the H-sector is always higher than the one in the public sector, whereas the wages in the S-sector are higher or lower than the wages

in the H- and P-sectors, depending on the probability of receiving the wage or the probability of finding a job in the H-sector.

It can also be written as follows:

$$L_P w_P = L_H w_H t$$

It means that the total payroll of the public is the share of the H-sector's payroll, and the total labour costs of the H-sector are $L_H w_H (t+1)$.

In addition to wages, workers in every sector are entitled to rights to benefits should they be disabled or unfit to work because of age. The government pays, but payment is conditional on previous contributions to the social security. We assume that the local government does not pay any pension benefits either directly or by means of contributions to the federal pension fund, and thus all the benefits are paid from this external source. For the sake of simplicity we neglect all the pension benefits (i.e. sickness benefit or disability pension) but the retirement one and assume that there are only two possibilities: to get either maximum or minimum benefit.

Making her employment decision the worker considers both her current and her future income. Firms in the H-sector pay all the pension contributions for their workers and H-workers get the maximum pension. Firms in the S-sectors do not pay contributions at all and their workers are entitled to the minimum pension. Although public employees pay payroll taxes, assume for now that the level of their wages will not allow them to get pensions above the minimum level. Summarising, workers in the S- and P- sectors can count upon the minimum state pension S, and H-workers get the maximum pension Sr, where r is the differentiation rate, determined by the government. Higher benefit from social security is a distinctive advantage of legal employment.

The value of employment (total income) of the H-company's worker is:

$$V_H = w_H + Sr \tag{6}$$

Quite obviously, r is greater than one: $r > 1$.

There is some turnover between two commercial sectors. The H-sector may expand or contract, some workers leave the labour force etc., and the sector randomly recruits workers from the shadow commercial sector. The possibility to obtain a job in the H-sector is valuable for the workers from other sectors, but H-sector firms recruit only from the other commercial sector. P-sector workers are ruled out because H-sector employers use jobs in the public sector as a biased screening devise, that is, workers of the P-sector are (unfairly) assumed to be unable to work in the commercial sector. Therefore, they should first migrate to the S-sector in order to have a chance to seek H-sector jobs.

The S-sector worker may get a job in the H-sector with the probability h that depends on the current number of jobs in the H-sector. All the workers in the S-sector are considered identical and hired randomly by the H-sector in case of need. Hence, the probability h is equal to the share of the sector in the economy. For simplicity the total labour force is normalised to 1.

$$h = \frac{L_H}{L} = g(w_H, t, E)$$

The shadow sector worker is uncertain about the promised wage due to the risks related to the fact that the whole business activity is hidden. With the probability $(1-\xi)$ an S-firm can be caught by the tax authorities or the labour inspection and be closed down. In this case a worker cannot claim wage debts due to the absence of a formal labour contract. Hence ξ is a subjective probability of obtaining the promised wage w_S in the S-sector.

We assume risk neutrality for the shadow economy's worker, and hence the value of S-sector employment is just the sum of expected wage, the minimum pension and a value of the possibility to become an H-sector employee:

$$V_S = \xi w_S + S + h[w_H - \xi w_S + Sr - S] \tag{7}$$

The expected value of the public sector worker includes wage and the minimum pension benefit S:

$$V_P = w_P + S \tag{8}$$

Workers in the H-sector get both higher wages and pensions than P-sector worker.

Jobs in the H-sector are scarce but the flow between the remaining two sectors is free. Workers migrate until incomes are equalised in equilibrium, which makes the workers indifferent between the sectors:

$$V_P = V_S \tag{9}$$

We have enough equations to determine endogenous variables: wages, expected incomes and employment in three sectors.

To characterise inequality of the labour incomes between the sectors I introduce an income differential between H- and S- and P-sectors:

$$D = V_H - V_S = V_H - V_P \tag{10}$$

By means of equations (3) and (5) I derive the expression for wages in public and honest sectors as the functions of k, t and E:

$$w_H = w_H kt + R(k, E)$$

$$w_H(k, t, E) = \frac{R(k, E)}{1 - kt}; \qquad w_P(k, t, E) = \frac{R(k, E)}{1 - kt} kt \tag{11}$$

And for the income differential D:

$$D = w_H - w_P + Sr - S = R(k, E) + S(r - 1)$$

Using equations (1), (2), (4) and (7) I get wage and expected value of employment in the S-sector also as the functions of k, t and E:

$$w_S = f\left[\overline{L} - \frac{1+k}{k} g\left(\frac{R(k,E)}{1-kt}, t, E\right)\right] \tag{12}$$

$$V_S = \xi(1-h)f\left[\overline{L} - \frac{1+k}{k} g\left(\frac{R(k,E)}{1-kt}, t, E\right)\right] + S(1+hr-h) + h\frac{R(k,E)}{1-kt} \tag{13}$$

To preserve the privileged position of the H-sector with wages greater than in the P-sector kt should be smaller than 1. This means that for $t=0,5$ the employment ratio k varies in the interval $(0,2)$, i.e. employment in the H-sector cannot be two times greater than P-sector employment. Since in today's Russia k is considerably less than 2, this value may be set as a target for the government policy. For lower tax rates the upper bound of the interval increases.

We remember that the employment ratio changes with the changes in employment in two sectors and stays unaffected if employments there change proportionally. To the contrary, any deterioration of the advanced sector conditions simultaneously leads to contraction of the public sector employment. Hence, k will change in the same direction as the H-sector employment itself, but with greater magnitude.

Effects on employment

The goal of this section is to consider how different government policies affect the employment ratio k in the economy.

Conditions for the labour market (1) and for employment in the H-sector (2) yield us the employment in the shadow sector as a function of k, t and E:

$$L_S = \overline{L} - \frac{1+k}{k} g\left(\frac{R(k,E)}{1-kt}, t, E\right) \tag{14}$$

Then, the migration equilibrium of the equality of expected incomes in the S- and P-sectors ($Vp = Vs$) allows us to derive the expected income in the S-sector

$$V_S = \xi w_S + S + h(w_H - \xi w_S + Sr - S) = hw_H + \xi w_S(1-h) + S + h(Sr - S) \tag{15}$$

and together with conditions (1), (3) and (5) we can state the function $Q(k,t,S,r,E,\xi,\overline{L})$, which relates to the employment ratio k and the model parameters.

$$Q(k,t,S,r,E,\xi,\overline{L}) \equiv V_P - V_S = w_P - hw_H - \xi w_S(1-h) - h(Sr - S)$$

$$= w_P - \xi(1-h)f\left[\left(\overline{L} - \frac{1+k}{k}g(w_H,t,E)\right),t\varepsilon\right] - h(w_H + Sr - S)$$

$$= \frac{R(k,E)}{1-kt}kt - \xi(1-h)f\left[\left(\overline{L} - \frac{1+k}{k}g\left[\frac{R(k,E)}{1-kt},t,E\right]\right),t\varepsilon\right] -$$

$$- h\left(\frac{R(k,E)}{1-kt} + Sr - S\right) = 0 \qquad (16)$$

Analysis of this function provides us with the opportunity to assess how the model parameters t, S, r, E, ξ and L influence the employment ratio k and, consequently, analyse how migration processes may be affected by the change in the model parameters. This function is constant in equilibrium and k is an implicit function of the parameters. Therefore the implicit function theorem is applicable.

So, we have:

$$dk = \frac{1}{\frac{\partial Q}{\partial k}}\left\{-\frac{\partial Q}{\partial t}dt - \frac{\partial Q}{\partial S}dS - \frac{\partial Q}{\partial r}dr - \frac{\partial Q}{\partial E}dE - \frac{\partial Q}{\partial \xi}d\xi - \frac{\partial Q}{\partial L}d\overline{L}\right\}$$

Therefore, to determine the direction of change of different parameters on k we need to know the influence of the parameters on the function Q.

Lemma 1. The partial effect of the employment ratio k on the function Q is positive. Proof:

$$\frac{\partial Q}{\partial k} = \frac{\partial w_P}{\partial k} - h\frac{\partial w_H}{\partial k} - \xi(1-h)f'\left[\frac{g}{k^2} - \frac{1+k}{k}g'\frac{\partial w_H}{\partial k}\right]$$

$$+ \xi w_S g'_{w_H}\frac{\partial w_H}{\partial k} - (w_H + Sr - S)g'_{w_H}\frac{\partial w_H}{\partial k} \qquad (17)$$

The sign of $-\xi(1-h)f'\left[\frac{g}{k^2} - \frac{1+k}{k}g'\frac{\partial w_H}{\partial k}\right]$ is clearly positive

according to the model assumption $\frac{\partial w_P}{\partial k} > 0, \frac{\partial w_H}{\partial k} > 0, f' < 0, g'_{w_H} < 0$

We have also:

$$\frac{\partial w_P}{\partial k} - h\frac{\partial w_H}{\partial k} = \frac{ktR'(1-kt) + tR}{(1-kt)^2} - h\frac{R'(1-kt) + tR}{(1-kt)^2} = \frac{R'(1-kt)(kt-h) + tR(1-h)}{(1-kt)^2}$$

The sign of the expression depends on $kt - h$. Substituting for k and L and normalising $L=1$ as before, we need to compare t and L_P. Since the

empirical data stipulates that t is about 0.5, L_P is between 0.2 and 0.5, we have $t>L_P$ and can take the sign of the first item to be proved positive.

We are left with the last term:

$$\xi w_S g'_{w_H} \frac{\partial w_H}{\partial k} - (w_H + Sr - S)g'_{w_H} \frac{\partial w_H}{\partial k} = g'_{w_H} \frac{\partial w_H}{\partial k}(\xi w_S + S - w_H - Sr)$$

$$= g'_{w_H} \frac{\partial w_H}{\partial k}\left(\hat{V}_S - V_H\right) > 0 \text{ since } \hat{V}_S - V_H < 0$$

where $\hat{V}_S$ is the "real" part of the shadow employment value such that $V_S = \hat{V}_S + h(w_H - w_S)$.

Summing up, we obtain $\dfrac{\partial Q}{\partial k} > 0$

Q.E.D.

Hence, the sign of the derivatives of Q with respect to the parameters is just the opposite to the sign of the derivatives of k with respect to them.

Effects of the tax policy

Proposition 1.

1. The employment share of the H-sector responds negatively on the increased tax rate;
2. The employment share of the H-sector with respect to tax rate is greater than the unity in absolute value.

Proof: see Appendix.

The first result can be justified because the higher tax impedes the development of the sector and simultaneously makes the other sectors more attractive. Hence, the model predicts that today's government's efforts to reduce personal taxes should bring expansion of the H-sector and lower level of employment in the S-sector.

The second result says that the employment ratio is quite sensitive to the changes of the tax rate. Nevertheless, I believe that the employment ratio cannot change too sharply with the tax rate and hence cannot be too big in magnitude.

What can we say about employment in the shadow sector? We would expect that the higher tax rate makes the sector larger and decreases wages there. To check that we take the partial derivative with respect to t and see that it is positive:

$$\frac{\partial L_S}{\partial t} = \frac{1+k}{k}\left(-g'_{w_H} \frac{\partial w_H}{\partial t} - g'_t\right) > 0$$

The general effect is a combination of direct and indirect effects:

$$\frac{dL_S}{dt} = \frac{\partial L_S}{\partial t} + \frac{\partial L_S}{\partial k}\frac{dk}{dt}$$

Since $\frac{dk}{dt}$ is proved to be negative, the sign of the whole expression depends upon how the employment ratio in the two sectors affects employment in the third one. Obviously, the sign depends on the main source of the change in k. If k primarily reflects changes in the H-sector, the effect for the shadow employment is negative, and the shadow sector grows when taxes are raised. Growth in k due to the shrinkage of the public sector increases the shadow sector and the whole effect of taxes on the sector depends on the relative magnitude of two effects: direct and indirect.

Nevertheless the partial derivative of L_S with respect to k provides us with an unambiguously counterintuitive result:

$$\frac{dL_S}{dk} = -\left(\frac{1+k}{k}g'_{w_H}\frac{\partial w_H}{\partial k}\frac{R'(1-kt)+Rt}{(1-kt)^2} - \frac{L_H}{k^2}\right) > 0$$

The positive signs of $\frac{\partial w_H}{\partial k}$ and $R'(1-kt)+Rt$ are proved in lemma 2 (see Appendix), g'_{w_H} is negative by assumption, and therefore L_S always grows with k, even if L_P grows. This result may be interpreted as follows: an expansion of the H-sector is accompanied by contraction of the two remaining sectors, but this contraction is entirely accounted for by the public sector diminution, whereas the shadow sector grows along with the H-sector.

The ambiguity of the result must make us careful in discussing the taxation effect for the shadow sector. Besides the direct effect of taxes on the sector we should consider how taxes affect the sector via their impact on the rest of the economy.

Effects of the technological level

We saw that a better technology changes the employment in the same direction as a higher tax rate does. The same we can say about the effects on the wages.

We expect that k decreases with E, and indeed:

Proposition 2.
1) Better technological conditions in the H-sector reduce the employment share of this sector.
2) The employment share of the H-sector with respect to the technological parameter is greater than the unity in absolute value.

Proof: see Appendix.

Despite the similar effects the rationale is quite different: the tax policy stunts development of the advanced sector and so reduces employment there. Better technology replaces workers and so reduces employment.

The second result is also quite interesting: the employment rate is quite sensitive to small changes in technology and the level of taxation. Nevertheless, the very high sensitivity is unreasonable to adopt for our analysis, otherwise it would be too easy for the social planner to reach the desirable level of k by very small changes in parameters.

The partial derivative of the shadow sector employment grows with higher E:

$$\frac{\partial L_S}{\partial E} = \frac{1+k}{k}\left(-g'_{w_H}\frac{R'}{1-kt} - g'_E\right) > 0$$

but the total effect is ambiguous:

$$\frac{dL_S}{dE} = \frac{\partial L_S}{\partial E} + \frac{\partial L_S}{\partial k}\frac{dk}{dE} \quad \text{since } \frac{\partial L_S}{\partial k} \text{ is positive and } \frac{dk}{dE} \text{ is negative}$$

The transmission mechanism is as follows: better technology reduces the demand for labour and hence employment in the advanced sector, whereas the remaining workers receive higher wage than before (will be shown later). Consequently, the value of the possibility to be employed by the H-sector for shadow workers becomes greater, but the chance to get this possibility becomes smaller. Therefore, the total reallocation of the labour force between the public and shadow sectors due to technological changes depends on the relative strength of these opposite effects.

Effects of the punitive policy

This type of policy means that the government attempts to affect the probability of receiving the wage ξ in the S-sector, using different administrative instruments: intensification of tax inspections, frequent raids of the tax police, thorough control of pay-sheets etc.

Derivation of Q with respect to ξ yields us the following result:

$$sign\left\langle \frac{dk}{d\xi} \right\rangle = sign\left\langle -\frac{\partial Q}{\partial \xi} \right\rangle, \text{ where } \frac{\partial Q}{\partial \xi} = -(1-h)w_S < 0.$$

It means that the higher probability ξ increases the employment ratio k, consequently reduces employment in the public sector. Hence, a higher frequency of inspections will squeeze workers out of the S-sector to the public sector without effects for the H-sector. Due to the equations (5) and (9) labour income becomes smaller in the S- and P-sectors.

Effects of the pension policy

We know that higher pensions increase expected incomes in all sectors. It is obvious since the source of pensions is outside the model and they may be

considered a gift. Now we will show that higher pension parameters also increase the employment ratio *k*.

Differentiation of *Q* w.r.t. the minimum pension S yields

$$sign\left\langle \frac{dk}{dS} \right\rangle = sign\left\langle -\frac{\partial Q}{\partial S} \right\rangle, \quad \frac{\partial Q}{\partial S} = -h(r-1) < 0$$

and correspondingly w.r.t. differentiation coefficient *r*:

$$sign\left\langle \frac{dk}{dr} \right\rangle = sign\left\langle -\frac{\partial Q}{\partial r} \right\rangle, \quad \frac{\partial Q}{\partial r} = -hS < 0$$

Therefore, with higher pension parameters employment in the H-sector grows. Intuition of this result is the following: higher benefits from legal employment reduce incentives to work in the hidden sector.

Effects of changes in the size of the total labour force

Assume that the government's demographic policy can affect the size of the labour force. We are interested in knowing how a change in the population size affects its allocation between the sectors of the labour market. The model allows us to check effects of the changes in $\overline{L}$ for the employment ratio *k*. The derivative of *Q* w.r.t. $\overline{L}$ is positive, and hence *k* declines with a greater labour force.

$$\frac{\partial Q}{\partial \overline{L}} = -\xi(1-h)f' > 0 \quad \text{and} \quad \frac{dk}{d\overline{L}} < 0$$

This result is quite sensitive: the H-sector does not meet higher supply on the labour market, and additional workers go to the two backward sectors. But since today's Russia experiences a decline in population, we can expect a tighter market and a higher fraction of the H-sector in the economy.

Effects on wages and expected incomes

In this section I intend to assess how different governmental policies affect labour incomes in the three sectors, and examine how wages in all sectors vary with the employment ratio *k* and the wage premium *R*.

Lemma 2. 1) The partial derivative of wage in the P-sector with respect to the employment ratio *k* is always positive. The partial derivative of wage in the H-sector is positive for actual values of *t*=0.5, $k \in (0;2)$ and $\vartheta \in (0;1)$.

Wage in the H-sector grows with *k* if $\dfrac{kt}{1-kt}$ is greater than the elasticity of the employment premium w.r.t. the ratio *k*.

2) The partial derivative of wage in the S-sector is negative with respect to the employment ratio *k*. The employment value in the sector goes

down with k as well, if the elasticity of the H-sector employment w.r.t. the wage ς is not less than $1 + \left| g'_{w_H} \right| \dfrac{\hat{w}_S}{L_H}$, where $\varsigma \equiv \dfrac{\partial L_H}{\partial w_H} \dfrac{w_H}{L_H}$.

Proof: see Appendix.

Since $\dfrac{\partial w_P}{\partial k} > \dfrac{\partial w_H}{\partial k}$, a tighter H-sector labour market (higher value of k) increases the wage of public employees faster than the wage in the H-sector because the employment premium in this sector goes up as k declines. The wage differential between the two sectors decreases with k, but cannot disappear on the given interval.

Thus, the value of employment in the S-sector is decreasing with k. But since there are several opposite effects on incomes in the S-sector from a changing employment structure, we can have a negative sign of the derivative even with a much lower elasticity if the negative term $\xi(1-h)\dfrac{\partial w_S}{\partial k}$ is large enough, i.e. if the product of probabilities $\xi(1-h)$ is close to 1 and the magnitude of the wage change with k is high.

The wage of a shadow worker is decreasing with the increasing employment premium of the H-sector, but the total employment value can change in either direction depending on the values of the parameters.

Hence higher employment rent makes the value of employment in the S-sector larger if k is sufficiently high and $f(L_S)$ and $g(R)$ are steep enough, and is reduced when the wage in the S-sector falls fast with higher employment there. The transmission mechanism works as follows: better conditions in the H-sector make the S-sector more attractive and equilibrium employment in the shadow sector increases at the expense of the public sector. Higher employment reduces the wage and the total result depends on the extent of this decrease.

Effects of the tax policy

Change in the tax rate is one of the most handy and powerful instruments of government regulation. The Russian tax reform proposes reduction in the personal tax rate, and this simple model allows us to assess the consequences for labour incomes. To assess taxation influence on wages in the different sectors I need to set up several interim results.

Lemma 3. Partial derivatives of wages in the public and H-sectors with respect to the tax rate are positive and equal. The partial derivative of the S-sector wage with respect to the tax rate is negative, but the sign of the derivative of the employment value in the S-sector is ambiguous.

Proof:

1. Differentiation of the wage functions with respect to t yields

$$\frac{\partial w_H}{\partial t} = \frac{kR}{(1-kt)^2} > 0 \quad ; \quad \frac{\partial w_P}{\partial t} = \frac{Rk(1-kt) + k^2 tR}{(1-kt)^2} = \frac{kR}{(1-kt)^2} > 0$$

We see that wages in the H- and P-sectors grow in t with the same magnitude.

$$2. \quad \frac{\partial w_S}{\partial t} = -f' \frac{1+k}{k} \left[g'_{w_H} \frac{\partial w_H}{\partial t} + g'_t \right] < 0$$

$$\frac{\partial V_S}{\partial t} = -\xi w_S \left[g'_{w_H} \frac{\partial w_H}{\partial t} + g'_t \right] - \xi(1-h)f' \frac{1+k}{k} \left[g'_{w_H} \frac{\partial w_H}{\partial t} + g'_t \right]$$

$$+ \left[g'_{w_H} \frac{\partial w_H}{\partial t} + g'_t \right] \left[w_H - S + Sr \right] + h \frac{\partial w_H}{\partial t} =$$

$$\left[w_H + Sr - \xi w_S - S - \xi(1-h)f' \frac{1+k}{k} \right] \left[g'_{w_H} \frac{\partial w_H}{\partial t} + g'_t \right] + h \frac{\partial w_H}{\partial t}$$

The last term is the only positive one. The sign of the whole expression depends on the relative magnitude of the negative and positive terms.

Q.E.D.

That fact that wages in the P- and H-sectors grow simultaneously with t is not very intuitive but remember that the wage in the H-sector consists of two parts, and while a higher tax rate increases the benchmark wage (P-sector wage), it decreases employment in the H-sector and thus makes the premium grow.

Now we are in a position to assess the general influence of the rate of taxation on the wages. We see that the general effect consists of two effects: direct (represented by the partial derivative) and indirect effect via the effect on k. The direct effect is obviously positive for the wages in the P- and H-sectors and negative for the S-sector. The indirect effect in all cases has the opposite sign, and the general effect is ambiguous. To discuss the conditions under which the indirect effect may be stronger than the direct one we need to compare the relative magnitude of the two effects. Let us establish several results, conditioned upon the assumptions about the values of the variables:

a) The wages in the H- and P-sectors go up with the tax rate if the changes in the tax rate do not cause significant changes in the employment ratio.

$$\frac{dw_H}{dt} = \frac{\partial w_H}{\partial t} + \frac{\partial w_H}{\partial k} \frac{\partial k}{\partial t} = \frac{Rk}{(1-kt)^2} - A \frac{R'(1-kt)+tR}{(1-kt)^2} =$$

$$= \frac{Rk}{(1-kt)^2} \left[1 - A \left(\frac{\vartheta(1-kt)}{k^2} + \frac{t}{k} \right) \right]$$

ϑ is the elasticity of the wage premium with respect to k, defined earlier. For our real data $\frac{t}{k}$ is lower than 1, and $\frac{\vartheta(1-kt)}{k^2}$ is negative. Hence the whole sum in parenthesis is lower than one (but positive), such that the higher elasticity ϑ makes it lower. Being multiplied by A (greater than one),

the expression also may turn out to be greater than one. Therefore, the sign of the whole expression depends on the magnitude of A and the elasticity ϑ. The greater the elasticity, the greater A should be to make the whole expression negative.

We see that $\dfrac{Rk}{(1-kt)^2} > \dfrac{R'(1-kt)+tR}{(1-kt)^2}$ and A plays a role of amplifying coefficient.

Analogously, for the public sector wage:

$$\frac{dw_P}{dt} = \frac{\partial w_P}{\partial t} + \frac{\partial w_P}{\partial k}\frac{\partial k}{\partial t} = \frac{Rk}{(1-kt)^2} - A\frac{R'kt(1-kt)+tR}{(1-kt)^2} =$$

$$\frac{Rk}{(1-kt)^2}\left(1 - A\frac{t}{k}\big(\vartheta(1-kt)+1\big)\right)$$

We see that the sum in parenthesis $\vartheta(1-kt)+1$ is lower than one and is multiplied by A (greater than one) and $\dfrac{t}{k}$ (generally smaller than 1). Hence, the total effect is unknown in general, but for a plausibly small A it will be positive as well.

Although for most of values of A the wages in two sectors will change identically, there is some interval of A for which the H-sector wage will increase and the public sector wage will decrease.

It means that in spite of the direct effects on both wages being positive, they are different in magnitude: the wage in the H-sector increases with the taxes more than one in the public sector. Correspondingly, the wage differential grows with tax rate:

$$\frac{dD}{dt} = \frac{dR(k,E)}{dt} = \frac{\partial R(k,E)}{\partial k}\frac{\partial k}{\partial t} > 0 \quad \text{since both partial derivatives}$$

are negative.

This result is quite important and is valid for the shadow sector wage as well: higher taxes make the advanced sector smaller but its well-paid workers are better off, and hence income inequality in the economy increases. We can conclude that the policy of reduction in personal taxation, conducted by the Russian government, will lead to more egalitarian income distribution.

b) S-sector wages go down under the reasonable assumptions regarding the A magnitude.

$$\frac{dw_S}{dt} = \frac{\partial w_S}{\partial t} + \frac{\partial w_S}{\partial k}\frac{\partial k}{\partial t} = -f'\frac{1+k}{k}\left(g'\frac{Rk}{(1-kt)^2}+g'_t\right) -$$

$$- A\left(f'\left(\frac{g}{k^2} - \frac{1+k}{k}g'_{W_H}\frac{Rk(1-kt)+tR}{(1-kt)^2}\right)\right) =$$

$$-f'\left(\frac{1+k}{k}\left(g'\left(\frac{Rk}{(1-kt)^2}-A\frac{Rk(1-kt)+tR}{(1-kt)^2}+g'_t\right)\right)-A\frac{g}{k^2}\right)$$

We can see that the sign of $\dfrac{Rk}{(1-kt)^2}-A\dfrac{Rk(1-kt)+tR}{(1-kt)^2}+g'_t$ is posi-

tive if A and g'_t are not too big in magnitude. If they are not, the wage in the shadow sector decreases with the tax rate.

This result was expected: the wage in the shadow sector is a declining function of the employment there, and since shadow employment increases with taxes, the wage should go down. But since the whole effect for shadow sector employment is ambiguous, the effect for the shadow sector wage is ambiguous as well.

We see that direct (represented by the partial derivative) and indirect (product of the partial derivatives of wage with respect to the wage differential and the partial derivatives of the wage differential with respect to the tax rate) effects on wages work against each other in all cases. It is the case because of interlinks between the sectors in the economy. A higher tax rate makes the wage of the S-worker go down and those of the H-worker go up, and therefore increases the wage differential between the sectors. At the same time a higher wage in the H-sector leads to contraction of the sector and the chance to get a job there also diminishes. Therefore, the value of a chance to enter the H-sector for an S-worker is influenced positively by a higher wage there and negatively by a lower probability to be captured by H-firms. Although we do not know the mutual effect, we can see that a lot depends on the size of the H-sector and the sensitivity of the sector's wage on the tax rate's change. If this effect is not so prominent compared with the direct wage effect, the value of S-sector employment will decline with a higher tax rate.

Effects of the policy influencing the level of technology
The government cannot affect the technological parameter E equally easily as to change the tax rate, but we assume that E may be influenced in different ways. It is a complex indicator reflecting effects on the level of investment in technologies and managerial skills, and depends not only on the government's actions. Nevertheless, we can interpret some government decisions as the direct change in E and see what consequences for labour incomes it may bring. To determine the direct impact of the technology on wages in the different sectors I set up the following lemma:

Lemma 4. Better technological conditions have a positive direct effect on labour incomes in the H- and P-sectors, and a negative effect on wages in the S-sector. The effect for the partial derivative of the employment value in the S-sector is ambiguous, but the partial derivative of the income differential with respect to E is unambiguously positive:
Proof:
1. Technological progress E in the H-sector is beneficial for the H- and P-sectors:

$$\frac{\partial w_H}{\partial E} = R`_E \frac{1}{1-kt} > 0 \qquad \frac{\partial w_P}{\partial E} = R'_E \frac{kt}{1-kt} > 0$$

since $1-kt$ and $R'_E > 0$.

We see that both wages increase with better technology in the H-sector, and the wage differential D goes up:

$$\frac{\partial D}{\partial E} = R'_E > 0$$

2. For the S-sector:

$$\frac{\partial w_S}{\partial E} = -f'\frac{1+k}{k}\left(g'_{w_H} \frac{\partial w_H}{\partial E} + g'_E \right) < 0$$

$$\frac{\partial V_S}{\partial E} = -\xi(1-h)f'\frac{1+k}{k}\left(g'_{w_H} \frac{\partial w_H}{\partial E} + g'_E \right) - \xi w_S \left(g'_{w_H} \frac{\partial w_H}{\partial E} + g'_E \right)$$

$$+\left(g'_{w_H} \frac{\partial w_H}{\partial E} + g'_E \right)(Sr - S + w_H) + h\frac{\partial w_H}{\partial E} =$$

$$=\left(g'_{w_H} \frac{\partial w_H}{\partial E} + g'_E \right)\left(-\xi(1-h)f'\frac{1+k}{k} - \xi w_S + Sr - S + w_H \right) + h\frac{\partial w_H}{\partial E}$$

In this case the positive effect on wages for the shadow employment value as well as for the public workers is just the spillover effect of higher productivity in the advanced sector, since the public workers get only a small fraction of the H-sector success.

Q.E.D.

To identify the sign of $\dfrac{\partial V_S}{\partial E}$ we have to know the relative magnitudes of the first negative term and the second positive one. The negative term expresses the effect of E on the wage part of the employment value and the second reflects the influence on the part of expected incomes of the S-worker related with possible employment in the H-sector. For the whole expression to be positive the second effect must be stronger than the effect on the real part of incomes $\hat{V}_S$. It may happen if E considerably increases the H-sector wage and the probability to get an H-sector job for an S-worker is sufficiently high such that a lower S-wage will be overcompensated by the increased value of the chance to improve her employment position.

The direct effect of better technologies is quite obvious: the H-sector requires fewer workers, but pays them more. The wage of public workers is exposed to two effects: higher tax revenues are distributed among a larger number of recipients, but the total direct effect is positive as well.

Again, the general effect of technologies on the wages is made up of two effects:

$$\frac{dw_H}{dE} = \frac{\partial w_H}{\partial E} + \frac{\partial w_H}{\partial k}\frac{dk}{dE} = \frac{R'_E}{1-kt} - B\frac{R'_k(1-kt) + tR}{(1-kt)^2} =$$

$$= \frac{R'_E(1-kt) - B(R'_K(1-kt) + tR)}{(1-kt)^2} = \frac{(1-kt)(R'_E - BR'_k) + BtR}{(1-kt)^2}$$

The sign of the expression depends on the relative values of two items in the nominator.

$$\frac{dw_P}{dE} = \frac{\partial w_P}{\partial E} + \frac{\partial w_P}{\partial k}\frac{dk}{dE} = \frac{t}{(1-kt)^2}\left(R'_E k(1-kt) - BkR'_k(1-kt) - BR\right) =$$

$$= \frac{t}{(1-kt)^2}\left(k(1-kt)(R'_E - BR'_k) - BR\right)$$

Hence, the sign of the expression depends on the sign of $R'_E - BR'_k$. If $\frac{dk}{dE}$ is not great in magnitude, this difference is positive and the whole expression is positive as well.

$$\frac{dw_S}{dE} = \frac{\partial w_S}{\partial E} + \frac{\partial w_S}{\partial k}\frac{dk}{dE} = -f'\frac{1+k}{k}\left(g'_{w_H}\frac{\partial w_H}{\partial E} + g'_E\right) - \frac{dk}{dE}f'\left(\frac{g}{k^2} - \frac{1+k}{k}g'_{w_H}\frac{\partial w_H}{\partial E}\right) =$$

$$= -f'\left(\frac{1+k}{k}\left(\frac{dk}{dE}g'_{w_H}\left(\frac{\partial w_H}{\partial k} - \frac{\partial w_H}{\partial E}\right) - g'_E\right) - \frac{g}{k^2}\frac{dk}{dE}\right)$$

If the value of g'_E is not too big, the sign of the expression is negative, i.e. shadow sector wages go down with better technologies in the economy.

The general effect of technology on H-sector employment is negative as both the direct effect and the indirect effect via wage $g'_{w_H}\frac{\partial w_H}{\partial E}$ are negative. Indeed, with better technological conditions and higher productivity H-firms require fewer workers, pay them more and thus can afford to hire even fewer workers. Thus, we see that the wage in the S-sector is decreasing with the technological parameter E due to the effect through L_S. While wages in the two legal sectors increase with better technologies, the shadow wage declines.

Despite the fact that wages increase in both law-abiding sectors, we can see that the income differential becomes wider with better technologies:

$$\frac{dD}{dE} = \frac{\partial R}{\partial E} + \frac{\partial R}{\partial k}\frac{dk}{dE} > 0$$

The first item is positive and the second is the product of two negative factors. Better technologies in the advanced sector widen the gap of well-being between the sectors.

Hence, under certain conditions better technology increases labour incomes in the H- and P-sectors, and decreases wages in the S-sector. The effect on the employment value in the S-sector is ambiguous, but the income differential between the H- and S-sectors unambiguously grows with E.

Effects of the pension policy

In our model the size of the pension does not depend on the wages, and the government can change only the pension boundary values. In its pension policy the Russian government constantly balances between a necessity to provide subsistence conditions to the poorest pensioners and to keep incentives for high-paid workers to pay contributions. In the difficult financial situation of the 1990s the difference between the maximum and the minimum pension constantly shrank, and that lowered incentives to pay contributions and further deteriorated the situation.

The minimum pension S and the ratio of pension differentiation r are instruments of the government policy here.

Proposition 5. 1) A higher minimum pension increases labour incomes in every single sector, such that incomes in the H-sector grow most and in the public sector least. 2) A higher pension differentiation ratio increases labour incomes in the H- and S-sectors, and the incomes in the H-sector grow most.

Proof:

The effects of the pension parameters on the value employment are obviously positive:

$$\frac{dV_S}{dS} = h(r-1) + 1 > 0 \qquad \frac{dV_S}{dr} = hS > 0$$

Comparing them with the pension parameters' influence on the employment values in the H- and P-sectors, we obtain:

$$\frac{dV_H}{dS} = r > 0 \qquad\qquad \frac{dV_H}{dr} = S > 0$$

$$\frac{\partial V_P}{\partial S} = 1 > 0 \qquad\qquad \frac{\partial V_P}{\partial r} = 0$$

since r is greater than 1 (otherwise the minimum pension is equal to the maximum one), $\dfrac{dV_H}{dS} > \dfrac{dV_S}{dS} > \dfrac{dV_P}{dS}$ and

$\dfrac{dV_H}{dr} > \dfrac{dV_S}{dr} > \dfrac{dV_P}{dr}$.

Q.E.D.

It is very intuitive that growth in the pension parameters improves the conditions of workers in all sectors (except the differentiation ratio r that does not affect public workers) but H-sector workers win most. Both income differentials increase; however, the differential between the H- and the S-sector grows less than between the H- and the P-sector.

In our model inequality grows with the pension parameters. Nevertheless, this result rests on the extreme simplification of the pension formula.

Suggested policies and their implications

The government's aspirations

I have derived the influences of different parameters on wages and employment in the economy. On this basis the policymaker may design a policy tailored to the particular politically or socially motivated needs.

It has been shown that an increase in the H-sector is accompanied by an increase in the S-sector, and therefore this model does not allow us to pursue simultaneously two tasks: to reduce the shadow sector and to promote development of the advanced sector. We also know that a higher employment ratio brings about unclear consequences for the employment in the public sector: it may grow or contract depending on different values of the parameters. Therefore, there is a trade-off for the government: either it prefers to support the advanced sector and becomes reconciled to the enlarged S-sector, or it imposes strict measures against the S-sector, which cause greater public sector employment and lower incomes there.

I assume that the government's objective function includes the volume of the governmental services provided and the probability to be re-elected, and therefore the government is interested in a large public sector. In terms of our model, it means large public sector expenditures (i.e. payroll), since we assume that the number of public employees and their quality expressed in salaries to a certain extent are substitutes.

Nevertheless, the government's utility depends on the value of the payroll only for a certain range of employment and wages values. If the latter is too low and the former too large, the utility from the public sector becomes negative, since poor public employees and a higher level of corruption are not favourable factors for re-election.

Low salaries in the public sector in today's Russia lead to severe corruption in various spheres, i.e. supervision and licensing bodies, the police, institutions of public health and education, and at the same time to a declining quality of the public services. Although the public sector in Russia has not reached the size of the public sectors in the advanced Western economies, it has considerably increased in size since the collapse of the Soviet economy. The Soviet state controlled everything in social and economic life, and given that the quality of public services in the health and educational systems has considerably declined, there is a strong perception in society that public sector is overmanned and inefficient.

The programme of economic reform, one of the Mr Putin's pre-elective documents, includes an administrative reform aimed to increase the quality of the public administration and to reduce corruption.[40] The reform encompasses a raise of salaries together with higher requirements regarding the

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40 The programme of economic reform (2000).

employees' qualifications and their higher responsibility. Unfortunately this reform has not been started.

A successful development of the economy provides the government with a higher probability of re-election and a larger tax base and therefore the government prefers maximum expansion of the advanced sector, conditioned on the desired size of the public sector. But taking into account the negative utility from the larger public sector for a given budget I argue that in our simple model it is socially optimal to make the H-sector as large as possible (to maximise k), since it provides high income for the public employees as well and make the public sector more efficient and reduces inequality in society.

If we assume that some of the public services performed by the private sector are socially optimal, we can consider partial privatisation and hence, in terms of our model, partial transformation of the public sector into the advanced one.

Policy affecting technological development

Assume that the government disposes of external financial sources to implement a policy of some sort. The government can support the advanced industry's development by subsidies or cheap credits, or by the instrumentality of non-pecuniary policies, i.e. through alleviating the import of modern technologies, removal of bureaucratic barriers, improvement in investment legislation, protection of property rights, support of propagation of advanced managerial techniques etc. Besides, all measures promoting foreign direct investment may also be considered promoting better technologies.

We know that a higher E reduces H-employment at the expense of the public sector, but incomes in both sectors go up. At the same time the wage and expected income of shadow sector workers go down and the sector becomes larger. We see that technological progress induces reallocation of the labour force in favour of the non-commercial sector and thereby strengthens the financial base of two law-abiding sectors. Hence, the support of the H-sector leads to higher employment in both the shadow and the public sectors, with lower growth in the shadow sector. The model's predictions are supported by the experience of developed countries, where technological changes have led to a decrease in industrial employment and enlargement of all kinds of services.

Notice that this type of policy is politically quite sensitive since the measures that really promote the technological development are not incontrovertible, and also that there are some social constraints in the implementation of this kind of policy. While the government supports the most prosperous part of the workforce, and despite improvements for public workers, income differentials between the H- and other sectors become wider. Since employment in the H-sector is reduced, some of dismissed workers suffer a reduction in incomes.

The tax policy

Effects of a higher tax rate strikingly resemble effects of a higher E. The model predicts that the higher tax burden depresses the advanced sector's development: employment there goes down and wages go up so that the total payroll decreases. The shadow sector rises, but incomes there decline. Effects for the public sector are ambiguous: incomes and employment there can move in either direction depending on the value of the model's parameters, but the gap in incomes between the advanced sector workers and the rest of the employed becomes wider, i.e. inequality in the economy grows. This result looks paradoxical: the government uses taxes as a tool of income redistribution. Nevertheless, we see that a higher tax burden makes smaller the only sector paying taxes and increases the number of beneficiaries in the public sector, whereas the remaining workers in the modern sector receive a higher wage than before. Some of these effects are illustrated in Figure 3. We see that the greater t increases wages in the two legal sectors, reduces employment in the H-sector and incomes in the shadow sector.
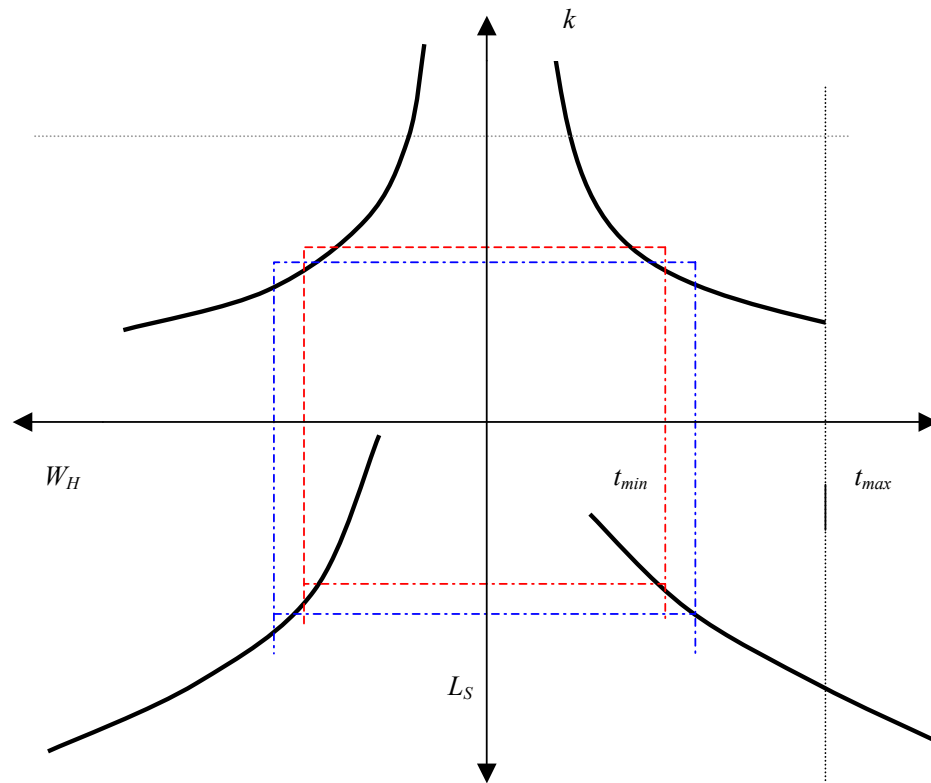

Figure 3 The consequences of a shift in the taxation policy. The model predicts that a cut in the tax rate brings about a lower ratio k, lower shadow employment and a higher wage in the modern sector.

At the beginning of 2001 the Russian government launched an ambitious tax reform, which includes a massive tax rates reduction, abolishment of pro-

gressive personal income taxation together with the introduction of regressivity in the unified social tax. These measures were accompanied by the elimination of many tax reliefs, including investment deduction for the profit tax. Since only efficient companies in Russia could afford to declare profits, and therefore made use of this tax shield and financed their investments from the tax savings, they have suffered the most from these measures.

Therefore, in terms of our model, the government reduced the tax rate t and the technological parameter E at the same time, and the model predicts that in this case the wage differential in the economy will shrink and the H-sector employment will increase. The public sector may lose a part of the funding and become relatively less attractive than the shadow commercial sector. The value of shadow employment increases through both effects and then the income differential will contract, but the number of shadow workers will become lower. The H-sector comes closer to the rest of the economy.

Enforcement measures

The government can intensify control over the shadow sector to make the shadow activity riskier and less profitable. Throughout the 1990s the government tended to emphasise the significance of proper administrative measures against the shadow sector. The model predicts that both employment and expected income in the shadow sector positively depend on ξ. Therefore, a higher frequency of tax and labour inspections may reduce the attractiveness of the sector and make it smaller. Nevertheless, this kind of policies may be applied in practice only at a rather limited scale. Inspections require huge human and financial resources, and may in turn create a necessity to control inspectors and so on.

Furthermore, the role of the shadow sector for Russia's economy is rather controversial. The shadow sector generates a number of acute social problems since it does not provide social guarantees, labour safety and control of consumers' rights. On the one hand, it helps to alleviate the situation for some groups of the population, such as the unemployed and low-skilled workers, and perhaps to create a base for small business development. The shadow sector's existence sends a message to policy makers about the limits to which taxation can be pushed. A severe fight against the S-sector, not accompanied by other policy measures, will increase the uncertainty in the shadow sector, and thus reduce the expected income of the S-sector's workers and lead to an outflow of workers to the non-commercial sector with a following reduction of wages there. Hence the sharp reduction in commercial sector activity will lead to a lower total production and create an excessively heavy burden for the public sector.

The pension policy

The pension system of Russia and the arguments for reforming

The Pension Fund of Russia (PFR) and the network of social security agencies constitute the state pension system in Russia.[41] The PFR is responsible

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41 The Federal Law # 166-FZ.

for the custody of pension rights, tax collection and pension delivery, and has its own budget separated from the federal budget and the regional offices responsible for pension collection and delivery in the region. Usually the pension contributions are collected and distributed as pension benefits in the same region, and the surplus is transferred to the regions with deficits. In practice pensioners in the poor regions often suffer from delays in payment, whereas PFR offices with superfluous sources prefer to keep their unutilised funds and invest them.[42] Such investments are not regulated and there are misuses in such practice: it happens that money is placed in deposits with very low interest rates but at the same time funds are borrowed to pay pensions.

No government agency exercises operational control over the PFR's activity, and the one instrument of legal external influence is the consideration of the yearly budget of the Fund. The State Duma confirms the budget execution for the previous year and fixes the budget for the next simultaneously for the Federal and the PFR's budgets. Therefore, it is quite difficult to assess how efficient the PFR is regarding expenses, and deputies usually notice too high a level of administrative expenditures, capital investments into new offices and equipment, large borrowings to cover temporary cash deficits etc. At the request of the World Bank the independent audit of the PFR was initially included into the governmental Pension reform programme,[43] but, due to the activity of the PFR lobby, was stricken off and not undertaken.

The financial sources of the pension system in 1990s were constituted by a specialised payroll tax, initially called "compulsory contributions", that was paid by the employers (the main part) and by the employees (the smallest part) directly to the PFR.[44] In 2002 contributions into the PFR and other extra-budgetary social security funds (social insurance and health insurance) were combined into the unified social tax with an approximately unified tax base. The tax rate was set as just the sum of the individual taxes (35.6 per cent).

The PFR is responsible for old age and disability pensions for all retirees[45] and pensions for long service for certain categories of workers. Inside the general pension schemes there were pension regimes allowing early retiring for workers of certain professions, or who worked in the factories with harmful labour conditions or lived in remote regions of the country. The degree of redistribution between different categories of workers with respect to relationship between contributions and payoffs inside the system was very high, and it obviously created different types of distortions.

The pension benefit in the old system was computed according to the pension formula relating pension with the length of service and the pre-retirement wage. The rights acquired in the old system are kept and the old pension formula is used in the transition period for the aged generations of workers. According to this formula, a retiree is entitled to a retirement benefit equal to the share of her pre-retirement wage for the last five years

42 Dubrovsky (1999).
43 The programme of the pension reform (1998).
44 The Tax Code, part two.
45 The pensions to the retired military men and to the functionaries are paid from the federal budget.

(replacement ratio), adjusted by the changes in the countrywide average wage, multiplied by a coefficient linearly depending upon the length of service (not more than 45 years for men and 40 for women). The value of the pension is inflation adjusted by the ratio of the country average wage and the individual wage, but not greater than 1.2. This result should not exceed the 3 minimum pensions.

The procedure of computing the pension is as follows:

1. Contribution of income A. Average ratio of the individual's wage and the average countrywide wage for the reporting period. This ratio cannot be greater than 1.2 (before 2002 it was 0.9).

$$A = \min\left(\frac{\sum_1^n \frac{w}{\overline{w}}}{n};1,2\right)$$

2. Replacement ratio, the length of service contribution. If the retiree has a minimum length of service (25 years for men and 20 years for women), the second factor is equal to 0.5. For every year above the minimum this factor increases by 0.01, but no more than 0.75 totally.
   Formally, for men:

$B = \min(0.25 + 0.01S;0.75)$, where B is a replacement ratio and S is a service.

3. The final pension is equal to the product of two factors, adjusted by the growth of the average countrywide wage.

$$P = AB\frac{\overline{w}_c}{\overline{w}_0}$$

Before introducing the new system the following rules were operative:

1. "Non-insured" periods
2. The ceiling for the wage ratio was 0.9.

Some features of the old pension system

1. The length of service is more important than the income. Increase in a service produces much greater increase in the pension value than the proportional increase in the wage, whereas the ceiling for such increases is much lower for the wages. To achieve the indifference point, where longer service does not affect his pension, a man 60 years old (the official pensionable age) should have worked 45 years, i.e. started when he was 15 years old. If we take into account that such periods as professional education, military service etc. were not counted into the length of service computation and were returned to just when the whole system was

revised, we realise that the limitation above was not binding for many Russian retirees. A worker with the same present value of taxed income but shorter length of service always necessarily received a smaller pension. If an individual continues to work after the pensionable age she receives her pension in addition to the wage and the length of services continues to grow so that the pension value would be recomputed. In combination with the very low level of pensions such a system creates incentives to work as long as it is otherwise optimal for the person.

2. We see that the pension cannot exceed 0.75x1.2=0.9 (before 2002 it was 0.75x0.9=0.675) of the average countrywide wage. In 2001 wages as a part of the total incomes of the population constituted about 35.8 per cent,[46] partly reflecting the scale of tax evasion: a part of labour incomes is registered as other incomes. As stated above, actual labour incomes are even higher, and it means that the replacement ratio for the pensioners is lower than 20 per cent. Considering that by the end of 1998 the average pension benefit became just 18 per cent lower than the maximum, we see that the vast mass of the well- and even average-paid workers must pay higher contributions than the final pension and therefore are not interested in the public pension system at all.

3. According to the law, pensions in the country should be regularly (yearly or quarterly if inflation is high) revised in accordance with the average wage increase. In the 1990s it was not the case. A high inflation rate and poor tax collection led to tremendous misery among the elderly and the pensioners with a small pension in 1996 and 1998 got an increase that was not stipulated by the pension legislation. Hence a considerable part of the pensions became government charity, not mentioned in the pension legislation. This increase in the minimum pension led to a situation where all ordinary pensioners received almost the same pension.

Inflation indexation is not also automatic either, and is the subject of political haggling. The pension formula does not allow pensions to decrease, and before elections and in other politically motivated situations the authorities tend to increase pensions. The pension legislation asserts that the average countrywide wage is established by the government in accordance with the statistical data about the wages and the employment provided by the Goskomstat. Nevertheless, the PFR refuses to accept the value of the average wage presented by the Goskomstat, and operates with its own calculations, based on the contributions collected. In 1997-98 a treatment of the law with regard to the method of average wage computation was the subject of the hottest debate between the State Duma and the Pension Fund. The value presented by the PFR was considerably lower than the statistically registered average wage, which in turn was lower than the real average by 1.5-2.5 times due to huge tax evasion. The PFR ignored the Duma's opinion and has since then used this average wage as a control value, and not the exogenously given. For example, when the PFR feels the necessity/possibility to index pensions (e.g. for political reasons) it just proclaims that the average wage in the country is growing and all pensions are raised correspondingly. Hence, despite the clear rules of computing and indexing of pensions their actual

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46 Gurevich (2002).

size is quite arbitrary. Trust regarding the pension legislation is low: there is always a possibility for the government to cut its obligations, especially when inflation is high. Actually the level of pensions depends not on the legislation but on the financial situation in the PFR. Generally speaking, the government pays almost as much as it will.

4. Gender differences in Russian society and hence the extent of redistribution in the pension system are striking. Men in average have considerably higher incomes but much lower life expectancy than women (59 years for men and 71 for women). The pension age is also different (60 and 55 years respectively). Thus women are mostly recipients whereas men are the main contributors.

5. Professional groups are treated differently. Generally, the low level of the maximum pension penalises all high-paid workers. In this situation the government becomes the subject of pressure to grant privileges for particular professional groups. For example, the civil pilots' union required a higher pension limit for their members arguing that the replacement ratio of retired pilots compared with the average is particularly low. The replacement ratio for the registered wages was about 40 per cent in 1998, but for pilots it was much lower, about 10 per cent. A lobbying activity by the pilots' union led to the inclusion of pilots in the special pension regime for long service, allowing pilots to retire earlier and receive a higher pension. Hence some professional groups with good lobbying possibilities can acquire better terms of pension provision at the expense of other groups of workers than the ordinary pension system provides. The constant pressure on the Duma from various interests groups requiring privileges erodes the system and makes participation in the "universal" public pension scheme less attractive for the majority of the population.

Another special pension regime is early retirement for many groups of workers employed in industries with harmful production processes. Their employers bore no extra expenses and were actually interested in creating new such working places instead of introducing harmless technologies.

Hence, a well-paid male employed in the ordinary industry without privileges is much less interested in participation in the public pension scheme than a poorly paid woman with professional privileges.

The pension reform

The present pay-as-you-go pension system is unsustainable in a medium-term perspective because of demographic processes, and the pension reform, another major reform on the Russian government's agenda, was launched in the beginning of 2002. The funded element was introduced and the final pension benefit now depends on the system's investment performance.

The reform was supported by both long-term and short-term considerations. In the long run fast demographic changes in Russia will lead to an unbearable burden for the pension system, breaking pension obligations and possibly lead to the bankruptcy of the pension system. A low birth rate made the population structure very asymmetrical, and in 10-15 years the retired generation will be less in size than the working generation and will hardly

receive a pension equivalent to the pension they provided to the elderly then they worked. Hence the present worker cannot rely on the promises of the public pension system, and therefore evades taxes and saves for her old age.

Young generations observe both the low level of pensions and the weak interlink between contributions and the final pension. In this situation most Russians resort to individual savings and support from the family. Such family traditions are still quite strong in Russia and retired parents usually receive some assistance. The importance of the public pension system is constantly diminishing.

The government hopes that the establishment of a funded "pillar" inside the state pension system can help reallocate revenues and liabilities more evenly in the following decades, but the reform is highly disputed and quite controversial.

The low efficiency of tax collection backs the necessity of changes in the fiscal policy. The huge tax evasion diluted the financial basis of the system and undermined an ability of the system to pay the bills and to keep the present pensioners politically loyal. In the short run the government wishes to revitalise the Russian capital market by establishing a large group of institutional investors that constantly manage the assets of the public-funded pension system and increase tax collection by improving the incentives of taxpayers to participate in the system. I intend to consider how the changes in the system will affect such incentives.

The demographic and labour market situation decreased the ratio of contributors to beneficiaries, and this ratio will obviously further decline. The timing of the reform was especially important to make the reform politically affordable. A part of pension revenues is to be diverted to the established funded system from the present pensioners, and that is difficult to afford if the elderly generation is relatively big. A favourable macroeconomic situation and high oil prices made the transition quite painless. A gradual increase of the share sent to the funded system should allow the present working population to accumulate enough to reduce the burden on the smaller future generations.

The main technical tool of the reform is a formal separation of the state "pension provision" where benefits depend on a disability to work or other characteristics of a beneficiary, and the state "pension insurance", where pensions are a function of the contributions to the system. It is supposed that the incentives to pay the "insurance" part of the system will create enough financial buoyancy for the system as a whole. Every rouble of contributions now is treated equally, i.e. a well-paid worker with shorter service receives the same pension as a worker with the same present value of accumulated contributions collected for a longer period of time.

By the logic of the reform the government has a duty to pay just a minimum basic pension and the pension generated by the contributions to the quasi-accumulative accounts. The funded part of the pension system is the subject of cumbersome and costly regulation but the eventual size of the pension depends on the investment performance of managing companies.

The theoretical literature on the liberal pension reform usually treats the compulsory savings mechanism as a tool against people's myopia. Society as a whole, including different generations and individuals, may have different

utility discount rates: hence the sum of individual preferences will not result in social utility. Consequently some people tend to consume too much from the point of view of a social optimum in their young age when the utility of money is possibly the highest for them and do not make sufficient savings for the future.

In the welfare state the government cannot abandon poor elderly people without support and hence the pension provision may be considered a public good and the same argument may be applied: some people will not contribute to a socially optimal value voluntarily, even if it concerns their own well-being. They will rather spend their money today being aware that society will take care of them later. Such arguments mean that the compulsory savings system theoretically may be socially superior to voluntary pension savings.

Revenues and liabilities of the pension system
Before the reform the employer paid totally to various social funds 38.5 per cent of the payroll and the employee paid 1 per cent, the employer deducting this sum from the wage. The distribution of payroll tax payments between an employee and an employer varies in different countries, but like many authors I do not care much how it is formally organised and sum up the rates. For our purpose the employee and the employer form coalitions, minimising combined tax expenses. At the second stage the partners share the resulting payoff in accordance with their bargaining power (equally in the Nash bargaining equilibrium case).

In 2002, instead of separated contributions to different social funds the Unified Social Tax (UST) was introduced. The UST (the tax rate is 35.6 per cent of the payroll for the overwhelming majority of enterprises) paid by the employer is split between various public welfare funds and the federal budget (14 per cent of payroll) to fund the social pension and the basic part of the insurance pension. The remaining part (14 percent) goes to the Pension Fund and serves as the financial basis of the "insurance" pensions, related to the value of life-time contributions. These 14 per cent are divided between a pay-as-you-go system (14, 12 or 8 per cent, according to the age), paid to the present pensioners immediately, and the rest is accumulated on the insurant's personal accounts and invested. The former part is booked as a "pension capital" of an insurant accumulating on quasi-funded accounts, backed by the Fund's obligations and will be taken from the contributions of the future generations. The later part is not included into the public pension system anymore. These 2 (or 6) per cent are considered the individual's property, a worker should take investment decisions himself and the government is not responsible for the resulting pension.

The government recognises that the rate of the UST should be reduced and the terms of such a reduction is hotly discussed in the Duma.[47] One of the proposals with good chances to be adopted is 14 per cent to the PFR directly, 6-8 per cent to the federal budget for pension purposes also and 6-8 per cent to other funds. In this proposal the federal budget and hence the financial base for the minimum and social pensions suffer.

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47 Dmitriev (1999).

The only way to somehow restrict pension capital accumulation from above is the regressive taxation of high wages. In Figure 4 we can see how much the taxpayer must pay to the pension system depending on the labour income. Theoretically the marginal tax rate decreases with the greater payroll, but no firms have claimed regressive taxation yet. According to the rules of regression the lower tax rate may be applied if the declared average wage per worker is higher than 100,000 roubles per year (about 3,330 USD), such that 10 per cent of the most-paid workers are eliminated from the computation. Regression aimed to encourage well-paid workers to reveal their incomes does not work since it may be applied only if the whole staff of the company is paid well above average, and this indicates that the threshold is too high.
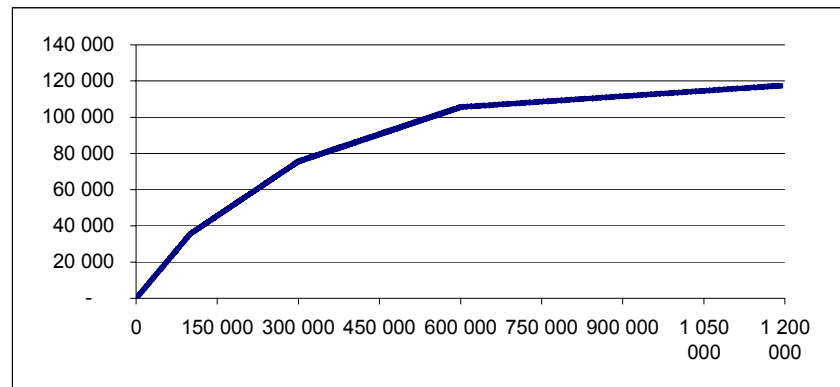

Figure 4. Regressive taxation for the Unified Social Tax
Source: The Tax Code, part 2.

The new pension formula[48]
The resulting pension is computed as the sum of the basic pension paid to every pensioner irrespective of wage and the length of service (the value is determined by law and equal for everybody), and the differentiated parts depending upon the contributions: insurance pension and accumulated pension. The retiring person is entitled to an insurance pension equal to the accrued "pension capital", the accumulated pension rights, divided by the number of the officially expected last 19 years (228 months). If the person retires later than the formal pensionable age, the expected pension payment period is correspondingly reduced, but not less than 14 years (168 months). Nevertheless, the sum of the basic and the insurance parts of the pension cannot be less than a certain minimum value. The accumulated part of the old-age pension is computed in the same fashion: really accumulated capital is spread for the same 19 years.

Assume a worker at a pensionable age with the opportunity to choose between the following options: retire and receive pension, postpone his retirement and continue to work or continue to work and start to receive pension. Since the present legislation allows working and receiving pension the

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48 The Federal law #173-FZ.

second option may be chosen only if the resulting increase in the pension will cover the lost pension for the years from the possible and the actual retirement. A postponed pension would be larger due to two effects: larger pension capital and lower number of months to divide this pension capital. If a worker chooses to receive pension and work simultaneously only the pension capital will increase. Hence, the second effect should be strong enough to make individuals refrain from retiring. Besides the preferences over wage/leisure the final decision for an individual depends on the form of his wage function. It is often assumed that the wage, lagging behind labour productivity, increases first and then decreases. It is not necessarily true for all countries and professions, but for Russia it is the realistic picture: elderly workers are paid less. Hence we can assume that the wage curve decreases for the person over pensionable age and reaches the point where an individual is indifferent between working and retiring. Ideally, the system should work in such a way that everybody who is able to continue working would be interested in that.

The defined contribution pension system imitates real life insurance with a usual annuity scheme. Compulsory contributions accumulate in the PFR and until the retirement age constitute the property of the insured, but being retired this person is entitled to the pension benefit only. (It means that if somebody dies a day before retirement her heirs get the accumulated capital, the day after they get nothing.) The expected period of pension payment is far from actuarially fair.

These three parts after entitlement would also have different dynamics, and the peer representatives of the neighbouring generations with different shares of the insurance (non-funded) and accumulated pensions would receive quite different pensions, if investment performance considerably exceeds the rates of indexation in the quasi-accumulating part of the pension. The minimum pension is indexed according to the government's decisions and is highly sensitive politically. Actually, the government will take into account how many pensioners would be significantly affected by changes in the minimum pension, i.e. poverty among the future elderly. The whole construction of the pension system depends on the size of the minimum pension: it cannot be too high to achieve the desired pension differentiation, but cannot be so low that it makes pensioners starve. Hence it is very difficult to predict how the minimum pension will change.

The second part of the pension is the government's obligations registered as the personal "pension capital", the part of contributions paid during the retiree's service. This value is adjusted with the growth in the officially admitted average wage in the country and at the moment of retirement constitutes the quasi-accumulated pension capital. After the monthly pension is computed, it is also adjusted by the growth in the average wage.

The pension capital actually accumulated on the personal accounts of the pensioner (the funded part of the pension) is calculated as the usual annuity: the pension capital will grow by the rate of return and diminish by the actual payments of pensions. The period of receiving the pension will be determined legislatively, not by mortality tables. Investment management of the public pension assets should be entrusted to a small number of authorised investment managers, but until 2004 all the money is invested into the Rus-

sian government's bonds and managed by the state-owned Vneshtorgbank, also the governmental general agent serving the government bonds.[49] The government decided that the number of the authorised managing companies should be small, and therefore the right to manage the assets of the funded pension system becomes the rent, causing wasteful rent seeking between large Russian financial groups. The costs of rent seeking will be incumbent on the pensioners.

Investment regulation is cumbersome and costly to comply with, and it also deteriorates the efficiency of the new system. New infrastructure including the general depositary and specialised managing companies, as well as new departments in the Pension Fund responsible for the investments should be established. The depositary's responsibility for errors in book-keeping must be insured. Officially, expenditures of the funded system may exceed 2 per cent of the assets under management. Therefore, in order to cover their fixed costs investment managing companies are interested in obtaining control over the highest possible amount of pension assets and hence maximally limit the number of competitors.

The investment portfolios are also the subjects of strict regulation.[50] So far, the only allowed directions of investment are the Russian state securities and the mortgage-based bonds issued by the government estate agency. Critics say that not all kinds of investments are defensible: placing them in domestic state bonds (the main and now the sole investment direction) does not change the basic principles of the present system, but leads to higher expenditures, while other types of investment in Russia are either too risky or too unprofitable.

But for the government strict investment regulation is the safety belt against people's dissatisfaction if the performance turns out to be poor. There is also a self-delusion problem: by rigid and inefficient regulation the government inflates the responsibility of the investment managers, and that is why investment managers are interested in such regulation.

Therefore, the system becomes quite complicated for a worker. Both the initial level of pension and the ways of inflation adjustment are unclear and depend on politics more than economics. The reform does not reduce the degree of various types of uncertainty related to the future pension (wage growth rate and risk of unemployment, life expectancy, investment risks, political risks), and hence for a risk-averse worker the expected value of the pension will be lower than its certainty equivalent. The subjective perception of risks related to the public pension system may turn out to be higher than the alternative risks: risks evasion and personal savings.

In the new system the resulting pension is the linear function of the discounted total lifetime contribution. The maximum limit is abolished, and only if a worker receives quite high wage s/he may pay a slightly less marginal contribution, but the relationship between accumulated contributions and the pension will be the same.

In the pre-reform pension system there were three categories of workers: those entitled to a minimum pension irrespective of declaring the wage; high-paid workers receiving the maximum pension and not interested in

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49 The scandalous conflict of interests is emphasised by many observers.
50 The basic legislative base is the Federal law #111-FZ.

declaring a value greater than the one providing them the maximum pension; and the intermediate type of workers with a pension depending on the contributions. It was shown that the intermediate case was not overwhelming at all in Russia due to the quite narrow range between minimum and maximum limits.

The previous pension system promoted the long length of service and confined the maximum wage that matters for the pension on a quite low level. Taking into account that professional education was excluded from the computation of the length of service, the old system supported poorly paid people with low education, who started to work early in their youth. Their returns from the pension system were the largest, and their pensions were often greater than the pensions of the well-paid employees. This situation was abolished by the new system. Not the length of service alone but the total value of accumulated contributions determines the size of pensions. The reform cancelled the maximum pension, possibly making the minimum pension lower than otherwise and hence increases the number of workers with a pension related to their declared wages. Other things being equal, the new system should create incentives for such workers to declare their wages. Better tax compliance via direct interest of workers and employers in the resulting pension was proclaimed the main short-term aim of the reform. How actually does the reform affect legalisation of the shadow labour relationships?

Consider two cases: 1.The coalition of employees and employer has an opportunity to evade taxation and pays the tax only if it is profitable for it. 2. The coalition cannot fully escape taxation and uses legal or semi-legal schemes to minimise tax expenses. Such schemes usually involve declaring labour incomes as other types of personal incomes of the workers.

In the first case gains from revealing their shadow incomes are certainly insufficient to cover an increasing tax burden. By declaring their payroll the coalition must pay 35.6 per cent of the Unified Social Tax and 13 per cent of personal income tax. From the 28 per cent of the Social Tax one half generates some obligations regarding future pension. 12 per cent (8 for a worker with the birth year later than 1967) back the government obligations to the present pensioners, but are booked as personal "pension capital", the government obligations to the pensioner. 2 or 6 correspondingly per cent of the payroll are invested on behalf of the pensioner. Hence, if we imagine that the worker would have invested this money voluntarily anyway, we can say that part of the taxpayer's money is back.[51] Hence, at best the reform is equivalent to the reduction of the tax rate (for workers younger than 37 years it may mean 6 per cent). After the reform every pensioner knows exactly which part is pure taxation and which is the contribution to her pension capital. In other words, a contributor's productive investments are heavily taxed. Hence, even if 14 per cent from the almost 50 per cent are managed efficiently and a worker would like to trust her money to the government anyway to provide

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[51] Assume that if the taxpayer has had the right to decide, she would form some investment portfolio anyway, not less than the obligatory savings inside the funded pension system. His investment preferences can also coincide with the government's ones, and the management-related expenses also should be incurred.

her retirement benefit, tax evasion costs should be too high to make tax compliance profitable.

Besides purely shadow firms there are numerous firms applying legal or semi-legal schemes to minimise the total tax bill. Some of the schemes allow reducing payroll taxation but simultaneously generate other tax liabilities.[52] Now we see a distribution of firms that differ in the costs of evasion from the payroll tax and the gains from participation in the pension system (due to e.g. such characteristics as a type of the industry, a size, an age or gender structure of the workers). Hence, for them even small favourable shifts in the payroll taxation may make evasion from this tax less rewarding and considerably increase their compliance via a switch for some other method of tax optimisation. They may just switch for a system supposing payments of the payroll taxes in full. The issue is how beneficial the changes in the pension system are.

The possible explanation of the shadow sector inertia is the costs of transition. Many enterprises have well established tax evasion schemes related with "black-cash", double bookkeeping etc. The decision to reveal the personnel's payroll may not be taken in isolation from policies towards evasion from other taxes, relationships with suppliers and contractors, as well as tax inspectors and other officials, and criminals. Therefore, a company may not switch for a transparent wage policy due to the costs of transition even if it is otherwise profitable. The costs of transition include among other things the potential costs of switching back, the special case of the well-known ratchet effect.

Enormous redistribution among the various groups of workers inside the Russian pension system was a serious challenge for the reform, resulting in a compromise: the scope of redistribution was just somewhat reduced.

Let us consider how the reform dealt with gender redistribution.[53] The main source of inequality, different retirement age for men and women, is kept. Since the pension capital is accumulated during the whole working life women partly lose their advantage over men, since if they like to retire at the official pensionable age, they will get a lower pension, even if their wage was equal.[54] Nevertheless, women's greater life expectancy together with a lower retirement age means the continuation of heavy redistribution inside the system towards women. So, if a woman and a man with equal wages and length of service retire simultaneously at the age of 60, they will be entitled to different pensions, since the man's "pension capital" will be divided into 19 "actuarially computed" years, but for the woman it will be 14 years. Hence, such a male pensioner receives a smaller pension for a shorter period of time than a female pensioner does.

Such redistribution inside the pension system somehow compensates the general wage inequality between men and women in their active years and the time that women bear and bring up children, but yet discourages men from participation in the system.

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52 A company may make payments to the workers from the after-tax profits (like dividends). Such payments are not levied by payroll taxation, but are costly from the point of view of profit taxation.

53 About gender redistribution see e.g. Baskakov (1999).

54 In the old system they paid during a shorter period but the pension was computed based on the same five pre-retirement years as for men.

Implications for the labour market model

Summing up the measures of the pension reform for purposes of our model:

1. The pension formula is to be revised: benefits must be computed on the base of contributions paid, but not the wage;
2. The same is applied to the length of service: periods without contributions (leaves, time of education etc.) are not reckoned in;
3. The pension differential has to be larger;
4. The retirement age may be increased;
5. Resources for establishment of the funded system should be partly diverted from the current pensioners and partly from the state budget.

The two first measures close the opportunity to cheat on the social security by switching between legal and shadow employment, which is possible when the benefit computation is based on the last pre-retired years of service. One should not earn the shadow sector wage and at the same time a legal sector pension. This brings more realism to the model.

The worker counts on a higher pension, which makes legal employment more valuable. It becomes important to receive registered and taxed wages because a larger gap between the minimum and maximum extremes increases the probability of obtaining an "interior" pension, which depends on a wage. A higher pension benefit in the public sector because of the migration equilibrium condition leads to higher wages in the S-sector and correspondingly lowers employment in the S-sector.

If subsidies to the funded pension system are taken not from the higher taxes but from other sources, then the government needs to reduce other expenditures. Hence the public workers receive only a fraction of the taxes paid by the H-sector, and the remaining taxes go to the pensions in all the sectors. Since now the pension of public workers is a linear function of the wage, and H-workers receive part of their taxes back, the total effect is similar to a lower tax rate with the same effects for income and employment.

Since the size of the advanced sector does not depend on the pension system, a higher pension differentiation ratio makes the total income differential with the remaining sectors even greater. Notice that the differential with the shadow sector will grow the least.

An increase in the retirement age makes actuarially computed pensions lower and work earnings more valuable, even if the monthly pension would be higher, and therefore it benefits shadow employment.

Adjustment in pension parameters leads to different outcomes depending on the particular size of the wage and the pensions. An increase in the pension differential makes work in the H-sector more rewarding; thus S-sector employment is increasing: the higher income of the H-sector's worker attracts some individuals to the commercial sector from the public one. An increase in the minimum pension alone raises employment in the public and the shadow sector, since it makes advanced sector jobs relatively less attractive.

It has been shown that the higher pension parameters increase the value of employment in every sector, but least of all in the public one, and besides, public workers do not gain from the higher maximum pension. The public

sector becomes less attractive and S-sector employment grows with higher pension parameters. This paradoxical result is produced by that fact that pensions in both sectors are rigid and do not depend on the legally declared wage. Therefore, a higher minimum pension creates incentives for tax evasion, since legal employment is not rewarding with respect to pension.

To discuss possible interpretations of these changes in the pension system terms we need to make some extension of the basic model, where we considered a pretty simple structure of pension benefits. Workers in the H-sector receive the highest pension and other workers get the low one. This simplifying assumption does not affect the result significantly since the extreme values of pensions in Russia prevail. Pensions do not differ in the P- and S-sectors and workers do not take them into consideration making employment decisions.

Nevertheless, according to the law the pension is a linear function of the average wage for the last several years of service and does not change with the wage with the exemption of the latter going beyond the limits. In today's Russia the difference between the two limits is so small that the constraints are almost always binding, yet this is a particular feature of the present situation and is not going to last.

We can extend the model to allow pension benefit to change with the wage, but keep the source of pensions exogenous. Hence the worker receives either the minimum pension S or the maximum pension $\overline{S}$, or the share of her current wage bw_H, where b is a replacement ratio of the pension system. The pension system differentiation ratio r is the quotient of the minimum and maximum pensions and is fixed by the pension legislation as 4, although it is actually lower in practice. Therefore, the value of a pension benefit is:

$$pension\ benefit = \max(S; \min(bw_H, rS)) \tag{17}$$

In terms of the option theory this worker's option position may be defined as a "Bullish vertical spread",[55] which combines one bought and one written European call-options. The strike of the purchased option is S and the strike of the written is Sr. Workers are concerned only about the value of the total position, which is equal to the difference between the values of the bought and written call-options.

The value of the pension option positively depends upon the government pension scheme parameters b, S and r, the interest rate of the alternative investment σ, the wage w and the remaining period of work before retirement d. The latter is determined by the age of the worker and the official retirement age. Thus, the pension benefit may be presented as follows:

$$P = B(S, r, b, w, \sigma, d) \quad P_1>0,\ P_2>0,\ P_3>0,\ P_4>0,\ P_5>0, P_6>0.$$

Russian pension legislation sets the limits for changes of b depending on the length of service. Maximum b is equal to 0.75 and most of the people in Russia get the maximum replacement ratio. Then

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55 The option theory and it application to the non-marketable options see Cox and Rubinstein (1985), Hull and Murphy (1998), McDonald and Siegel (1984).

$$rS > B_h = 0.75 W_H$$

$$w_H \leq \frac{rS}{0.75}$$

So, the derivative of the pension option w.r.t. wage is not a continuous function and takes the following form:

$$B'_{w_H} = \begin{cases} 0, & if \ \ w_H > \dfrac{rS}{0.75} \\ 0.75, & w_H \leq \dfrac{rS}{0.75} \\ 0, & if \ \ w_H < S \end{cases} \qquad \Rightarrow (1 - B') = \begin{vmatrix} 1 \\ 0.25 \\ 1 \end{vmatrix}$$

and since $1 \geq (1 - B') > 0, \quad \Rightarrow (12) > 0$

The marginal earnings on pension due to the increase in the minimum pension are positive if the pension is equal to one the extreme values and zero otherwise.

$$B' = \begin{cases} 1, & w_H > \dfrac{rS}{0.75} & \qquad B' > 0 \\ 0, & w_H \leq \dfrac{rS}{0.75} \quad \Longrightarrow & \qquad B' = 0 \\ 1, & w_H < S & \qquad B' > 0 \end{cases}$$

If the marginal earnings on pension due to the increase in the possible spread in pensions (S_{fixed}, S_{max} increased) is less then the discount factor then we obtain the negative sign of the derivative.

$$B' = \begin{cases} 1, & w_H > \dfrac{rS}{0.75} & \qquad B' > 0 \\ 0, & w_H \leq \dfrac{rS}{0.75} \quad \Longrightarrow & \qquad B' = 0 \end{cases}$$

Consider the employment value in the three sectors again. Assume now that the H-sector worker obtains either a maximum pension or the pension as a linear function of the wage, and the public sector worker obtains either a minimum pension or a function of the wage.

$$V_H = \min\{(1 + b)w_H ; Sr + w_H\}$$

$$V_P = \max\{(1 + b)w_P ; w_P + S\}$$

A worker in the shadow sector still obtain the minimum wage:

$$V_S = \xi w_S + S + h\big[\min\{(1+b)w_H \,; Sr + w_H\} - \xi w_S - S\big]$$

In comparison with equations 6-8 all the employment values, except the S-one, may not depend on the pension parameters S and r. Consider the most plausible case: the wage of the advanced sector workers is high enough to give entitlement to the maximum pension as before but a worker in the public sector receives a pension equal to bw_p. The effects of the pension parameters now are even more pronounced: the higher minimum pension S keeps V_P untouched, but increases V_H and V_S. The public sector becomes even less rewarding compared with the shadow sector and shadow employment grows with a higher S.

Another type of extension is heterogeneity of the firms and workers concerning the pension system. In our model all the firms belonging to one of the three sectors are homogeneous, as well as the labour force in the economy. If we allow the workers and the firms to be different with respect to costs of evasion and gains from the pension system, the coalition between firms and employees will solve the problem according to the tax optimisation problem and the solution with depend upon the individual interplay between gains and costs. Hence, for some distribution of firms any changes in the parameters lead to shifts in the number of evading firms.

It was presumed that too high tax rates and a levelling of the pensions for everybody cause low tax compliance. According to the tax authorities, arrears for personal tax and the UST were reduced to about 10 per cent in 2002.[56] Even if we attribute all the improvements in tax collection to the tax and pension reforms, this result is quite modest. We have seen that the reform has not produced strong enough incentives to transit to the legal labour relationships. Private savings are much more efficient than the public pension scheme, and the evasion costs are generally not high. Generally people do not trust the public pension system and the government needs a quite long while to build up the pension system's reputation. Firmness of the pension liabilities is the prerequisite of the reform's success, and the government must commit itself not to worsen the pension legislation for the present contributors in the future. It creates a well-known game-theoretic situation: the government cannot credibly commit not to change pension legislation and the worker, being aware of this, does not declare her wage.

We see that the government, under certain stipulations, has an opportunity to tailor an efficient policy to achieve specific goals in employment and income distribution by applying some combination of different policy instruments.

I should make the reservation that while talking about the government we do not take into account the existence of different levels of government, as they may not be well co-ordinated. For example, the pension system is run by the Federal Pension Fund, while taxation and public employment are partly under the jurisdiction of local authorities. Therefore, the regional government will solve the problem considering the pension system's parameters given.

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56 Tax Collection Ministry (2002).

Conclusion

The aim of the report is to highlight the most striking features of the Russian labour market: adjustment without large unemployment, persistence of the shadow sector, swelling of the public employment. A three-sector static model in the Harris-Todaro tradition has been provided. The model sheds light on the mechanism of labour force reallocation between different sectors in the closed regional economy, shows how workers make decisions concerning their employment in different sectors and gives some predictions about the possible labour market policy consequences. The influences of different parameters on wages and employment in the economy have been derived. On this basis the policymaker may design the policy tailored to the particular politically or socially motivated needs.

It has been shown that the effect of any labour policy depends on the particular parameters of development of the labour market. For instance, strict administrative measures against the shadow sector may cause reduction in total production, exaggerate the labour market situation and increase income inequality in the economy.

We have seen that the shadow economy problem is closely connected to the slenderness of the advanced sectors in the economy, the high tax rate due to high governmental commitments, weak unions and the legal system, unsound social security etc. Due to complexity of the problem the government cannot overcome the shadow sector's problem by a single strong measure. For example, since the beginning of the 2001 the radical changes in the payroll taxes structure and rates have been implemented, but they did not promote any energetic growth in taxpayers' compliance for a decline in economic activity concealment.

Encouragement of honest taxpayers by reduction in tax rates increases the number of honest companies, but the reform should be supported by progress in everyday taxation practice, better work of the legal system, lowering of the administrative barriers for business. The success of any policy of this kind will also heavily depend on the real content of other scheduled reforms: new labour legislation, pension and administrative reform etc.

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Appendix

Proof of Proposition 1:

1. Since we know the sign of $\dfrac{\partial Q}{\partial k}$, $sign\left\langle \dfrac{dk}{dt} \right\rangle = sign\left\langle -\dfrac{\partial Q}{\partial t} \right\rangle$.

Taking the derivative of Q w.r.t. t yields us:

$$\frac{\partial Q}{\partial t} = \frac{\partial w_P}{\partial t} + \xi(1-h)f'_L \frac{1+k}{k}\left(g'_{w_H} \frac{\partial w_H}{\partial t} + g'_t \right) - h\frac{\partial w_H}{\partial t}$$

$$+ \xi w_S\left(g'_{w_H} \frac{\partial w_H}{\partial t} + g'_t \right) - \left(g'_{w_H} \frac{\partial w_H}{\partial t} + g'_t \right)(w_H + Sr - S)$$

Using the model assumption $\dfrac{\partial w_P}{\partial t} > 0$, $\dfrac{\partial w_H}{\partial t} > 0$, $g'_t < 0$, $f'_L < 0$

and $g'_{w_H} < 0$ we obtain $\left(g'_{w_H} \dfrac{\partial w_H}{\partial t} + g'_t \right)(\xi w_S + S - w_H - Sr) > 0$

And also notice that

$$\frac{\partial w_P}{\partial t} - h\frac{\partial w_H}{\partial t} = \frac{kR}{(1-kt)^2} - h\frac{kR}{(1-kt)^2} = (1-h)\frac{kR}{(1-kt)^2} > 0$$

Therefore, $\dfrac{\partial L_S}{\partial k}$ and $\dfrac{dk}{dt} < 0$.

We see that the payroll tax rate affects the employment share of the H-sector negatively.

2. Using the implicit function we can put down the expression for $\dfrac{dk}{dt}$:

$$\frac{dk}{dt} = -\frac{\partial Q/\partial t}{\partial Q/\partial k} = A =$$

$$= -\frac{\left(\dfrac{\partial w_P}{\partial t} - h\dfrac{\partial w_H}{\partial t} \right) + \xi(1-h)f'\dfrac{1+k}{k}\left(g'_{w_H} \dfrac{\partial w_H}{\partial t} + g'_t \right) + \left(g'_{w_H} \dfrac{\partial w_H}{\partial t} + g'_t \right)(\xi w_S - Sr + S - w_H)}{\dfrac{\partial w_P}{\partial k} - h\dfrac{\partial w_H}{\partial k} - \xi(1-h)f'\left(\dfrac{g}{k^2} - \dfrac{1+k}{k}g'_{w_H} \dfrac{\partial w_H}{\partial k} \right) + g'_{w_H} \dfrac{\partial w_H}{\partial k}(\xi w_S - Sr + S - w_H)}$$

To be greater than one in absolute value of the numerator of A must be greater than the denominator, i.e. the difference between its numerator and denominator must be positive. For convenience the whole expression is divided into three parts:

a)

$$\left(\frac{\partial w_P}{\partial t} - h\frac{\partial w_H}{\partial t} \right) - \left(\frac{\partial w_P}{\partial k} - h\frac{\partial w_H}{\partial k} \right) = \frac{ktR'(1-kt) + tR - hR'(1-kt)htR}{(1-kt)^2} =$$

$$= \frac{R(1-h)(k-t) - R'(1-kt)(kt-h)}{(1-kt)^2} > 0 \qquad \text{for all } k > t.$$

b) $\xi(1-h)f'\left(\dfrac{1+k}{k}\left(g'_{w_H}\dfrac{\partial w_H}{\partial t}+g'_t\right)+\dfrac{g}{k^2}-\dfrac{1+k}{k}g'_{w_H}\dfrac{\partial w_H}{\partial k}\right)=$

$$=\xi(1-h)f'\left(\dfrac{g}{k^2}+\dfrac{1+k}{k}\left(g'_{w_H}\left(\dfrac{\partial w_H}{\partial t}-\dfrac{\partial w_H}{\partial k}\right)+g'_t\right)\right)>0 \quad \text{if} \quad \dfrac{g}{k^2}$$

is reasonably small.

c) $\left(g'_{w_H}\dfrac{\partial w_H}{\partial t}-g'_{w_H}\dfrac{\partial w_H}{\partial k}+g'_t\right)(\xi w_S-Sr+S-w_H)>0 \quad$ since

both factors are negative.

Therefore, $\left|\dfrac{dk}{dt}\right|$ is proved to be greater than the unity on the whole

domain.

Q.E.D.

Proof of Proposition 2:

Applying the same logic, as in the previous proposition we have:

$$sign\left\langle\dfrac{dk}{dE}\right\rangle=sign\left\langle-\dfrac{\partial Q}{\partial E}\right\rangle$$

The derivative of Q w.r.t. E:

$$\dfrac{\partial Q}{\partial E}=\dfrac{\partial w_P}{\partial E}+\xi(1-h)f'\dfrac{1+k}{k}\left(g'_{w_H}\dfrac{\partial w_H}{\partial E}+g'_E\right)-h\dfrac{\partial w_H}{\partial E}$$

$$+\xi w_S\left(g'_{w_H}\dfrac{\partial w_H}{\partial E}+g'_E\right)-(w_H+Sr-S)\left(g'_{w_H}\dfrac{\partial w_H}{\partial E}+g'_E\right)$$

To determine the sign of the whole expression we consider again the signs of its parts:

$$w_H(k,t,E)=\dfrac{R(k,E)}{1-kt}$$

$$\left(\xi(1-h)f'\dfrac{1+k}{k}+(\xi w_S-w_H-Sr+S)\right)\left(g'_{w_H}\dfrac{\partial w_H}{\partial E}+g'_E\right)>0$$

as

both factors are negative.

We obtain $\dfrac{\partial Q}{\partial E}>0$, and $\dfrac{dk}{dE}<0$.

2.

$$\dfrac{\partial k}{\partial E}=-\dfrac{\partial Q/\partial E}{\partial Q/\partial k}=B=$$

$$=\dfrac{\dfrac{\partial w_P}{\partial E}-h\dfrac{\partial w_H}{\partial E}+\xi(1-h)f'\dfrac{1+k}{k}\left(g'_{w_H}\dfrac{\partial w_H}{\partial E}+g'_E\right)+\left(g'_{w_H}\dfrac{\partial w_H}{\partial E}+g'_E\right)(\xi w_S-Sr+S-w_H)}{\dfrac{\partial w_P}{\partial k}-h\dfrac{\partial w_H}{\partial k}-\xi(1-h)f'\left(\dfrac{g}{k^2}-\dfrac{1+k}{k}g'_{w_H}\dfrac{\partial w_H}{\partial k}\right)+g'_{w_H}\dfrac{\partial w_H}{\partial k}(\xi w_S-Sr+S-w_H)}$$

By the same logic we compare the numerator and the denominator of the expression and for the sake of clearness we divide this difference into three parts:

a)

$$\left(\frac{\partial w_P}{\partial t}-h\frac{\partial w_H}{\partial t}\right)-\left(\frac{\partial w_P}{\partial k}-h\frac{\partial w_H}{\partial k}\right)=R'_E\frac{kt}{1-kt}-R'_E\frac{h}{1-kt}+\frac{hR'_k(1-kt)+tR}{(1-kt)^2}-\frac{ktR'_k(1-kt)+tR}{(1-kt)^2}=$$

$$=\frac{1}{(1-kt)^2}\left((1-kt)(R'_E-R'_k)+tR(h-1)\right)$$

The sign of the expression depends on the relative magnitude of the negative $tR(h-1)$ and the positive $(1-kt)(R'_E-R'_k)$.

b)

$$\xi(1-h)f'\frac{1+k}{k}\left(g'_{w_H}\frac{\partial w_H}{\partial E}+g'_E\right)+\xi(1-h)f'\left(\frac{g}{k^2}-\frac{1+k}{k}g'_{w_H}\frac{\partial w_H}{\partial k}\right)=$$

$$\xi(1-h)f'\left(\frac{1+k}{k}\left(g'_{w_H}\left(\frac{\partial w_H}{\partial E}-\frac{\partial w_H}{\partial k}\right)+g'_E\right)+\frac{g}{k^2}\right)>0 \quad\text{for rea-}$$

sonably small $\dfrac{g}{k^2}$.

c)

$$\left(g'_{w_H}\frac{\partial w_H}{\partial E}+g'_E\right)(\xi w_S-Sr+S-w_H)-g'_{w_H}\frac{\partial w_H}{\partial k}(\xi w_S-Sr+S-w_H)=$$

$$=\left(g'_{w_H}\left(\frac{\partial w_H}{\partial E}-\frac{\partial w_H}{\partial k}\right)+g'_E\right)(\xi w_S-Sr+S-w_H)>0 \quad\text{since both}$$

factors are negative.
   Q.E.D.

Proof of lemma 2:
   1) By assumption kt is always smaller than 1, the employment premium in the H-sector is strictly positive and the wage in the H-sector is $1/kt$ times higher than the public sector wage.

   Partial derivatives with respect to k and t yield:
   $$\frac{\partial w_H}{\partial k}=\frac{R_k'(k,E)[1-kt]+tR(k,E)}{(1-kt)^2}$$
   $$\frac{\partial w_P}{\partial k}=\frac{ktR_k'(k,E)[1-kt]+tR(k,E)}{(1-kt)^2}$$

   If we assume $t=0,5$, then $k\in\left(0;\dfrac{1}{t}\right)$, and hence $k\in(0;2)$.

   Since $R'_k(k,E)<0$, $tR(k,E)>0$, we see that the sign depends on the comparative magnitudes of the first and the second terms in the numerator.
   For the derivatives to be positive the following expression must hold:

   $$\frac{1}{1-kt}>\frac{kt}{1-kt}>\vartheta ,$$

   where ϑ is the elasticity of employment premium w.r.t. ratio k.

For $t=0.5$ and $k \in (0;2)$, then $\lim_{k \to 0} \dfrac{1}{\dfrac{1}{kt} - 1} = 0$ and

$\lim_{k \to 2} \dfrac{1}{\dfrac{1}{kt} - 1} = +\infty$

$\lim_{k \to 0} \dfrac{1}{1-kt} = 1$ and $\lim_{k \to 2} \dfrac{1}{1-kt} = +\infty$

Since $\vartheta \in (0;1)$ we have $\dfrac{1}{1-kt} > \vartheta$ and $\dfrac{\partial w_P}{\partial k} > 0$ is always satisfied.

Since $\dfrac{kt}{1-kt} \in (0;+\infty)$ and $\vartheta \in (0;1)$ we do not know the sign of

$\dfrac{\partial w_H}{\partial k}$ in general, and there may be two cases:

$\dfrac{\partial w_P}{\partial k} > 0 > \dfrac{\partial w_H}{\partial k}$ and $\dfrac{\partial w_P}{\partial k} > \dfrac{\partial w_H}{\partial k} > 0$

Nevertheless, we can check the sign for the chosen function of the form $R = Ee^{-\lambda k}$ satisfying the model's assumptions. Here $\vartheta = \lambda k$ and $\lambda \in \left(0; \dfrac{1}{2}\right)$.

Here we have $tEe^{-\lambda k} > (1 - kt)E\lambda e^{-\lambda k}$;

$\lambda < \dfrac{t}{1-kt} \Rightarrow \lambda < 0,5$ (holds for the minimum value of k).

Therefore, for this form of function both wages grow with the higher k.

2) By taking the partial derivatives of the wage and the expected income with respect to the employment ratio k we find that

$\dfrac{\partial w_S}{\partial k} = f'\left[\dfrac{g}{k^2} - \dfrac{1+k}{k} g'_{w_H} \dfrac{\partial w_H}{\partial k} \right] < 0$

$\dfrac{\partial V_S}{\partial k} = -\xi w_S g'_{w_H} \dfrac{\partial w_H}{\partial k} + \xi(1-h)\dfrac{\partial w_S}{\partial k} + g'_{w_H} \dfrac{\partial w_H}{\partial k}(w_H + Sr - S) + h\dfrac{\partial w_H}{\partial k}$

$= \xi(1-h)\dfrac{\partial w_S}{\partial k} + \dfrac{\partial w_H}{\partial k}\left(g'_{w_H}\left(-\xi w_S + w_H + Sr - S\right) + h \right)$

Using the model assumptions it remains to show under what conditions we can get $g'_{w_H}\left(-\xi w_S + w_H + Sr - S\right) + h \le 0$ to assure a negative sign of $\dfrac{\partial V_S}{\partial k}$.

Substituting for $h=L_H=g$:

$$\left|g'_{w_H}\right|\left(-\xi w_S + w_H + Sr - S\right) \le L_H$$

The first term of the expression may be presented as the change in probability of transition from S- to H-employment: $g'_{w_H} = \dfrac{dL_H}{dw_H} \equiv \dfrac{dh}{dw_H}$,

and the second term is a gain from such a transition.

Therefore the condition may be reorganised as:

$$\left|\frac{dh}{dw_H}\right|\frac{w_H}{L_H}\left(-\xi w_S + w_H + Sr - S\right) \le w_H$$

or $\left|g'_{w_H}\right|\left(V_H - \hat{V}_S\right) \le L_H$

where $V_H = w_H + Sr$ and $\hat{V}_S = \xi w_S + S$.

Let $g'_{w_H} = g'_{V_H}$ and using that fact that the wage differential is lower than the wage w_H itself we have this condition is equivalent to

$$\varsigma \ge 1 + \left|g'_{w_H}\right|\frac{\hat{w}_S}{L_H}$$

Q.E.D.

Summary[57]

The report discusses the main peculiarities of the Russian labour market, such as the relatively low unemployment, the prevailing shadow labour relationships and the overmanning in the public sector. The three-sectoral model of the Russian labour market was developed in order to describe a developed urban economy with a closed regional labour market with various employment opportunities for a worker. A solution to the model provides us with the opportunity to make some predictions concerning labour market behaviour in the changing environment; in particular, how basic characteristics of the market respond to different policies that can be implemented by the government. The impact on the labour market of various reforms implemented by the Russian government is examined, with special stress on the consequences of the pension reform.

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