Estimation of Effect of Taxation on Real Sector Investment in Russia: Calculation of Marginal Effective Tax Rates[1)]

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In this paper we present the theoretical framework, which can be used to examine the potential impact of the taxation system on the accumulation of physical capital in Russia. The modified version of M. King and D. Fullerton microeconomic simulation model of marginal effective tax rates (METRs) is applied to Russia in order to examine incentives provided by three different Russian tax legislations to save and invest in the private non-financial corporate sector. Changes in treatment of interest payment deductibility, in the rates and methods of depreciation of assets, in personal income taxation, as well as some other details of taxation were taken into account. METRs computed for investment projects financed by domestic households through bank loans under the old Tax Laws are not that different from the new Tax Code. They may be considered average by international standards. Under the new Tax Code, we observe a drastic reduction of the effective tax burden on the corporate level and a substantial increase of the tax load on interest income on the personal level. Results may be different when investment projects are financed out of retained earnings or through new share issues.

1. The Role of Tax Reform in the Economic Transition Process in Russia

The reform of tax policy in Russia is crucial to the success of economic transformation efforts in the country. A modernized tax regime is necessary to help the country to develop and maintain the revenue-raising capacity to meet pubic service provision needs, contribute to the realization of macroeconomic stabilization objectives and attain social equity objectives. At the same time a modernized tax system should minimally distort relative prices and economic decision-making, and hence encourage an efficient allocation of scarce resources among competitive uses.

For about a decade Russian tax legislation was based on the Law on the Principles of Tax System (adopted in December 1991), which was a big step forward compared to the previous tax system. It specified a list of federal, regional and local taxes. A set of laws on specific taxes (on Profit Tax, on Value Added Tax, etc.) came

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into force starting in 1992. The tax system was structured to some extent similarly to that of developed countries. But that tax system had many drawbacks which have become obvious with time: multiplicity of taxes, use of distortive taxes, widespread exemptions and allowances, special accounting provisions, differentiated rate structures for the major taxes, loopholes in legislation, high cost of compliance, problems with assignment of taxes to different levels of government, timing of tax payments, relations of taxpayers with tax authorities, penalties, sanctions, etc.

During the years of transition, numerous amendments to these laws were made and the system became increasingly complicated and inefficient. Local and foreign businesses complained about high, unpredictable and arbitrary tax burdens in Russia, individual tax privileges that undermined competition, and the high cost of compliance with Russian tax laws.

People in the business sector claimed that the tax regime before year 2001 was extremely unfavorable for real sector investment. According to them, the cost of tax compliance was so high that in combination with other unfavorable factors it almost completely discouraged investment in the domestic real sector. Domestic savings were going abroad, were invested in the financial sector and short-term trade projects, but avoided domestic manufacturing and agriculture. In many cases, even replacement investment was a problem for enterprises. Over several years, these problems led to the degradation of entire industries in the Russian economy and to the decline of GDP.

A new Tax Code was proposed as a solution to these problems and as a tool for comprehensive tax reform. The proclaimed key objectives of a tax reform in Russia are adequate revenue-raising capacity, economic neutrality, social equity and administrative simplicity. These objectives were the same as those for a tax system in any decentralized economy. The main goals of tax reform in Russia are: to make the tax system more equitable for taxpayers; in particular, to reduce the substantial use of legal loopholes and illegal methods of tax evasion; to make the tax system more neutral for economic decisions of firms and consumers; and, to reduce the administrative cost of tax compliance both for the state and for taxpayers.

Proponents of the Tax Code claim that it will significantly reduce distortions in the definition of taxable income, disparities in tax rates and deductions across sectors and, therefore, will make the Russian tax system more conducive to local and foreign business investment. Many provisions of the Tax Code affect investment decisions of firms. The main issue we would like to address in this paper is how can we assess the impact of taxation on investment behavior of Russian firms?

2. Rationale for Calculation of Marginal Effective Tax Rates

Studies of impact of tax policy on business (mainly corporate) investment have been prominent in public finance and macroeconomic research[2)]. This is still a relatively new issue for economists in Eastern European countries. It is noticed in many papers (see for example [1], [2], [3], [6], [7], [16], [17]), that *provisions of the tax code* influence firms' accumulation of capital. Taxes on profits, on the wealth of

[2)] See, for example, papers by A. Auerbach, B. Bosworth, J. Cummins, K. Hassett and R. Hubbard, A. Harberger, M. Feldstein, S. Fazzari, M. King, and D. Fullerton, J. Mintz, L. Summers.

corporations or on the value of assets, provisions of deductibility of business expenses, and other details of tax laws affect the after-tax returns on capital.

D. Jorgensen [12] identifies two approaches for assessing the impact of taxation on investment. The first approach is the econometric modeling of the process that generates time series observations on saving and investment. A major problem with this approach is the complexity of the correct specification of tax variables, uncertainty, adjustment costs, and production lags in the model. Another problem is the very limited number of available observations. The data usually contains insufficient information to allow confidence in identifying the underlying process. Moreover, the relation between investment and taxation depends upon financial policy and on the pattern of ownership.

The second approach is to compute *Marginal Effective Tax Rates (METRs)* via direct calculation of the *tax-wedge* between the pre-tax rate of return on investment and the after-tax rate of return on savings used to finance the investment for a series of hypothetical marginal projects. Such estimates are not substitutes for econometric analysis of investment behavior, rather they provide a description of the actual incentives offered by the tax system. The Marginal Effective Tax Rates estimates summarize a very complicated set of tax laws in a compact and illustrative way. In the modern public finance literature the main approach to assess the impact of taxation on the investment activity of enterprises is the calculation of Marginal Effective Tax Rates (METRs)[3]. Comparisons of incentives to invest offered by the different tax systems are based on matrices of METRs that are calculated for the different tax regimes. For one tax system, the matrix indicates METRs for different combinations of assets, industries, types of financing, and other relevant features of new marginal investment projects. In the 1980s and 1990s, the METR methodology was applied to many OECD countries as well as to several developing countries. The results obtained provided policymakers with useful information about the effects of tax laws on real investment.

The main idea of the model is the following: in the absence of taxes, when the saver puts up money to finance a marginal investment project he earns a rate of return equal to that earned on the project itself. With distortionary taxes, the two rates of return can differ. The size of the tax wedge depends upon the system of corporate taxation, the interaction of these taxes with inflation, the tax treatment of depreciation and inventories, the personal tax code, the treatment of different legal forms of income (capital gains versus dividends, for example), the existence of wealth taxes (tax on fixed assets of enterprise), and a number of other details. It is clear therefore that the METR on an investment project depends upon the industry where it is located, the particular asset purchased, the way the investment is financed, and the identity of the investor who supplies the finance. Calculation and discussion of estimates of the Marginal Effective Tax Rates (METRs) for different combinations of these factors show relative incentives to invest in those particular combinations given by the tax system.

The METR approach also has some limitations, especially when financial markets are imperfect or information is asymmetric. This has been recognized in the

[3] See for example: K.J. McKenzie, M. Mansour, A. Brule, [15], and [9], [13], [14].

literature[4]. One way to deal with the limitations of the METR approach in the face of imperfect capital markets is to compute *Average Effective Tax Rates (AETRs)*, understood as a ratio of all tax liabilities of the firm to its before-tax profits. However, we share the view stated in King- Fullerton study about a major limitation of the AETR approach: it does not specifically show incentives or disincentives for new investment, because the tax burden measures the observed tax liability on realized capital income (on «old capital» income). It does not measure the incentive for additional investment (addition of «new capital»), which is a function of the marginal tax rate. Also it ignores the interaction between personal and corporate taxation. This can be very important as in the case of interest payments that are deductible at the corporate level and are taxed in the personal sector upon receipt. The incentives to invest depend upon the combined weight of personal and corporate taxes.

We believe that for investments for which retained earnings are the only possible source of financing, calculation of METRs and AETRs both provide useful information. The amount of retained earnings does depend on the tax burden on the enterprise, and that can be measured by the AETR. The AETR captures all taxes, direct and indirect, levied on the business entity, but does not capture the burden on the external saver. Nevertheless, the decision on whether to finance investment or not, given that the only available type of financing is retained earnings, depends on the METRs. So, the AETR and the METR answer different questions: AETR gives information on the availability of internal potential investment resources, left after all taxes are paid by enterprise (and this is especially important when retained earnings are the main source to finance investment), while the METR contains information important for decisions on new investment, namely, how the tax system on corporate and personal levels distorts the final outcome of investment activity.

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[4] These authors investigated the case of firms that do face imperfect markets for external finance. They came to conclusion that if the cost of internal finance differs substantially from external finance for some firms, their investment depends on available cash flow. For these firms, the amount of earnings devoted to taxes - and therefore the *average tax rate* on returns from existing projects - matters for investment, possibly along with incentive effects of *marginal tax rates*. For example, S. Fazzari, G. Hubbard, and B. Peterson [8] argue that under the METRs approach researchers assume that financial markets are perfect, and if a firm is willing to pay the cost of capital, the financial markets will make the funds available. In other words, availability of finance does not limit investment, and thus firms choose the mix of finance among internal funds, debt, and new equity independently. But empirical evidence supports the existence of financing constraints. Manufacturing corporations rely heavily on internal finance, particularly small corporations that are most likely to face financing constraints and asymmetric information problems. In addition, the average retention ratio of small corporations is very high and many of them pay no dividends at all for long periods of time. Many profitable small corporations exhaust internal finance, but do not borrow through long-term debt or new equity issue. This result is important for the case of many Russian business firms, which operate in environment with underdeveloped capital and financial markets with high real interest rates on bank loans and asymmetric information.

3. The Theoretical Framework for Calculation of Marginal Effective Tax Rates on Investment

Our goal is to examine the incentives to save and invest in the private non-financial corporate sector offered by the tax system in Russia. We follow the theoretical approach developed by the team of economists led by M. King and D. Fullerton [14], which consists in direct calculation of Marginal Effective Tax Rates for a series of hypothetical marginal investment[5)] projects. We use parameters of alternative tax regimes in Russia. The focus of the model is on the flow of profits that result from a particular type of investment back to households. The model allows us to compute the share of pre-tax rate of return which, according to tax laws of the country, will be withdrawn as taxes on two levels of taxation– corporate income and personal income taxation. METRs can be viewed as a total tax burden on a marginal investment imposed by taxation on both the corporate and personal levels. In the model, only domestic savings and investment are considered.

The size of the tax «wedge» depends upon a number of factors: the system of corporate taxation, provisions of the personal tax code, the interaction of these taxes with inflation, the tax treatment of depreciation and inventories, the treatment of different legal forms of income (capital gains vs. dividends, for example), the existence of wealth taxes, a number of further details. The METR on an investment project depends upon: the industry where it is located, the particular asset purchased, the way the investment is financed, the identity of the investor who supplies the finance (households, pension funds, insurance companies, etc.).

Tax Wedge[6)]. Let p denote the pretax real rate of return on a marginal investment project, net of depreciation. It is the return the society earns on a particular investment of one extra monetary unit. It is supposed that the project is financed by a household or institution, which will be referred to as the «saver». The saver earns a post tax rate of return s. The tax wedge, w, is the difference between the pretax real rate of return on the marginal investment, net of depreciation, p, and the post-tax rate of return on the savings used to finance the investment, s, so that $w = p - s$. Finally, the marginal effective tax rate , METR, is the tax wedge divided by the pre-tax rate of return, $METR = (p - s)/p$.

The Cost and the Value of the Project. We consider hypothetical projects that all earn the same pre-tax real rate of return p. Provisions of tax laws, such as profit and wealth tax rates, method and rates of assets' depreciation, all kinds of tax grants and some other details of tax regulation affect the relationship between the pre-tax real rate of return p and after-tax real return to the saver, s.

In order to compute the tax wedge and the METR for the investment project we will first calculate the firm's subjective discount rate ρ at which the company

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[5)] Marginal investment is understood as a small increase in the level of real investment in the domestic non-financial corporate sector, financed by an increase in the savings of domestic households.

[6)] In description of the King-Fullerton model we follow very closely the original source without direct quotation. Notation used also practically coincides with the notation of the King-Fullerton study.

discounts cash flows. This discount rate ρ is the net of tax interest rate the firm could afford to pay on the finance obtained to purchase the asset. Given the real rate of return on a marginal project, p, the firm's subjective discount rate ρ is the rate that equates the present discounted value of after-tax profits (V) with the present discounted value of the cost of project (C):

$$V = C \tag{1}$$

The value of discount rate ρ depends on economic as well as tax legislation parameters. The present value of the cost of the project, C, is unity, the initial payment for the asset, minus the present discounted value of any grants or tax allowances given for the asset, or $C = 1 - A$, where A is the present value of grants and tax allowances given to the project. The present discounted value of the project, V, is the present discounted value of the after-tax profits to the firm.

The relation between the market nominal interest rate, i, and the post-tax return to the saver, s, depends on the tax treatment of personal income[7]. Let m be the marginal personal tax rate on interest income and let w_p be the marginal personal wealth tax rate, then the relationship between the real interest rate and the post-tax real rate of return to the saver is given by[8]:

$$s = (1 - m)i - \pi - w_p \tag{2}$$

The firm's discount rate ρ is connected with the market interest rate. In the debt finance case when nominal interest payments are tax deductible, the rate at which firms discount after-tax cash flows is the net of tax interest rate. So, for the debt finance case with 100% interest payments deductibility $\rho = (1 - \tau)i$. Given a value for p and given a type of investment project, we will calculate a METR. First we find the relationship between p and the firm's discount rate ρ from equations which will be derived explicitly below, but which in essence equate V to C. Then, using equation (2) we find the relationship between i and the post-tax return to saving, s. Given p and s we calculate the METR.

We will calculate METRs for a series of hypothetical investment projects. These projects correspond to different combinations and we will choose the following combinations for Russia: 1) assets (buildings, machinery, computers); 2) industries (manufacturing, construction, commerce); 3) savers (households), 4) type of finance (debt financing in the form of bank loans). Comparing the METRs corresponding to a common value for p, provides a picture of the incentives offered by the tax system for particular kinds of investment projects. *Expectations are that the effect of these varying METRs would be to stimulate investment in low-taxed projects relative to*

[7] There are several types of individual and institutional savers in Russia. Individual savers provide their saving to finance real sector projects via bank deposits, direct purchase of corporate shares, corporate bonds and purchase of a variety of financial instruments.

[8] At high (two digit) rates of inflation instead of a simplified formula $i \cong r + \pi$ we should use $1 + r = \frac{1 + i}{1 + \pi}$.

more highly taxed investments. The following assumptions are maintained throughout the analysis: 1) statutory tax rates are constant over time; 2) perfect certainty; 3) inflation is uniform over time.

Let MRR denote the gross marginal real rate of return to an increment of the capital stock of one unit cost. It will be assumed that capital depreciates at a constant exponential rate δ. Then $p = \text{MRR} - \delta$ is the net of depreciation rate of return on the investment.

The assumption of exponential depreciation is consistent with what is known from empirical research about true economic depreciation[9]. The tax depreciation allowances based on statutory depreciation rates, established by tax authorities may be very different from the amount of true economic depreciation. Let τ be the statutory corporate profit tax rate, π be the rate of inflation, then V, the present discounted value of the project is[10]:

$$V = \int_0^{\infty} (1-\tau) MR\, Re^{-(\rho+\delta-\pi)u}\, du = \frac{(1-\tau)}{\rho+\delta-\pi} MRR. \tag{3}$$

Present value of the cost of project is $C = 1 - A$, where A is the present discounted value of grants and tax allowances for the asset under consideration. A in general case can include the following components[11]: 1) standard depreciation allowances A_d; 2) immediate expensing; 3) cash grants (equivalent to tax credits). Given (3) and (4), equation (1) can be re-written as

$$p = \frac{(1-A)}{(1-\tau)}(\rho+\delta-\pi) - \delta. \tag{4}$$

We can solve this equation for ρ in terms of p.

The present value of standard tax depreciation allowances, *PVTDA,* or A_d in our notation, will depend on the pattern allowed for tax depreciation (straight line; declining balance; and other schemes). The $PVTDA$ can be expressed in terms of parameters of the tax legislation and firm's discount rate. In case of straight-line depreciation tax depreciation allowances during the lifetime of fixed asset (L years), *PVTDA* is[12]:

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[9] See the Wykoff-Hulten study [11] for empirical findings on economic depreciation and for a table of δ for different assets.

[10] We will be interested in projects of finite present value so that we assume that $\rho + \delta - \pi$ is greater than zero.

[11] In the case of Russia studied in this paper A will consist only of standard depreciation allowances, A_d.

[12] If tax laws prescribe the exponential write-off of the value of asset at a rate a, then the *PVTDA* equals $A_d = \int_0^{\infty} \tau a e^{-(a+\rho)u} du = \frac{\tau a}{a+\rho}$.

$$(5) \qquad PVTDA^{13)} = A_d = \int_0^L \tau\left(\frac{1}{L}\right) e^{-\rho u} du = \frac{\tau(1-\tau e^{-\rho L})}{\rho L}.$$

Besides the corporate income tax, the wealth tax on corporations (tax on fixed assets) affects the value of the project. Marginal investment leads to one unit increase in the wealth of corporation. Let w_c be the rate of corporate wealth tax, then if the wealth tax is not deductible for corporation tax purposes, the net of tax return to the company is reduced to $(1-\tau)MRR - w_c$. When the wealth tax is deductible against the corporate profit tax base, the post-tax return is $(1-\tau)(MRR - w_c)$ and

$$(6) \qquad V = \int_0^\infty \left[(1-\tau)MRR - (1-d_1\tau)w_c\right] e^{-(\rho+\delta-\pi)u} du = \frac{\left[(1-\tau)MRR - (1-d_1\tau)w_c\right]}{\rho+\delta-\pi},$$

where $d_1 = 1$ if corporate wealth taxes are deductible against the corporate tax base, and $d_1 = 0$ otherwise.

Economic Depreciation Rate. In the model we distinguish between the statutory depreciation rate that affects the amount of tax depreciation allowances on the one hand and the true economic depreciation of assets on the other. Statutory depreciation rates are set in the tax regulations. True economic depreciation of assets can be defined as the decline in asset price due to aging. The rate of economic deprecation is the percentage decline in asset prices between two points in time. Charles R. Hulten and Frank C. Wykoff investigated the fundamental question: «Can actual depreciation be measured with sufficient precision to be used in the formulation of tax policy?» [11, p. 82]. In their judgment, depreciation can be measured. They estimated depreciation using the approach they call «used market price approach». It relies on the market data from used asset markets. The Bureau of Economic Analysis of the USA also performed numerous capital market studies and obtained estimates. Hulten and Wykoff founded that the two approaches produce similar results. Hulten and Wykoff in their study have found that the age-pricing profiles for assets ranging from buildings to machine tools and construction equipment have approximately a geometric form and they estimated economic depreciation rates for many types of fixed assets.

Firm's Internal Discount Rate. The next step in the model is to relate the firm's discount rate, ρ, to the market interest rate. With perfect certainty and no taxes, the two would be equal. In a world of distortionary taxes, however, the discount rate will differ from the market interest rate and in general will depend upon the source of finance. There are three main types of financing: debt financing, financing through retained earnings, and financing through new share issues. In this paper we will discuss only debt financing.

Under debt financing, if nominal interest payments are tax deductible, the rate at which firms will discount after-tax cash flows is the net of tax interest rate:

$$\rho = i\,(1-\tau).$$

Computing METRs. The equation which enables us to calculate ρ, the firm's discount rate, and finally the METRs for each combination is the following:

[13)] This formula for the continuous time works well for the discrete time case too.

$$(7)\qquad 1-\int_0^L \tau\left(\frac{1}{L}\right)e^{-\rho u}\,du=\int_0^L (1-\tau)MR\,\mathrm{Re}^{-(\delta+\rho-\pi)u}\,du-\int_0^L (1-\tau)w_c e^{-(a+\rho)u}\,du\,,\qquad \text{or}$$

$$(8)\qquad 1-\frac{\tau(1-e^{-\rho L})}{\rho L}=(1-\tau)\frac{MRR}{\delta+\rho-\pi}-(1-\tau)\frac{w_c}{a+\rho}\cdot$$

In equation (7) expression $\int_0^L (1-\tau)w_c e^{-(a+\rho)u}\,du$ is the present value of the tax on wealth of corporations, and *a* is the exponential rate of write-off of the value of assets on which the wealth tax is levied. This is the «continuous» version of the equation for the case for which assets are not revalued with inflation and when the wealth tax is deductible from the profit tax base[14)].

Tax legislations in some countries with high inflation allow revaluation of assets at the rate of inflation. If revaluation of assets is allowed by legislation and if revaluation is done at the rate of inflation, then in case of a constant rate of inflation, the «continuous» version of formula (8) to calculate ρ becomes[15)]:

$$(9)\qquad 1-\int_0^L \tau\left(\frac{1}{L}\right)e^{-(\rho-\pi)u}\,du=\int_0^L (1-\tau)MR\,Re^{-(\delta+\rho-\pi)u}\,du-\int_0^L (1-\tau)w_c e^{-(a+\rho-\pi)u}\,du.$$

In the fixed-p case, given a value for *p*, we solve (7) or (9) for the discount rate *ρ*. Then, given a discount rate ρ, we solve for the market interest rate. After that we solve for the post-tax real rate of return to savers, *s*. Finally the METR is calculated as *(p–s)/p*. The functional relationship between *p* and *s* is, in general, non-linear. The values of the tax wedge and the METR thus depend upon the values of *p* at which they are evaluated[16)].

It is clear from the equations above that the METR depends upon the particular asset in which an investment is made, and upon the industry, source of finance, and category of owner. The complex tax system that countries levy on corporate and personal incomes mean not only that the METR differs from the statutory of either an income tax or a corporate tax, but also that effective tax rates vary from one combination to another.

[14)] If depreciation has exponential type, then equation (7) transforms into:

$$1-\int_0^\infty \tau a e^{-(a+\rho)\,u}\,du=\int_0^\infty (1-\tau)MR\,Re^{-(\delta+\rho-\pi)u}\,du-\int_0^\infty (1-\tau)w_c e^{-(a+\rho)u}\,du\,.$$

[15)] In the case of exponential type of depreciation with revaluation of assets equation (9) becomes: $1-\int_0^\infty \tau a e^{-(a+\rho-\pi)u}\,du=\int_0^\infty (1-\tau)MR\,Re^{-(\delta+\rho-\pi)u}\,du-\int_0^\infty (1-\tau)w_c e^{-(a+\rho-\pi)u}\,du\,.$

[16)] The King-Fullerton study for 4 countries [14] was done for a value of 10% per annum for *p*.

4. Modification of the model for the case of Russia

Modifications of the King-Fullerton model for Russia are needed in order to take into consideration specifics of the old Tax Laws (TL), of the Draft Tax Code (DTC), and the new Tax Code (TC). In this section we derive explicitly formulas for the present values of tax depreciation allowances, of the wealth tax and formulas from which we will later compute the subjective discount rate of the firm. We will take into consideration all relevant details of the tax legislation.

1. The old Tax Law:

Tax Depreciation Allowances. The old Tax Law provisions regarding the depreciation rates were set in the Decree *No. 1072*, issued by the Council of Ministers of the USSR on October 22, 1990. The method of depreciation was the straight-line depreciation. Profit tax was assessed on a monthly basis and depreciation was calculated monthly as well. In the case without revaluation of assets at the inflation rate the present value of tax depreciation allowances, *PVTDA*, is:

$$PVTDA = \tau d_m \sum_{i=1}^{n} \frac{1}{(1+\rho_m)^i} = \tau d_m \frac{(1+\rho_m)^n - 1}{(1+\rho_m)^n \rho_m} \quad (10)$$

where d_m is the monthly depreciation rate, or 1/12 of the annual rate d; n is the «tax life» of asset in months, $n = 1/d_m$; ρ_m is the monthly firm's discount rate, which is related to the annual rate in the following manner $(1+\rho_m)^{12} = (1+\rho)$.

If firm chooses to reevaluate assets at the rate of inflation we assume that firm uses the standard approach, applying inflation indexes reported by State Committee on Statistics, GosKomStat.

With revaluation of assets *PVTDA* is:

$$PVTDA = \tau d_m \sum_{i=1}^{n} \left(\frac{1+\pi_m}{1+\rho_m} \right)^i = \tau d_m \frac{(1+\pi_m)(1+\rho_m)^n - (1+\pi_m)^{n+1}}{(1+\rho_m)^n (\rho_m - \pi_m)}. \quad (11)$$

Estimation of depreciation rates for selected assets. According to the old Tax Law, all fixed assets were divided into 11 broad categories with several subgroups within each category. All assets were listed in a very detailed manner. For example, the biggest Category 4: Machinery and Equipment listed 1095 depreciation rates for 1095 specific types of machines and equipment. We propose to use median as the most representative statistics for the central tendency. The median seems to represent the central tendency better than the mean, because it is less affected by outliers[17)].

Wealth Tax (Tax on Assets of Enterprise). The wealth tax in Russia under the old Tax Law (Tax on Assets of Enterprise) was applied to all fixed assets. Rates might differ from region to region, but should not exceed 2%. The tax rate was ap-

[17)] But the «median method» may not work automatically. This method sometimes should be combined with the «expert opinion» method. For example, the group «Buildings» under the Tax Law included several old fashion types of buildings, which are no longer constructed. It makes sense to exclude these types of assets from consideration.

plied to the current «balance» value of the asset, which equaled the original (historic) cost net of accrued depreciation, or the «residual» value of the asset. The wealth tax was assessed every quarter. It was allowed to reevaluate assets with inflation. Wealth tax payments was deductible from the profit tax base.

Wealth Tax without revaluation of assets under the old Tax Law:

$$(12)\quad PVW = \frac{w}{4}\left[\frac{(1-d_q)}{(1+\rho_q)} + \frac{(1-2d_q)}{(1+\rho_q)^2} + \ldots + \frac{(1-ld_q)}{(1+\rho_q)^l}\right] = \frac{w}{4}\sum_{i=1}^{l}\frac{1-id_q}{(1+\rho_q)^i} = \frac{w}{4}\sum_{i=1}^{l}\frac{1}{q^i} - \frac{w}{4}\sum_{i=1}^{l}\frac{id_q}{q^i} =$$

$$= \frac{w(1-q^i)}{4(1-q)q^i} - \frac{w}{4}d_q\sum_{i=1}^{l}(-q)\frac{d}{dq}\frac{1}{q^i} = \frac{w}{4}\left[\frac{1-q^l}{(1-q)q^l} - d_q\frac{l(1-q)-(1-q^l)}{(1-q)^2q^l}\right],$$

where $q \equiv (1+\rho_q)$, w is the statutory wealth tax rate, ρ_q is the quarterly discount rate correspondent to the annual discount firm's rate ρ; d_q is the quarterly depreciation rate correspondent to the annual depreciation rate; l is the «tax life» of the asset measured in quarters of the year.

Wealth Tax with revaluation of assets under the old Tax Law:

$$(13)\quad PVW = \frac{w}{4}\sum_{i=1}^{l}\frac{(1-id_q)(1+\pi_q)^i}{(1+\rho_q)^i} = \frac{w}{4}\left[\frac{1-q^l}{(1-q)q^l} - d_q\frac{l(1-q)-(1-q^l)}{(1-q)^2q^l}\right],$$

where $q \equiv \dfrac{(1+\rho_q)}{(1+\pi_q)}$.

Under the previous Tax Law it was allowed to revaluate fixed assets at the rate of inflation. It was done during special campaigns in periods of high inflation.

Formulas for calculation of firm's internal discount rate:

The old Tax Law without revaluation of assets:

$$(14)\quad 1-\tau d_m\frac{(1+\rho_m)^n-1}{(1+\rho_m)^n\rho_m} = (1-\tau)\frac{p+\delta}{\rho+\delta-\pi} - (1-\tau)\frac{w}{4}\left[\frac{1-q^l}{(1-q)q^l} - d_q\frac{l(1-q)-(1-q^l)}{(1-q)^2q^l}\right],$$

where $q \equiv (1+\rho_q)$.

The old Tax Law with revaluation of assets:

$$(15)\quad 1-\tau d_m\frac{(1+\pi_m)(1+\rho_m)^n-(1+\pi_m)^{n+1}}{(1+\rho_m)^n(\rho_m-\pi_m)} =$$

$$= (1-\tau)\frac{p+\delta}{\rho+\delta-\pi} - (1-\tau)\frac{w}{4}\left[\frac{1-q^l}{(1-q)q^l} - d_q\frac{l(1-q)-(1-q^l)}{(1-q)^2q^l}\right],$$

where $q \equiv \dfrac{(1+\rho_q)}{(1+\pi_q)}$.

Interest payment deductions. The old Tax Law in Russia treated the interest payments on bank loans as business expenses deductible from the profit tax base,

but there were some restrictions[18)]: 1) Interest payments were deductible if the rate did not exceed CBR refinancing rate +3 percentage points on loans in domestic currency or 15% on hard currency loans. The portion above was not deductible; 2) Interest payments together with some other expenses, including, for example, real sector investments, financing of housing construction, were deductible in an amount not to exceed 50% of the tax base, so that not to reduce the profit tax liability by more than 50% (we will refer to this as «50% rule»).

Without interest payment deductibility, the interest rate paid to saver would be just ρ. With 100% deductibility, the firm pays to the saver interest rate i, where $i(1-\tau)=\rho$, or $i=\frac{\rho}{(1-\tau)}$. This is because the firm can deduct interest payments from profit tax base, and therefore, reduce its expenses and increase the return to savers.

In case of the old Tax Law, a «50% reduction» rule meant that there was a limit on interest payment deductibility, even if interest rate was considered «ordinary». We can interpret this in the following manner: nominal pre-tax rate of return on marginal investment to the firm (investor) is $(p+\pi)$. Nominal after corporate taxation rate of return investor pays to the saver if 100% of interest payments are deductible from the tax base is $i=\frac{\rho}{(1-\tau)}$. In the case with «50% reduction» rule the interest paid to the saver is *i* so that

$$(p+\pi-i)=\frac{1}{2}(p+\pi-\rho). \qquad (16)$$

The right-hand side of equation (16) is half of normalized profit tax liability on marginal investment when interest payment is not deducted at all, or in other words the minimum tax liability allowed by Tax Authorities in this case. The left-hand side of the equation includes the pre-corporate tax nominal return to investor $(p+\pi)$, minus the interest paid to the saver (i). The interest rate paid to savers in case of restricted interest deductibility is therefore $i=\frac{1}{2}(p+\pi+\rho)$.

So, after calculation of ρ, we check whether interest payment deductions exhaust the allowed limit, and if they do, we limit the deduction. We first calculate the profit tax liability with the assumption of 0% deductibility, equal to$(p+\pi-\rho)$. Then we calculate the profit tax liability with 100% interest payments deductibility, equal to $\left(p+\pi-\frac{\rho}{1-\tau}\right)$. If the latter is smaller than half of the former, we assume that the actual tax liability is $\frac{1}{2}(p+\pi-\rho)$ and saver gets $i=\frac{1}{2}(p+\pi+\rho)$, which is later taxed at the personal level. If the latter is greater than half of the former, then it means that interest deductions did not exhaust the 50% limit and the interest paid

[18)] Instruction of the Ministry on Taxes and Levies N 62 on 06.15.2000 (Profit Tax) Article 4.1.1 and 4.4.

to savers is $i = \frac{\rho}{(1-\tau)}$. Further taxation of the interest income of the saver is done according to the personal income tax law.

2. The Draft Tax Code

The Draft Tax Code was considered by the Duma in May of 2001 (first reading). The new adopted version of the Tax Code differs from this draft. The important differences between the Draft and the enacted Tax Code are the following: methods of grouping of fixed assets and provision regarding revaluation of assets at the rate of inflation (revaluation is not envisioned so far in the Tax Code).

Calculation of Tax Depreciation Allowances: In the Draft Tax Code, all assets were grouped into 7 groups. A single monthly depreciation rate is assigned to each group and, therefore, just 7 numbers substitute for all previous multiple depreciation rates. In the Draft Tax Code the proposed method of depreciation is close to the exponential depreciation rate. The amount of monthly depreciation allowances is calculated as a product of the monthly depreciation rate times the residual value of the asset. The residual value of the asset is calculated each month based on the formula $S_n = S(1-k_i)^n$, where S is initial value of the asset, in case of marginal investment $S = 1$; S_n is the residual value after n months; k_i is the monthly depreciation rate for group i (i =1,2,...,7), expressed in real numbers. The amount of the depreciation allowances in month n for asset i, allowed for deduction from the profit tax base is $A_n = k_i S(1-k_i)^n$. For the Draft Tax Code the discrete version of the present value of tax depreciation allowances without revaluation of asset is:

$$PVTDA = \tau k_i \sum_{n=1}^{\infty} \left(\frac{1-k_i}{1+\rho_m} \right)^n = \tau k_i \frac{1-k_i}{\rho_m + k_i}. \tag{17}$$

In the Draft Tax Code the reevaluation of residual value of fixed assets at inflation rate is allowed. Since $\frac{(1-k_i)(1+\pi_m)}{(1+\rho_m)} < 1$, the discrete version of the present value of tax depreciation allowances with revaluation of asset will be:

$$PVTDA = \tau k_i \sum_{n=1}^{\infty} \left[\frac{(1-k_i)(1+\pi_m)}{(1+\rho_m)} \right]^n = \tau k_i \frac{(1-k_i)(1+\pi_m)}{(1+\rho_m)-(1-k_i)(1+\pi_m)}. \tag{18}$$

Wealth Tax in the Draft Tax Code: In the Draft Tax Code only buildings and structures were supposed to be taxed, and the rest of fixed assets - machinery, equipment, etc. were not taxed. Wealth tax payments were deductible from the profit tax base.

Present value of wealth tax without revaluation of assets under the Draft Tax Code:

$$PVW = w \sum_{n=1}^{\infty} \left(\frac{1-k_i}{1+\rho_m} \right)^n = w \frac{1-k_i}{\rho_m + k_i}. \tag{19}$$

Present value of wealth tax with revaluation of assets under the Draft Tax Code:

$$PVW = w\sum_{n=1}^{\infty}\left(\frac{(1-k_i)(1+\pi_m)}{1+\rho_m}\right)^n = w\frac{(1-k_i)(1+\pi_m)}{(1+\rho_m)-(1-k_i)(1+\pi_m)}. \quad (20)$$

Framework for calculation of firm's subjective discount rate ρ

The Draft Tax Code without revaluation of assets:

$$1-\tau k_i\frac{1-k_i}{\rho_m+k_i}_i = (1-\tau)\frac{p+\delta}{\rho+\delta-\pi}-(1-\tau)w\frac{1-k_i}{\rho_m+k_i}. \quad (21)$$

The Draft Tax Code with revaluation of assets:

$$1-\tau k_i\frac{(1-k_i)(1+\pi_m)}{(1+\rho_m)-(1-k_i)(1+\pi_m)} = (1-\tau)\frac{p+\delta}{\rho+\delta-\pi}-(1-\tau)w\frac{(1-k_i)(1+\pi_m)}{(1+\rho_m)-(1-k_i)(1+\pi_m)}. \quad (22)$$

Interest payment deductions: In the Draft Tax Code, interest payments on borrowed funds are considered as business expenses. If the interest rate on a ruble loan does not exceed the CBR refinancing rate plus 3% points, or 12% on a foreign currency loan, interest payments are 100% deductible from the profit tax base. The portion above this limit is not allowed for deduction.

3. The New Tax Code

The new Tax Code of the Russian Federation came into force in January 2002.

Calculation of tax depreciation allowances under the Tax Code: In the new Tax Code all fixed assets are divided into 10 groups[19]. As under the old Tax Law all assets are listed is a very detailed manner. For the groups 8–10 only straight line depreciation is allowed. Two alternative methods of depreciation are allowed for groups 1–7.

To the best of our knowledge, so far there is no provision which allows re-evaluating assets at the rate of inflation. For groups 1–7 the first method is traditional straight-line depreciation. The second method combines two different parts: the first part is close to exponential write-off of the balance value and the last 20% of the balance value under this method is written off according to the straight-line method. In this section we first derive explicitly formula for the second method (which we call «combined method»).

According to the Tax Code monthly depreciation is calculated as the rate of depreciation k times the residual value of the asset in respective month and $k=2/n$, where n is «useful lifetime» of the asset in months. Residual value in month l is $RV_l = IV - \sum_{i=1}^{l-1} DA_i$, where RV_l is the residual value by the end of month l, and IV is the initial value of the asset equal to 1 in marginal investment project, DA_i – depreciation allowances in month i and $DA_i = k \cdot RV_{i-1}$.

[19] Decree No.1 of the Government of the Russian Federation on 1.1.2002.

The non-linear scheme is applied up to the month g, when the residual value reduces to 20% of initial value of the asset. After that point the linear scheme of depreciation is applied: during the remaining months (n–g) the value writes-off per equal amounts. With marginal investment equal to 1, monthly depreciation in month m is equal to $DA_m = k\alpha^{m-1}$ and the residual value of asset by the end of month m can be computed as $RV_m = IV - \sum_{i=1}^{m-1} DA_i = RV_{m-1} - DA_m = \alpha^m$, where $\alpha \equiv 1-k$. We can calculate month g, when one should switch to the linear method of depreciation: $RV_g = \alpha^g = 0{,}2$, therefore $g = \frac{\ln 0{,}2}{\ln(1-k)}$.

The present value of tax depreciation allowances of the «non-linear» part of depreciation of asset during g months is:

$$(23) \quad PVTDA_1 = \frac{\tau k}{1+\rho_m}\left[1+\sum_{i=1}^{g-1}\left(\frac{\alpha}{1+\rho_m}\right)^i\right] = \frac{\tau k\left[(1+\rho_m)^g-(1-k)^g\right]}{(1+\rho_m)^g(\rho_m+k)}, \text{ where } k = 2/n.$$

The present value of the remaining part of tax depreciation allowances, calculated on linear basis is:

$$(24) \quad PVTDA_2 = \tau\frac{\alpha^{g+1}}{(n-g)}\sum_{i=g+1}^{n}\frac{1}{(1+\rho_m)^i} = \tau\frac{(1-k)^{g+1}\left[(1+\rho_m)^{n-g}-1\right]}{(n-g)\rho_m(1+\rho_m)^n}.$$

Therefore, the present value of tax depreciation allowances during the entire «useful lifetime» of asset is:

$$(25) \quad PVTDA_{comb} = \frac{\tau k\left[(1+\rho_m)^g-(1-k)^g\right]}{(1+\rho_m)^g(\rho_m+k)} + \frac{\tau(1-k)^{g+1}\left[(1+\rho_m)^{n-g}-1\right]}{(n-g)\rho_m(1+\rho_m)^n}.$$

For linear method of depreciation (groups 8–10, and possibly for groups 1–7) the present value of depreciation allowances is:

$$(26) \quad PVTDA = \frac{\tau}{n}\sum_{i=1}^{n}\frac{1}{(1+\rho_m)^i} = \frac{\tau\left[(1+\rho_m)^n-1\right]}{n(1+\rho_m)^n\rho_m}.$$

The wealth tax under the new Tax Code. We will derive an explicit formula for the present value of the wealth tax for the case of non-linear method of depreciation. In general the present value of the wealth tax during the life time of the asset can be presented as: $PVW = \frac{w}{4}\sum_{i=1}^{a+b}\frac{RV_i}{(1+\rho_q)^i}$, where ($a$+$b$) is the number of quarters in the «lifetime» of asset, i.e. $a+b = \frac{n}{4}$. If firm chooses the non-linear method of depreciation, then there will be two parts in the PVW: first, which cor-

responds to the non-linear write-off of the value of asset during the first a quarters, $a = \frac{g}{4}$; and the second which corresponds to the linear write-off of the remaining 20% of the initial value of the asset during the last b quarters, $b = \frac{n-g}{4}$. The first part of the *PVW* is:

$$(27) \quad PVW_1 = \frac{w}{4}\sum_{i=1}^{a}\frac{\alpha^{4i}}{(1+\rho_q)^i} = \frac{w\beta(1-\beta^a)}{4(1-\beta)}, \text{ where } \beta \equiv \frac{\alpha^4}{(1+\rho_q)}.$$

Derivation of the second part of the *PVW* is tedious, but is not difficult:

$$(28) \quad PVW_2 = \frac{w}{4}\sum_{i=1}^{b-1}\frac{RV_{a+i}}{(1+\rho_q)^{a+i}} = \frac{w\alpha^g}{4(1+\rho_q)^a}\left[\sum_{i=1}^{b-1}\frac{1}{(1+\rho_q)^i} - \frac{1}{b}\sum_{i=1}^{b-1}\frac{i}{(1+\rho_q)^i}\right] =$$

$$= \frac{w\alpha^g}{4(1+\rho_q)^a}\left[\frac{(1-q^{b-1})}{(1-q)q^{b-1}} - \frac{\left[(b-1)(1-q)-(1-q^{b-1})\right]}{b(1-q)^2q^{b-1}}\right],$$

where $q = 1+\rho_q$. Therefore, the present value of the wealth tax for the entire lifetime of the project is:

$$(29) \quad PVW = \frac{w}{4}\frac{\beta(1-\beta^a)}{1-\beta} + \frac{w\alpha^g}{4(1+\rho_q)^a}\left[\frac{(1-q^{b-1})}{(1-q)q^{b-1}} - \frac{\left[(b-1)(1-q)-(1-q^{b-1})\right]}{b(1-q)^2q^{b-1}}\right].$$

Interest payment deductions. Under the Tax Code interest payments are100% deductible from the profit tax base if the interest rate on ruble loans does not exceed 1.1•CBR refinancing rate or 15% on foreign currency loans. The portion above is not deductible.

Framework for calculation of firm's subjective discount rate ρ under the Tax Code.

Case of the linear method of depreciation:

$$(30) \quad 1 - \frac{\tau\left[(1+\rho_m)^n - 1\right]}{n(1+\rho_m)^n\rho_m} = (1-\tau)\frac{p+\delta}{\rho+\delta-\pi} - (1-\tau)\frac{w}{4}\left[\frac{1-q^l}{(1-q)(1-q)q^l} - \frac{\left[l(1-q)-(1-q^l)\right]}{l(1-q)^2q^l}\right],$$

where n is the lifetime of asset in months, l is the number of quarters in the lifetime of the asset and $q = (1+\rho_q)$.

Case of non-linear method of depreciation:

$$(31)\qquad 1-\frac{\tau k\left[(1+\rho_m)^g-(1-k)^g\right]}{(1+\rho_m)^g(\rho_m+k)}-\frac{\tau(1-k)^{g+1}\left[(1+\rho_m)^{n-g}-1\right]}{(n-g)\rho_m(1+\rho_m)^n}=$$

$$=(1-\tau)\frac{p+\delta}{\rho+\delta-\pi}-\frac{w(1-\tau)\beta(1-\beta^a)}{4(1-\beta)}+\frac{w(1-\tau)\alpha^g}{4(1+\rho_q)^a}\left[\frac{(1-q^{b-1})}{(1-q)q^{b-1}}-\frac{\left[(b-1)(1-q)-(1-q^{b-1})\right]}{b(1-q)^2q^{b-1}}\right].$$

Economic depreciation rates for Russia. Estimation of true economic depreciation rates for Russia represents a difficult problem. To the best of our knowledge, there has been no any special study in Russia to estimate the form of decay and the rates of depreciation of real assets.

As a solution, we propose to rely on estimates of the Hulten and Wykoff study. The weak point here is that this study was performed in mid-70 for the USA economy. However, theoretically we do not see any reason why in Russia assets should not decay exponentially. We will use rates of true economic depreciation obtained in the Hulten/Wykoff study. It is clear that estimated rates of true economic depreciation and tax law statutory rates of depreciation do not necessarily coincide: we use estimates of true economic depreciation rates to assess the marginal pre-tax rate of return, which changes with physical decay of the asset, and we use statutory depreciation rates for calculation of depreciation allowances and the wealth tax liabilities.

Inflation and revaluation of assets. In this model, we assume that the marginal rate of return on the project, MRR, increases at a rate of inflation. The firms have two options: either to revalue their assets, or not. Revaluation was allowed under the old Tax Law and the Draft Tax Code. If they choose to revalue their assets, then it affects the amount of tax depreciation allowances and wealth tax liabilities. We assume that during the entire lifetime of the project the inflation rate is stable.

Inflation affects tax liabilities and the expected rate of inflation enters into both the determination of p in equation (1) and s in (2). To measure effects of inflation we propose to calculate effective tax rates for five different rates: 1) 0% rate provides a benchmark against which to judge other figures and it describes the impact the tax system would have if it were fully indexed; 2) 10% per annum is the rate of inflation for which the international study for 4 countries was conducted and which reflects a midpoint in the historical experience of selected countries in the decade of 1970−79; 3) 13% inflation rate is the official target for the Russian economy in year 2002; 4) 18% is the expected inflation rate in year 2002; 5) 25% is the inflation rate for the Russian economy in year 2000 (based on Consumer Price Index).

Taxation of interest income under the Tax Code. According to provisions of the new Tax Code interest income **a**bove three quarters of the CBR refinancing rate is taxed at 35% rate.

5. METRs for Russia: Results of Calculations and Conclusions

We used the logic of METRs model adjusted to parameters of the Russian tax legislation for calculation of METRs under three tax regimes: old Tax Law, Draft Tax Code and new Tax Code (effective on January 1, 2002). Results of calculations of METRs for a range of inflation rates (0%, 10%, 13%, 18%, 25%) are presented in Table 1. Parameters of three tax regimes are given in Table 1 in Appendix.

Table 1.

METRs calculated for three tax regimes

	π per year	Old Tax Law		Draft Tax Code		Tax Code	
		without revaluation	with revaluation	without revaluation	with revaluation	non-linear depreciat.	linear depreciat.
		1	2	3	4	5	6
Buildings in Manufacturing	0	0.3311	0.4269	0.4923	0.4923	n/a*	0.4128
	0.1	0.3440	0.3819	0.3916	0.4123	n/a	0.4169
	0.13	0.3486	0.3881	0.3683	0.3919	n/a	0.4135
	0.18	0.3568	0.3975	0.3325	0.3583	n/a	0.4061
	0.25	0.3673	0.4091	0.2883	0.3164	n/a	0.3943
Buildings in Construction	0	0.2147	0.2363	0.4923	0.4923	0.2822	0.2984
	0.1	0.2779	0.2652	0.3916	0.4123	0.2946	0.3135
	0.13	0.2911	0.2730	0.3683	0.3919	0.2962	0.3157
	0.18	0.3103	0.2847	0.3325	0.3583	0.2981	0.3174
	0.25	0.3319	0.3003	0.2883	0.3164	0.2986	0.3179
Buildings in Commerce	0	0.2070	0.2265	0.4604	0.4604	0.2932	0.3121
	0.1	0.2679	0.2567	0.3656	0.3840	0.3058	0.3265
	0.13	0.2813	0.2648	0.3430	0.3631	0.3071	0.3284
	0.18	0.2813	0.2768	0.3088	0.3314	0.3074	0.3289
	0.25	0.3214	0.2928	0.2665	0.2914	0.3064	0.3272
Machines in Manufacturing	0	0.2674	0.3035	0.3038	0.3038	0.3459	0.3771
	0.1	0.3483	0.3255	0.3178	0.2321	0.3732	0.4092
	0.13	0.3644	0.3313	0.3142	0.2136	0.3773	0.4135
	0.18	0.3863	0.3406	0.3049	0.1848	0.3807	0.4171
	0.25	0.4095	0.3523	0.2862	0.1479	0.3818	0.4177
Machines in Construction	0	0.2793	0.3133	0.3291	0.3291	0.3355	0.3647
	0.1	0.3687	0.3401	0.3568	0.2545	0.3655	0.4004
	0.13	0.3870	0.3456	0.3557	0.2349	0.3710	0.4066
	0.18	0.4119	0.3539	0.3490	0.2047	0.3769	0.4132
	0.25	0.4373	0.3649	0.3330	0.1666	0.3813	0.4177
Machines in Commerce	0	0.2971	0.3346	0.3330	0.3330	0.3004	0.3212
	0.1	0.3919	0.3637	0.3633	0.2581	0.3230	0.3490
	0.13	0.4099	0.3686	0.3626	0.2389	0.3278	0.3543
	0.18	0.4335	0.3762	0.3567	0.2080	0.3333	0.3614
	0.25	0.4571	0.3860	0.3408	0.1698	0.3381	0.3667
Computers	0	0.3388	0.3640	0.3265	0.3265	0.3277	0.3543
	0.1	0.4661	0.4259	0.3580	0.2528	0.3608	0.3951
	0.13	0.4885	0.4291	0.3608	0.2337	0.3675	0.4026
	0.18	0.5174	0.4342	0.3600	0.2036	0.3758	0.4132
	0.25	0.5451	0.4407	0.3523	0.1656	0.3839	0.4224

* n/a – Under the Tax Code Buildings in Manufacturing selected belong to the Group 8 for which only linear method of depreciation is allowed.

We are interested in two types of comparisons:

a. METRs under the old Tax Law and the new Tax Code to predict the general effect of the tax burden on incentives for new real sector investments that will result from the transition.

b. Marginal Effective Tax Rates for Russia in comparison with METRs for those developed economies where similar studies were performed.

We find that under the new Tax Code the METRs for debt financed investment projects are not significantly lower than under the old Tax Law. As we will see

later, this is practically always due to more heavy taxation of interest income as part of personal income. It makes sense to compare METRs under two alternative tax regime at actual inflation rates. We will compare METRs at 25% inflation rate under the old Tax Law with METRs at 18% inflation rate under the Tax Code, see Chart 1.

Chart 1: METRs for selected assets under Tax Law and Tax Code, at actual inflation rates

*Actual inflation rates for old Tax Law (year 2000) is 25%, and for new Tax Code (year 2002) expected rate is 18%.
** On horizontal axis numbers stand for:
1 – Buildings in Manufacturing; 2 – Buildings in Construction; 3 – Buildings in Commerce; 4 – Machinery in Manufacturing; 5 – Machinery in Construction; 6 – Machinery in Commerce; 7 – Computers in all industries.

As we see from Table 1 under the old Tax Law calculations predict lower METRs if firms choose to revalue assets (compare METRs in columns 1 and 2)[20]. Even though many Russian firms practically ignored this right (except in cases when it was officially prescribed to reevaluate the «balance» value of assets), still we use these lowest METRs for comparisons with METRs under the new Tax Code because we are interested in analysis of all incentives provided by tax legislation, whether they are used or not by firms in real life. From the data in Table 1 we see that the Draft Tax Code, which was not adopted, levies smaller tax load on assets in debt financed investment projects than both the old and the new tax regimes.

Why doesn't the new Tax Code (according to our calculations of METRs) seem more favorable for debt financed investments than the previous tax regime (see Chart 1)? To investigate this we propose to decompose METRs into several elements and to calculate tax burdens at three stages:

[20] It is known that firms reevaluated their assets mainly during special obligatory campaigns organized by the State from time to time in periods of high inflation. Firms preferred not to reevaluate their assets in other times. This fact probably can be explained by low profits of many firms registered in official statistics and additional administrative costs of reevaluation procedure.

1. Calculation of firm's subjective discount rate, ρ, (sometimes called internal rate of profitability of the project). At this stage we take into account the following provisions of the tax legislation: rates and methods of assessment of profit and wealth tax liabilities, rates and methods of depreciation. At this stage we calculate intermediate real rates of return on project $S1$ and corresponding intermediate marginal tax burdens $M1$, where $S1 = \frac{1+\rho}{1+\pi} - 1$ and $M1 = \frac{p - S1}{p}$ (see Appendix, Tables 2, 3).

2. Calculation of real rate of return, $S2$, and intermediate tax burden on project, $M2$, before taxation on personal level. At this stage we take into account provisions regarding deductibility of interest payments from the profit tax base. Under the old Tax Law interest income paid to saver before taxation on personal level, given all limitations, can be computed as $i = \min\left\{\rho + \pi i^{ord}; 0.5(p + \pi + \rho); \frac{\rho}{1-\tau}\right\}$ and under the new Tax Code $i = \min\left\{\rho + \pi i^{ord}; \frac{\rho}{1-\tau}\right\}$, where i^{ord} stands for what is called in tax legislation an *ordinary interest rate*. Under the old Tax Law ordinary interest rate, i^{ord}, equals CBR refinancing rate, RR, plus 3% points ($i^{ord} = RR+3\%$ points), and under the new Tax Code $i^{ord} = 1.1 \cdot RR$. The real interest rate paid is $S2 = \frac{1+i}{1+\rho} - 1$ and the tax burden at the end of the second stage before taxation of personal income is $M2 = \frac{p - S2}{p}$. $M2$ measures the overall marginal tax burden levied on the corporate level.

3. At the third stage we calculate the tax paid by saver on his/her interest income: $t = 0.15(i - RR)$ under the old Tax Law and $t = 0.35(i - 0.75RR)$ under the Tax Code. After-tax real interest rate of return to the provider of financing is $S = \frac{1+i-t}{1+\pi} - 1$ and the final effective tax rate on investment is $METR = \frac{p - s}{p}$. In our calculation we assumed that CBR refinancing rate is linked to the inflation rate in the following way: $RR = \pi + 3\%$ points.

Results of calculations of $S1$, $S2$, S, and $M1$, $M2$ and $METR$ for every project selected are reported in Appendix (see Tables 2 and 3). First of all, as we can see from these tables, METRs computed under the alternative tax regimes are not very different. We observe some decrease of METRs under the new Tax Code, especially for computers, but not really a significant one. The result is unexpected, given the reduction of the profit tax rate from 35% to 24%, more favorable rules for depreciation of assets, and abolition of the «50% rule» for interest payments deductibility. To understand the final result, we should look at the composition of METRs, since METRs capture tax loads at both levels of taxation, corporate and personal.

As we see the composition of the final effective tax rates under the two tax regimes is different. For example, we select investment project *Machinery in Construction*. Under the old Tax Law, at actual inflation rate 25% (year 2000) the tax

burden on the corporate level, $M2$, equals 29.52%. Permission to deduct interest payments on borrowed funds from the profit tax base substantially reduces the tax burden on corporate level from $M1 = 59.04\%$ to $M2 = 29.52\%$. But for investor, provider of financing, this is not the end of the tax story: after taxation of interest income the overall tax burden increases from $M2 = 29.52\%$ to METR = 36.49%.

Under the new Tax Code, for many investment projects $M2$ calculated are negative. Negative $M2$ can be interpreted as a subsidy provided by the tax system on a corporate level. At first glance, it seems unusual, but international data from the King-Fullerton study shows that subsidies (negative taxes) provided by the tax system is not a rare case. For *Machinery in Construction* at expected inflation rate 18%, $M1 = 40.85\%$, $M2 = -6.14\%$. Compared with numbers for the old Tax Law we find that $M1$ is lower under the Tax Code, this is due to reduction of the profit tax rate from 35% to 24%, as well as to more realistic method of depreciation and «lifetime» of the asset. As we know, so far reevaluation of assets at inflation rates is not envisioned in the new tax legislation. This may be a sign of a serious commitment of monetary and fiscal authorities to keep inflation under control.

The provision, which allows to deduct interest payments as business expenses, and which practically increases the payments to saver by πi^{ord}, is also more generous then before, when the above mentioned «50% rule» effectively limited these deductions. As we see from data in Table 3, overall effective tax rate on corporate level for selected projects is either close to 0% or even negative. But under the new Tax Code taxation of interest incomes becomes much heavier than before: all interest income above 3/4 of CBR refinancing rate is taxed at a 35% rate, compared with 15% over CBR refinancing rate under the old Tax Code.

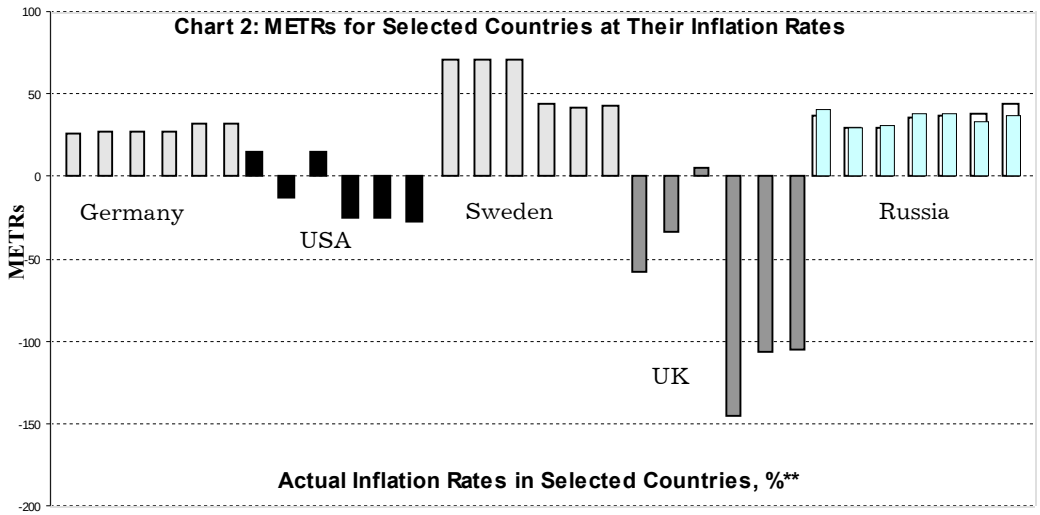
It is this taxation on personal level, which reverts negative or close to zero numbers of tax burden into final positive two-digit numbers. In our example selected $M2 = -6.14\%$, after taxation of interest income on personal level rises to $METR = 37.69\%$, which is close to the tax burden on this investment project under the old Tax Law.

In general, the change of rules for taxation of interest incomes raises the issue about the relationship between inflation rate and CBR refinancing rate. We assume that CBR refinancing rate, set by monetary authorities, is pegged to inflation rate: $RR = \pi + \Delta$. Then the current tax on interest income can be presented as $t = 0.35(i - 0.75RR) \cong 0.35(r + \pi - 0.75(\pi + \Delta)) = 0.35(r + 0.25(\pi - 3\Delta))$. If $\pi > 3\Delta$, not only real income, but also an inflationary component is taxed. For example, in our calculations we assumed that $RR = \pi + 3\%$ points. Then, with inflation rates higher than 9%, tax on interest includes an inflationary component which distorts the picture. In addition to that, there is another issue about justification of a high 35% rate on real interest (compared to 13% on many other types of income). In our view, interest income in Russia cannot be considered a risk free type of income, given the present state of economy and of the banking system.

The values for METRs computed depend on the parameters we have chosen for computations. There are several problems here: while statutory tax rates, procedures and methods of depreciation are directly stated in the tax legislation, some other parameters used in calculations are mere estimates. This refers first of all to

the rates of economic depreciation of assets, which determine the decay of productivity and profitability of assets in the model. The quality of METRs estimates could be improved if we could get rates of economic depreciation of real assets estimated specifically for the Russian economy.

The second question we are interested in is how these METRs for Russia look in comparison with METRs for other countries. International team of economists led by M. King and D. Fullerton performed these calculations for USA, UK, Germany and Sweden in 1980s. On Chart 2 we present METRs computed for several countries (for USA, UK, Germany, Sweden the data is from the King-Fullerton study; for Russia we use our estimates) for the projects with the same type of financing (bank loans), the same type of savers (domestic households), the same set of assets (buildings, machinery, computers) employed in the same industries (manufacturing, construction, commerce). METRs presented on Chart 2 were calculated for actual rates of inflation in respective countries in the year of study (USA – 6.77%, Germany – 4.2%, Sweden – 9.4%, UK – 13.57%, Russia under the old Tax Law – 25% (year 2000), and Russia under the new Tax Code – 18% (year 2002, expected inflation rate)).



* Russia 1 stands for the old Tax Law, Russia 2 stands for the new Tax Code.
** Actual inflation rates in the year of study: USA – 6.77%, Germany – 4.2%, Sweden 9.4%, UK – 13.57%, Russia under the old Tax Law – 25 % (year 2000), and Russia under the new Tax Code – 18% (year 2002, expected inflation rate).

As we see on Chart 2, METRs for the Russian economy under the two tax regimes at actual rates of inflation are significantly higher than in the UK and in the USA, where the tax system provided subsidies for selected debt financed investment projects, and METRs for Russia are to some extent higher than in Germany. Among these countries it was only in Sweden where METRs in the period of study were significantly higher than in Russia under both tax regimes.

We consider the METRs computed within the model as «lowest estimates» of marginal tax burdens on debt financed marginal investments, because we do not take into account some provisions of tax legislation and administrative costs of compliance with tax laws, which can be high. Neither do we account for expenses of the banking system which servesas an intermediary between corporations and savers.

As a concluding remark, we would like to note that if the Russian authorities want to channel domestic savings into real sector investments, the current rules for interest income taxation should be examined very carefully and probably changed in order to reduce disincentives for domestic savers, who make their investment decisions in an already uncertain environment. A reduction of the tax rate on interest income would provide more incentives to domestic households to invest in the Russian economy.

Appendix

We use the logic of the *fixed-p* METR model to calculate the METRs for each selected marginal investment project financed out of savings of domestic households through bank loans (debt financing). We selected the following combinations: assets – buildings, machinery, computers; industries – manufacturing, construction, and commerce. Economic depreciation rates and other relevant details of tax legislation for assets selected are reported in Table 1.

Table 1.

Parameters of Alternative Tax Regimes

	Buildings in Manufacturing	Buildings in Construction	Buildings in Commerce	Machines in Manufacturing	Machines in Construction	Machines in Commerce	Computers
Old Tax Law	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.0361\\58.82\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.0361\\10.1\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.0247\\10.204\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.1225\\9.6\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.1650\\8.475\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.1722\\10\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.2729\\10\end{bmatrix}$
Draft Tax Code	$\begin{bmatrix}\tau\\p\\w\\\delta\\k\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.0361\\.0065\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\k\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.0361\\.0065\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\k\end{bmatrix}=\begin{bmatrix}.35\\.1\\.02\\.0247\\.0065\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\k\end{bmatrix}=\begin{bmatrix}.35\\.1\\0\\.1225\\.02\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\k\end{bmatrix}=\begin{bmatrix}.35\\.1\\0\\.1650\\.02\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\k\end{bmatrix}=\begin{bmatrix}.35\\.1\\0\\.1722\\.02\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\k\end{bmatrix}=\begin{bmatrix}.35\\.1\\0\\.2729\\.04\end{bmatrix}$
Tax Code	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.24\\.1\\.02\\.0361\\20\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.24\\.1\\.02\\.0361\\5\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.24\\.1\\.02\\.0247\\7\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.24\\.1\\.02\\.1225\\7\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.24\\.1\\.02\\.1650\\5\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.24\\.1\\.02\\.1722\\3\end{bmatrix}$	$\begin{bmatrix}\tau\\p\\w\\\delta\\L\end{bmatrix}=\begin{bmatrix}.24\\.1\\.02\\.2729\\3\end{bmatrix}$

Table 2.

Old Tax Law: Calculation of marginal intermediate and final effective tax burdens, METRs

Inflation rate, π	0	0.1	0.13	0.18	0.25
Buildings in Manufacturing					
ρ	0.0472	0.1492	0.1796	0.2300	0.3005
s1	0.0472	0.0447	0.0439	0.0424	0.0404
s2	0.0736	0.0724	0.0719	0.0712	0.0702
s	0.0671	0.0656	0.0651	0.0643	0.0633
M1	0.5280	0.5527	0.5611	0.5763	0.5960
M2	0.2640	0.2764	0.2805	0.2881	0.2980
METR	**0.3294**	**0.3440**	**0.3486**	**0.3568**	**0.3673**
Buildings in Construction					
ρ	0.0691	0.1696	0.1997	0.2500	0.3202
s1	0.0691	0.0633	0.0617	0.0593	0.0562
s2	0.0845	0.0816	0.0808	0.0797	0.0781
s	0.0764	0.0735	0.0727	0.0715	0.0700
M1	0.3090	0.3673	0.3832	0.4068	0.4384
M2	0.1545	0.1836	0.1916	0.2034	0.2192
METR	**0.2363**	**0.2652**	**0.2730**	**0.2847**	**0.3003**
Buildings in Commerce					
ρ	0.0714	0.1718	0.2019	0.2522	0.3224
s1	0.0714	0.0653	0.0636	0.0612	0.0579
s2	0.0857	0.0826	0.0818	0.0806	0.0790
s	0.0773	0.0743	0.0735	0.0723	0.0707
M1	0.2860	0.3473	0.3637	0.3881	0.4208
M2	0.1430	0.1736	0.1819	0.1941	0.2104
METR	**0.2265**	**0.2567**	**0.2648**	**0.2768**	**0.2928**
Machinery in Manufacturing					
ρ	0.0533	0.1540	0.1842	0.2345	0.3049
s1	0.0533	0.0491	0.0480	0.0462	0.0439
s2	0.0857	0.0826	0.0818	0.0806	0.0790
s	0.0697	0.0675	0.0669	0.0659	0.0648
M1	0.4670	0.5091	0.5204	0.5381	0.5608
M2	0.2335	0.2545	0.2602	0.2691	0.2804
METR	**0.3035**	**0.3255**	**0.3313**	**0.3406**	**0.3523**
Machinery in Construction					
ρ	0.0495	0.1502	0.1804	0.2308	0.3012
s1	0.0495	0.0456	0.0446	0.0431	0.0410
s2	0.0748	0.0728	0.0723	0.0715	0.0705
s	0.0680	0.0660	0.0654	0.0646	0.0635
M1	0.5050	0.5436	0.5540	0.5695	0.5904
M2	0.2525	0.2718	0.2770	0.2847	0.2952
METR	**0.3196**	**0.3401**	**0.3456**	**0.3539**	**0.3649**
Machinery in Commerce					
ρ	0.0434	0.1441	0.1743	0.2246	0.2950
s1	0.0434	0.0401	0.0392	0.0378	0.0360
s2	0.0644	0.0700	0.0696	0.0689	0.0680
s	0.0592	0.0636	0.0631	0.0624	0.0614
M1	0.5660	0.5991	0.6080	0.6220	0.6400
M2	0.3560	0.2995	0.3040	0.3110	0.3200
METR	**0.4076**	**0.3637**	**0.3686**	**0.3762**	**0.3860**
Computers All Industries					
ρ	0.0350	0.1280	0.1582	0.2085	0.2789
s1	0.0350	0.0255	0.0250	0.0242	0.0231
s2	0.0560	0.0627	0.0625	0.0621	0.0616
s	0.0521	0.0574	0.0571	0.0566	0.0559
M1	0.6500	0.7455	0.7504	0.7585	0.7688
M2	0.4400	0.3727	0.3752	0.3792	0.3844
METR	**0.4790**	**0.4259**	**0.4291**	**0.4342**	**0.4407**

Table 3.

Tax Code: Calculation of marginal intermediate and final effective tax burdens, METRs

Inflation rate	0	0.1	0.13	0.18	0.25
Buildings in Manfacturing					
ρ	0.0703	0.1657	0.1951	0.2445	0.3141
s1	0.0703	0.0597	0.0576	0.0547	0.0513
s2	0.0782	0.0909	0.0950	0.1016	0.1104
s	0.0587	0.0583	0.0586	0.0594	0.0606
M1	0.2970	0.4027	0.4239	0.4534	0.4872
M2	0.2178	0.0907	0.0501	-0.0164	-0.1042
METR	**0.4128**	**0.4169**	**0.4135**	**0.4061**	**0.3943**
Buildings in Construction					
ρ	0.0904	0.1864	0.2155	0.2641	0.3325
s1	0.0904	0.0785	0.0757	0.0713	0.0660
s2	0.0983	0.1097	0.1130	0.1183	0.1251
s	0.0718	0.0705	0.0704	0.0702	0.0701
M1	0.0960	0.2145	0.2434	0.2873	0.3400
M2	0.0168	-0.0975	-0.1304	-0.1825	-0.2514
METR	**0.2822**	**0.2946**	**0.2962**	**0.2981**	**0.2986**
Buildings in Commerce					
ρ	0.0887	0.1845	0.2136	0.2624	0.3310
s1	0.0887	0.0768	0.0740	0.0698	0.0648
s2	0.0966	0.1080	0.1114	0.1168	0.1239
s	0.0707	0.0694	0.0693	0.0693	0.0694
M1	0.1130	0.2318	0.2602	0.3017	0.3520
M2	0.0338	-0.0802	-0.1136	-0.1681	-0.2394
METR	**0.2932**	**0.3058**	**0.3071**	**0.3074**	**0.3064**
Machinery in Manufacturing					
ρ	0.0806	0.1731	0.2014	0.2491	0.3165
s1	0.0806	0.0665	0.0632	0.0586	0.0532
s2	0.0885	0.0977	0.1006	0.1055	0.1123
s	0.0654	0.0627	0.0623	0.0619	0.0618
M1	0.1940	0.3355	0.3681	0.4144	0.4680
M2	0.1148	0.0235	-0.0057	-0.0554	-0.1234
METR	**0.3459**	**0.3732**	**0.3773**	**0.3807**	**0.3818**
Machinery in Construction					
ρ	0.0822	0.1744	0.2025	0.2498	0.3166
s1	0.0822	0.0676	0.0642	0.0592	0.0533
s2	0.0901	0.0988	0.1015	0.1061	0.1124
s	0.0665	0.0634	0.0629	0.0623	0.0619
M1	0.1780	0.3236	0.3584	0.4085	0.4672
M2	0.0988	0.0116	-0.0154	-0.0614	-0.1242
METR	**0.3355**	**0.3655**	**0.3710**	**0.3769**	**0.3813**
Machinery in Commerce					
ρ	0.0876	0.1816	0.2100	0.2577	0.3249
s1	0.0876	0.0742	0.0708	0.0658	0.0599
s2	0.0955	0.1054	0.1082	0.1128	0.1191
s	0.0700	0.0677	0.0672	0.0667	0.0662
M1	0.1240	0.2582	0.2920	0.3415	0.4008
M2	0.0448	-0.0538	-0.0818	-0.1283	-0.1906
METR	**0.3004**	**0.3230**	**0.3278**	**0.3333**	**0.3381**
Computers All Industries					
ρ	0.0834	0.1752	0.2031	0.2500	0.3161
s1	0.0834	0.0684	0.0647	0.0593	0.0529
s2	0.0913	0.0996	0.1021	0.1063	0.1120
s	0.0672	0.0639	0.0632	0.0624	0.0616
M1	0.1660	0.3164	0.3531	0.4068	0.4712
M2	0.0868	0.0044	-0.0207	-0.0631	-0.1202
METR	**0.3277**	**0.3608**	**0.3675**	**0.3758**	**0.3839**

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