

**International Studies Program  
Working Paper 07-28  
December 2007**

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Tax Evasion and Real Side Response  
of Russian Households**

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International Studies Program  
Andrew Young School of Policy Studies  
Georgia State University  
Atlanta, Georgia 30303  
United States of America

Phone: (404) 651-1144  
Fax: (404) 651-4449  
Email: [ispaysps@gsu.edu](mailto:ispaysps@gsu.edu)  
Internet: <http://isp-aysps.gsu.edu>

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# MYTH AND REALITY OF FLAT TAX REFORM: TAX EVASION AND REAL SIDE RESPONSE OF RUSSIAN HOUSEHOLDS

Yuriy Gorodnichenko  
University of California-  
Berkeley

Jorge Martinez-Vazquez  
Georgia State University

Klara Sabirianova Peter  
Georgia State University  
IZA Bonn  
(kpeter@gsu.edu)

September 23, 2007

## Abstract

We use detailed micro-level data on consumption and income for a 1998-2004 panel of Russian households to study the effects of the flat income tax reform in 2001. We show that the gap between household expenditures and reported income is a meaningful measure of tax evasion. We use the difference-in-difference and regression discontinuity approaches to assess the response of tax evasion and worker productivity to the flat tax. We find that the tax evasion response (10-12%) is larger than the productivity response (0-4%), and thus increased tax revenues and reported earnings are largely driven by improved tax compliance.

**Keywords:** tax evasion, consumption-income gap, personal income tax, flat tax, difference-in-difference, regression discontinuity, transition, Russia.

**JEL Classification:** D73, H1, J3, J4, O1, P2

## 1. Introduction

Tax evasion is a pervasive worldwide phenomenon. It is widely believed that high personal income tax rates are partially responsible for high levels of tax evasion everywhere, especially in emerging markets. High personal income tax rates are also often associated with negative effects on the real side of the economy. This paper is a general exploration of the relationship between income tax rates and the level of evasion and work effort based on Russia's recent experience with tax reform.

In January 2001, Russia introduced a fairly dramatic reform of its personal income tax when it became the first large economy to adopt a flat tax. The Tax Code of 2001 replaced the conventional progressive rate structure with a flat tax rate of 13 percent.<sup>1</sup> Over the next year, while the Russian economy grew at almost 5 percent in real terms revenues from the personal income tax increased by over 25 percent in real terms (Table 1). Despite the fact that economic theory does not precisely predict the effect of reduced tax rates on the degree of tax evasion,<sup>2</sup> advocates of the flat tax largely credit Russia's flat tax reform with this dramatic turn in revenue performance. Advocates also credit the flat tax with beneficial changes in the real side of the economy. More recently, several other Eastern European countries (Serbia, Ukraine, Georgia, Romania, Slovakia, and Macedonia) have adopted flat rate income tax reforms. Although after-reform data are not yet fully available for these countries, in some cases (for example, Slovakia) flat tax reform is again being credited with significant revenue turnarounds and the stimulation of

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<sup>1</sup> Estonia, first, and then Latvia and Lithuania had introduced flat rate personal income taxes during the early 1990s. In Russia, the 13 percent rate was the sum of a 12 percent flat rate for the personal income tax and a 1 percent contribution to the pension fund paid by employees.

<sup>2</sup> For a discussion, see Andreoni, Erard and Feinstein (1998) and Alm (1999).

economic activity. Several OECD countries are now considering the adoption of flat tax reforms in the near future.<sup>3</sup>

Beyond the excitement Russia's flat tax reform has created, so far very little solid evidence has been provided on its impact on tax evasion or the real side of the economy. As shown in Table 1, after a period with negative real growth and high inflation rates that culminated with the financial crisis of 1998, the Russian economy started a period of solid economic growth and more stable prices in 1999. By the time the flat rate income tax was introduced in the Tax Code of 2001, real GDP had grown by 9 percent in 2000 and 5 percent in 2001. At the same time, the most striking observation is that real collections from the personal income tax grew at close to 26 percent in 2001, the year of the reform, and continued to grow by 21 percent in 2002 and almost 12 percent in 2003; in posterior years the growth rate declined significantly. This burst in collection performance for the new personal income tax can potentially be explained by the better performance of the real economy, by improved voluntary compliance from taxpayers, and/or by stricter enforcement of the tax system via higher penalties and enforcement efforts by the tax authorities. Although real income grew during 2001 and the years after, the figures in Table 1 would seem to strongly suggest that something else should have been behind the increase in real income tax collections. An explanation based on higher penalties for tax evasion is even less plausible. A significant feature of the new Russian Tax Code of 2001 was that it generally reduced the draconian tax penalties that had been in force during the 1990s.<sup>4</sup> Therefore, it would seem worthy to investigate the potential roles of voluntary compliance and better administration enforcement. Some recent papers (Ivanova,

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<sup>3</sup> See Owens (2007). Several policy makers praised the Russian flat tax reform. For example, during a state visit of Russia's President Putin to the U.S. in 2001, President George W. Bush said, "I am impressed by the fact that [Putin] has instituted tax reform -- a flat tax. And as he pointed out to me, it is one of the lowest tax rates in Europe. He and I share something in common: We both proudly stand here as tax reformers."

<sup>4</sup> See Martinez-Vazquez, Rider, and Wallace (2007).

Keen, and Klemm 2005 and Gaddy and Gale 2005) conclude that the large increase in income tax revenues contemporaneous with the Russia's flat tax reform is largely explained by better enforcement of the tax laws, not by changes in tax compliance. The difficulty with the conclusions in those studies is that they do not measure changes in tax evasion and that the confounding effects of improved voluntary compliance and improved enforcement on tax evasion are never separated and identified.

Measuring the level of tax evasion is notoriously difficult, requiring programs of random intensive taxpayer audits such as the Taxpayer Compliance Measurement Program (TCMP) conducted by the U.S. Internal Revenue Service (Slemrod 2007). Most countries, including Russia, have not carried out this type of program. In this paper, we develop a framework to estimate the extent of tax evasion before and after the tax reform using micro-level data on income and household spending. Specifically, we estimate the gap between annual household expenditures and reported earnings as a proxy for tax evasion. Controlling for time-invariant unobservable household characteristics, we show to what extent tax evasion is associated with worker and job characteristics and policy changes. Our main finding is that the most significant reduction in tax evasion was for taxpayers that experienced the largest decrease in tax rates after the flat rate income tax was introduced. In the paper, we also explore the issue of whether the decline in tax evasion in Russia following the flat tax rate reform was due to a greater enforcement effort by the tax administration authorities as opposed to a change in voluntary compliance. We find that the significant changes in tax evasion following the adoption of the flat tax cannot be explained by the changes in tax enforcement policies introduced at the time. In addition to estimating the extent of tax evasion, we also assess the effect of the tax reform on productivity, and we find it to be generally small.

Our approach in this paper, based on the differences between reported consumption and reported income, has not been previously used in the tax evasion literature; however, several other studies have used data on income composition to study tax evasion. This previous research typically uses a group of taxpayers who are known to comply (e.g., employees subject to withholding) as a benchmark to assess the true income for a group of taxpayers in question (e.g., self-employed).<sup>5</sup> Given this dichotomy of tax compliers and non-compliers, one can use the discrepancy between the two groups to approximate the level of tax evasion. Thus, for example, Pissarides and Weber (1989) exploit differences in food consumption, Lyssiotou, Pashardes, and Stengos (2004)<sup>6</sup> look at differences in the composition of consumption, and Feldman and Slemrod (2007) examine differences in charitable contributions to impute income hidden from taxes. For Russia we cannot use this approach as tax evasion has been widespread with employees quite likely practicing as much tax evasion as other groups of taxpayers.<sup>7</sup> There has often been an explicit or implicit agreement between employers and employees to conceal a part of wages to reduce the tax burden. The modes of tax evasion have included employees receiving compensation in the form of envelopes with cash, purchase of life insurance policies and other fringe benefits, interest from bank deposits made by the employer, not reporting income from a second job, failure to consolidate incomes from different sources, and so on.

Our approach based on the differences between reported consumption and reported income before and after the tax reform allows us to use temporal variation to provide a lower bound on the degree of tax evasion. As a lower flat income tax reduces incentives to under-

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<sup>5</sup> For example, the IRS in the U.S. reports that for 2001 filed returns only 1 percent of wages and salaries were underreported but that an estimated 57 percent of non-farm proprietor income was not reported (IRS 2006).

<sup>6</sup> Lyssiotou, Pashardes, and Stengos (2004) use the consumption demand approach in measuring tax evasion. They observe that the tax evasion influences the composition of consumption, and one can impute true income by adjusting income to match consumption shares.

<sup>7</sup> Measures of tax evasion based upon extensive integral tax audits are not available in Russia.

report income, the after-reform reported income provides a benchmark for what a worker could have actually earned at the time of high taxes. As a result, we can compute how much income he or she hid when compared to actually reported earnings before the reform. Since the reform decreases marginal tax rates only for some groups of people, we use the variation across time and tax payers to identify and estimate the effects. Previous studies typically use only cross-sectional variation.

As we noted above, some other countries besides Russia have recently introduced flat tax reforms and several other countries are considering the adoption of this reform. An important implication of this paper is that in countries where tax rates are high and tax evasion levels are significant, extrapolating from Russia's experience, we may expect the adoption of a flat rate income tax to lead to significant reductions in tax evasion and increased tax revenues following the reform. But these revenues are likely to come from better reporting and increased compliance, and much less from changes in labor supply and increased economic activity.

From a methodological viewpoint, this paper offers a general approach to estimating the extent of tax evasion in different countries provided there is available longitudinal household income-expenditure surveys and intermittent tax reforms with significant changes in tax burdens. Although these conditions will not always be met, the list of countries where the methodology can be applied far exceeds that of countries that implement extensive random audit programs to examine the extent of tax evasion. The paper also contributes empirical evidence on the relationship between tax rates and tax evasion, which has not been clearly forthcoming in past cross-sectional studies.

The remainder of the paper is organized as follows. In Section 2, we derive a tax evasion function using the difference in the log of consumption and income. In Section 3, we introduce

our data and descriptive statistics. In Section 4 we present the estimates of the tax evasion function. In Sections 5 and 6, we discuss methodological issues and provide estimates of the flat tax effect using difference-in-difference and regression discontinuity approaches. In Section 7, we investigate the productivity effect of the flat tax, and in Section 8 we draw some conclusions.

## 2. Derivation of Tax Evasion Function

In this section, we motivate our econometric analysis of tax evasion.

Let  $Y_{ht}^*$  be the (true) income received by household  $h$  at time  $t$ . Households may choose to conceal a part of their income and report only  $Y_{ht}^R = \lambda_{ht} Y_{ht}^*$ , where  $\lambda_{ht}$  is the fraction of reported current income. We can model  $\lambda_{ht}$  as a function of observable characteristics  $S_{ht}$  that influence tax compliance:  $\lambda_{ht} = \lambda(S_{ht}) = \exp(\lambda_x S_{ht} + error)$ . In addition to job and worker characteristics, the vector  $S_{ht}$  might also include various central and regional government policies, in particular, the 2001 flat tax reform, which is our focus.

Further, let's assume that current household income  $Y_{ht}^*$  is related to permanent income  $Y_{ht}^P$  as  $Y_{ht}^* = \eta_{ht} Y_{ht}^P$ , where  $\eta_{ht} = \eta(Q_{ht}) = \exp(\eta_x Q_{ht} + error)$  captures deviations of current income from permanent income due to life cycle factors  $Q_{ht}$  such as age, schooling, employment participation, number of children, etc. and due to transitory shocks absorbed into the error term. Accounting for the life-cycle factors is necessary because the difference between permanent/lifetime income and current income exhibits strong life-cycle dynamics (e.g., Hubbard, Skinner, and Zeldes 1995, Gourinchas and Parker 2002, and Haider and Solon 2006).

Since service flows of durable goods are often unknown, we should further assume that expenditures on non-durables  $C_{ht}$  constitute a fraction of permanent income, that is,  $C_{ht} = \theta_{ht} Y_{ht}^P$ . This fraction is fixed if the consumption aggregator for durables and non-durables has a CES or

Cobb-Douglas form in the utility function.<sup>8</sup> We allow the fraction  $\theta$  to vary across households. In particular, we let  $\theta_{ht} = \theta(Z_{ht}) = \exp(\theta_x Z_{ht} + error)$ , where  $Z_{ht}$  consists of the number of household members and number of children in order to account for economies of scale, while the number of elderly members, age, and schooling are included as tastes shifters. This list of variables is commonly used in empirical consumption functions (e.g., Blundell et al 1994, Browning and Lusardi 1996).

Given our assumptions, we obtain three important relationships:

$$\ln Y_{ht}^R - \ln Y_{ht}^* = \lambda_x S_{ht} + error, \quad (1a)$$

$$\ln Y_{ht}^* - \ln Y_{ht}^P = \eta_x Q_{ht} + error, \quad (1b)$$

$$\ln C_{ht} - \ln Y_{ht}^P = \theta_x Z_{ht} + error. \quad (1c)$$

Even though  $Y_{ht}^*$  and  $Y_{ht}^P$  are not observable, we can still estimate our parameter of interest  $\lambda_x$  if we combine equations (1a-1c) into the observed consumption-income gap function (2).

$$\ln C_{ht} - \ln Y_{ht}^R = -\lambda_x S_{ht} - \eta_x Q_{ht} + \theta_x Z_{ht} + error. \quad (2)$$

Since the  $Q$  and  $Z$  vectors are likely to overlap considerably let  $X=(Q, Z)$ . Thus, our final specification of the consumption-income gap function can be written:

$$\ln C_{ht} - \ln Y_{ht}^R = \gamma S_{ht} + \beta X_{ht} + u_h + \varepsilon_{ht}, \quad (3)$$

where  $\gamma = -\lambda_x$  shows the effect of  $S_{ht}$  on tax evasion (or reverse effect on tax compliance);  $u_h$  is a time-invariant component of the error term that accounts for risk aversion, preferences, and other

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<sup>8</sup> Pissarides and Weber (1989) and subsequent literature allow the income elasticity of food consumption and other specific goods to be different from one. We do not make this assumption because we consider the total consumption of non-durables. The ratio of non-durables to income is fairly stable in macroeconomic data, which is consistent with the constant unit elasticity. Furthermore, if the elasticity significantly departs from one, then we should find that the factors explaining consumption and/or income should also explain a significant fraction of the variation in the consumption-income gap. We do not find this in our data. Specifically, we find that the  $R^2$  falls from about 0.2-0.3 in separate consumption and income regressions to 0.05 in the consumption-income gap regressions, which is again consistent with the unit elasticity of non-durables consumption with respect to permanent income.

constant household and local characteristics affecting consumption and/or income, and  $\varepsilon_{ht}$  is a random error term.<sup>9</sup> Following Pissarides and Weber (1989), Lyssiotou, Pashardes, and Stengos (2004), and others, we assume the consumption of non-durables is correctly reported, and the income reported in RLMS is used for tax purposes.

This function shows that it is possible to estimate the effect of a policy change on tax evasion in a consistent way as long as we control for those factors in  $X$  that are correlated with  $S$  (e.g., age, schooling, employment participation, and household structure). These factors can affect the composition of consumption, and, to some extent, the properties of the permanent component of the income. Hence, omitting them is likely to create biased estimates. However, if proper controls are included, the consumption-income gap function becomes a tax evasion function, and thus a useful tool for policy analysis.<sup>10</sup>

### 3. Data and Variables

We estimate the tax evasion function using the 1998, 2000-2004 rounds of a household panel survey, the Russian Longitudinal Monitoring Survey (RLMS), which is based on the first national probability sample drawn in the Russian Federation.<sup>11</sup> This is a very rare household database with a sufficiently long panel before and after the flat tax reform. The panel structure of the data is particularly useful in implementing before and after analysis while controlling for

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<sup>9</sup> The consumption-income gap function has a convenient semi-log functional form. From the permanent income/life-cycle theory of consumption, the consumption-income ratio should be equal to one and the log of this ratio is zero. Thus, we can interpret the coefficients in equation (3) as percentage deviations of the consumption-income ratio from the “steady state”. Using the log-ratio also improves the statistical properties of our estimates as the consumption-income ratio is highly skewed.

<sup>10</sup> The permanent income hypothesis assumes that households have the ability to borrow and lend to smooth consumption. This could be a strong assumption in the Russian context, and one may be inclined to use the cash-on-hand as a chief determinant of consumption (instead of permanent income). In this case, the consumption-income gap function continues to be the relevant tool for studying tax evasion because constrained households should spend available income on consumption.

<sup>11</sup> We do not use the 1994-1996 rounds because of high macroeconomic volatility during this period, with annual inflation reaching 214% in 1994, and apparent noise in respondents’ answers, especially, with regard to food items. On top of that, the early questionnaires did not include contractual earnings, which are the key variable for our analysis as well as several important expenditure items such as medicine, car repair, etc.

unobservable household and local characteristics in estimations. There were approximately 8,343-10,670 individuals who completed the adult (age 14 and over) questionnaire and 3,750-4,718 households who completed the household questionnaire in each round. These individuals and households reside in 32 oblasts (regions) and 7 federal districts of the Russian Federation.<sup>12</sup>

The key variables in the tax evasion function are household expenditures and household reported income. The household questionnaire contains detailed information on separate expenditure items purchased in the last 30 days (unless indicated otherwise): more than 50 items of food at home and away from home, alcoholic and non-alcoholic beverages, and tobacco products purchased in the last 7 days; aggregate expenditures on food; expenses on clothing and footwear in the last 3 months; gasoline and other fuel expenses (3 subcategories); rents and utilities, and 15-20 subcategories of services (such as transportation, repair, health care services, education, entertainment, recreation, insurance, etc.). These expenditure items are aggregated into monthly expenditures on non-durables (all weekly food expenses are multiplied by  $30/7=4.286$ ). In addition to non-durable consumption items, households also report transfer payments in the last 30 days (6 subcategories include alimonies and various contributions in money and in kind to individuals outside the household unit). For each expenditure item, it is known whether or not a household purchased the item, as well as the amount of the purchase.<sup>13</sup>

Total household income is the combined income of all household members after taxes from all jobs and other regular sources. The labor income is reported by the reference person as after-tax payments received by all household members from all places of work in the form of

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<sup>12</sup> Russia has 89 regions and 7 federal districts.

<sup>13</sup> When a household purchased the item but did not report the amount of the purchase, the missing amounts are imputed by regressing the log of expenditure on the complete interaction between year dummies and federal district dummies, controlling for the size of the household, number of children (18 years old or younger), and number of elderly members (60+). The procedure is described in Gorodnichenko, Sabirianova Peter, and Stolyarov (2007). The subcategories with the largest number of missing values include utilities (2.12% of the sample), gasoline and motor oil (1.63%), transportation services (1.54%), and contributions to non-relatives (1.35%). Missing values for other subcategories are trivial.

money, goods, and services in the last 30 days. Non-labor income includes pensions, stipends, unemployment benefits, rental income, interests and dividends, alimonies, and child care benefits. Other receipts from the last 30 days are combined into the category of irregular receipts that consist of lump-sum payments from insurance, amounts received from the sales of material assets, and 11 subcategories of contributions from persons outside the household unit, including contributions from relatives, friends, charity, international organizations, etc. These irregular receipts are generally not included in the definition of income. As with expenditures, missing income amounts for the subcategories of non-labor income and irregular receipts are imputed using the regression approach described in Gorodnichenko, Sabirianova Peter, and Stolyarov (2007). Overall, imputations are minimal. Labor income is not imputed.

In addition to consumption expenditures and income, we also calculate change in net financial worth as the difference between the net change in financial assets and the net change in liabilities. The net change in financial assets includes purchases of stocks, bonds, and other securities in the last 30 days, plus current cash savings in the last 30 days, minus sales of stocks, bonds, and other securities in the last 30 days, minus the amount of spent savings, foreign currency and valuables in the last 30 days. The net change in liabilities is computed as money borrowed in the last 30 days, minus money lent outside the household unit in the last 30 days, minus payments to creditors in the last 30 days, plus amounts received from debtors in the last 30 days.

All monetary values at the household level are expressed in December 2002 prices and adjusted for regional cost-of-living differences by using the regional value of a fixed basket of goods and services.<sup>14</sup>

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<sup>14</sup> To adjust for monthly inflation, we express all flow variables in December prices of the corresponding year by using a country average monthly CPI and the date of interview. If the date of the interview is in the first half of the

The household-level data are supplemented by individual information on the head of the household, including employment participation, earnings, age, schooling, tenure, and characteristics of the primary employer such as formal organization, ownership, location, and firm size. The head of the household is defined as the person with the largest income. If more than one individual within a household have similar incomes, then the oldest person is defined as the head of the household. In a few exceptional cases of multiple household members with the same age and income, the priority is given to the first person in the roster files.

#### **4. Estimation of Tax Evasion Function**

The dependent variable in our tax evasion function is the consumption-income gap, which is defined as the difference between the log of expenditures on non-durables and the log of reported current household income. Our preferred choice of the income measure includes regular portions of labor and non-labor income, as defined above (Y1). The second income measure (Y2) adds irregular payments received in the last 30 days.

The data on expenditures also gives us several measures to choose from. The first measure includes expenditures on food, alcoholic and non-alcoholic beverages, tobacco, clothing and footwear, gasoline and other fuel expenses, rents and utilities, and services (such as transportation, repair, health care services, education, entertainment, recreation, insurance, etc.) (C1).<sup>15</sup> The second consumption measure adds transfer payments such as alimonies paid and help to others (C2). Although transfer payments are not typically considered as part of

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month, the previous month CPI is used. If the date of interview is in the second half of month, the current month CPI is used. Then the annual (December to December) CPI for each 32 oblasts (regions) is applied to convert the flow variables into December 2002 prices.

<sup>15</sup> Expenditures on food are computed as the sum of weekly expenditures on individual food items multiplied by 4.286. Since some food items are storable (flour, sugar, potatoes and vegetables) and expenditures on these goods tend to be seasonal (typically, in the fall), we use top coding for unreasonably high amounts of food purchases conditional on household structure and food prices. The procedure of top coding of food items is described in Gorodnichenko, Sabirianova Peter and Stolyarov (2007).

consumption, households may derive extra utility from altruistic motives by transferring resources to relatives (Laitner and Juster 1996, Altonji, Hayashi and Kotlikoff 1997, Kopczuk and Lupton 2007). Finally, to compare total income and total expenditures, we consider a measure of expenditures that includes the net change in financial worth (net savings) as defined above in the data section (C3).<sup>16</sup>

On the right-hand side of equation (3), we have two vectors of covariates  $S$  and  $X$ . The vector  $S$  accounts for individual variation in tax evasion due to age, schooling, marital status, tenure, type of job (enterprise vs. self-employment), sector (private vs. public), and the firm size for the head of the household. It also contains year dummies and a trend variable for the after-reform period. Based on our earlier discussion, the vector  $X$  includes age, schooling, employment participation, number of household members, number of children, and number of elderly members. Since some of the factors are present in both vectors (e.g., age and schooling), we have to be cautious not to attribute the estimates solely to tax evasion.

Having specified all the variables, we are now in a position to estimate equation (3). The FE results for the four possible combinations of income and consumption are presented in Table 2.<sup>17</sup> All four specifications show that the consumption-income gap is declining with age but not changing with schooling. Although we cannot interpret results on age and schooling as factors of tax evasion, the sign of coefficients on age is consistent with other studies showing that the tax evasion is less likely among older (and risk-averse) workers (e.g., Clotfelter 1983, Andreoni, Erard, and Feinstein 1998). Married individuals are estimated to have a significantly smaller

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<sup>16</sup> We use net savings only in supplementary (not primary) specifications. This measure is not fully adequate for our purposes because increased borrowing primarily goes for the purchases of durables that are excluded from the definition of consumption. If the service flow of durables was available and included into consumption, then expenditures on durables and an increase in financial liabilities are likely to cancel out, leaving the overall consumption-income gap unchanged.

<sup>17</sup> We experimented with other definitions of consumption, such as the one that uses a non-itemized food expenditure variable or the one that includes net change in financial worth (net savings). For these, and other measures, we find similar results which we do not report.

consumption-income gap, which is also likely to reflect their risk aversion.<sup>18</sup> The estimated positive effect of tenure might be due to accumulated additional experience regarding tax evasion opportunities while working at the same job. The coefficient on working at an enterprise (as opposed to being self-employed) is negative and statistically significant, and it is consistent with previous U.S. studies showing that self-employed individuals tend to have higher noncompliance rates (Feinstein 1991, Feldman and Slemrod 2007, Slemrod 2007). Firm size is another important determinant of tax evasion, but previous literature provides mixed evidence. The size effect is found to be positive in the U.S. firm-level studies (Slemrod 2007), but negative for Cameroon businesses (Gauthier and Gersovitz 1997) and positive or negative depending on whether an individual taxpayer in Jamaica works in the private or public sector (Alm, Bahl, and Murray 1990). Our results show that the consumption-income gap is smaller for Russian workers employed in larger enterprises. Since larger firms are subject to more extensive tax-compliance monitoring, workers are less likely to have loopholes in underreporting their incomes. Larger firms also find harder to implement tax evasion schemes with a variety of workers.<sup>19</sup> We also find that the gap is largest for workers in the state sector, which is in line with the finding by Gorodnichenko and Sabirianova Peter (2007a), who show that a greater consumption-income gap in the public sector in Ukraine reflects widespread corruption and bribery of public sector employees.

The most important result is that the consumption-income gap, after being constant prior to 2001, started to continuously decline over time. Table 2, Panel B reports a large and

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<sup>18</sup> This finding is opposite to what typically found in the U.S. literature (e.g., Feinstein 1991, Martinez-Vazquez and Rider 2005, Slemrod 2007). The marriage tax penalty and complex married return are two common explanations for why married individuals in the U.S. are more likely to evade. However, the Russian tax law does not allow for separate tax filing of married people, and the marriage tax penalty does not exist.

<sup>19</sup> The negative tax evasion effect of the firm size could also be linked to the employer size-wage premium literature (Brown and Medoff 1989). Employees of large firms earning a wage premium will have weaker incentives to seek additional employment in the shadow economy.

statistically significant coefficient on the after-reform trend variable indicating an average 6-7% decline in the consumption-income gap per year from 2001 to 2004. This decline by itself is a remarkable finding, although we cannot attribute it solely to the flat tax reform because of the many other factors that occurred at the same time. In the next section, we investigate if the flat tax was responsible for at least some portion of the decline in the consumption-income gap.

Overall, the estimates of the consumption-income gap function are consistent with a tax evasion story and its common determinants. Obviously, tax evasion is a concealed act and therefore we cannot test directly whether the consumption-income gap truly captures (or at least is correlated with) the extent of latent tax evasion. However, we can provide compelling, indirect evidence to support our claim that the consumption-income gap is related to tax evasion. Specifically, one may expect that households are more likely to evade in the local jurisdictions where people are skeptical about whether the majority of the population pays taxes. In 1998 and 2002 (coincidentally before and after the tax reform), the RLMS collected information on attitudes and perceptions about taxes. We construct a district-level measure for the share of individuals who believe that most people don't pay taxes or pay taxes on less than half of their income and use it as an additional regressor in the consumption-income gap function. We find an overwhelmingly strong relationship between the consumption-income gap and average tax perceptions.<sup>20</sup> In the districts where people tend to believe that most people do not pay taxes, households indeed have a larger consumption-income gap (see Table 3). Thus, a consumption-income gap is likely to provide meaningful information about tax evasion at the household level.

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<sup>20</sup> Alm, Martinez-Vazquez, and Torgler (2006) discuss the influence of these perception on taxpayers' tax morale in Russia.

## 5. Tax Evasion Function: Difference-in-Difference Approach

One conclusion that we can draw so far with certainty is that, beginning in 2001, consumption of non-durables and reported income appear to be converging. This convergence could have occurred for multiple reasons, some of which may not be related to the tax reform. For example, the Russian economic growth might have brought a permanent change in the composition of consumption  $\theta$  that is not accounted for by the  $X$  vector. The credit market boom in the 2000s may also have reduced the consumption-income gap by providing incentives to report income in order to obtain a housing mortgage or other credit lines (Gorodnichenko and Sabirianova, 2007b).

The 2001 tax reform by itself was comprehensive and was not limited to the changes in the PIT rates (Ivanova, Keen, and Klemm 2005). Among the most significant tax code changes are i) the replacement of separate contributions to four social funds by the unified social tax paid by employers at the overall reduced rate, ii) abolished rules for multiple job holders to submit tax declarations, iii) a considerably higher 35% rate for income received from gambling, prizes, voluntary insurance contributions and excessive interest in attempt to combat various schemes of tax avoidance, and iv) a new system of tax deductions providing incentives to declare income<sup>21</sup> (Russian Tax Code 2000). Apart from the reduced top marginal rates and the above noted changes in the tax code, the on-going reforms of tax administration might also have contributed to better income reporting.

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<sup>21</sup> The 2000 amendments to the Russian Tax Code allow residents to claim tax deductions for their expenses on education, health care, charitable contributions, housing purchases, and other property-related deductions. The number of declarations claiming tax deductions has been steadily growing at 28% per year for housing deductions, 25% per year for educational deductions, and 58% per year for medical bills over the 2002-2005 assessment years (or 2001-2004 income years). The numbers are computed using the annual results of declaration campaigns from the Federal Tax Department archive, [www.nalog.ru](http://www.nalog.ru).

As a first step of separating the tax evasion effect of reduced marginal rates from other factors, we use the difference-in-difference approach considering those who are affected by the tax reform (higher tax brackets) as a treatment group while those who are not affected (lower tax brackets) as a control group. Although the difference-in-difference method has not yet been applied to the estimation of the tax evasion function, it has been widely used in estimating the response of labor supply and earnings to changes in taxation (Feldstein 1995, Eissa and Liebman 1996). This methodology has been previously applied by Ivanova et al (2005) and Martinez-Vazquez et al (2006) in estimating the effect of the Russian flat tax on after-tax earnings. While the first study did not find a significant effect in the year following the reform, the second study using a longer time span and a regression approach shows a large positive effect of the flat tax on the growth of earnings.

Unlike previous studies, our paper focuses on the tax evasion effect and for the first time applies this methodology to household-level consumption-income data, controlling for changes in the characteristics of the treatment and control groups. In particular, we estimate the following specification:

$$\ln C_{ht} - \ln Y_{ht}^R = \gamma S_{ht} + \beta X_{ht} + \mu d_{ht}^{treat} + \alpha (d_{ht}^{treat} \cdot D_p) + u_h + \varepsilon_{ht}, \quad (4)$$

where  $d_{ht}^{treat} = I(\tau_{ht} < \tau_{ht-1})$  is a dummy variable indicating if the head of the household is in the treatment group (i.e., the group that experiences a decline in marginal tax rates conditional on  $Y_{ht}^*$ ) and  $D_p$  is a dummy variable for the post-reform period 2001-2004.

The difference-in-difference approach is a very attractive tool as it controls for non-tax factors that simultaneously affect control and treatment groups. However, there is a challenging methodological issue that needs to be addressed before applying this method. Since the pre-reform marginal tax rates are correlated with the pre-reform level of current income, there is a

potential source of endogeneity in equation (4) as the dummy variable  $d_{ht}^{treat}$  can be correlated with the error term  $\varepsilon_{ht}$ . Specifically, households can endogenously fall into the treatment group due to their choice of income.<sup>22</sup>

To understand the nature of this potential endogeneity, recall that  $\varepsilon_{ht}$  is the composite error term that originates in the three equations - 1a, 1b, and 1c. The permanent income/life-cycle theory of consumption implies that the last equation (1c) should hold for all marginal tax rates and therefore  $\ln C_{ht} - \ln Y_{ht}^P$  should be uncorrelated with the marginal tax rate faced by household members. However, the left-hand side of equations (1a) and (1b) contains the current income  $Y_{ht}^*$ , on the basis of which households are assigned to the treatment group, thus creating the problem of reverse causality. The second equation (1b) contains a transitory error component that might also be correlated with the marginal tax rate. Unusually high income in one period is not generally consumed immediately. As a result, the large transitory movements in current income can generate the negative serial correlation in  $(\ln Y_{ht}^* - \ln Y_{ht}^P)$ , which can lead to the negative correlation between  $(\ln Y_{ht}^* - \ln Y_{ht}^P)$  and pre-reform marginal tax rates if the rates are positively associated with the pre-reform income (so called “reversion to the mean” problem, see Moffitt and Wilhelm (2000)). We should note, however, that a vast majority of households in the RLMS are liquidity constrained (only a tiny fraction of households report positive savings), and thus transitory income is likely to be consumed at the time it occurs. Fortunately, in addition to actually received earnings, the RLMS provides information on contractual earnings that we can use to create treatment and control groups. Contractual earnings have a much smaller

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<sup>22</sup> The endogeneity problem has been noted by the previous studies of labor supply and earnings responses to tax changes; see Triest (1998), Moffitt and Wilhelm (2000), and Auten and Carroll (1999) for exposition and a survey.

transitory component than the earnings actually received last month, and therefore they are less vulnerable to “the reversion to the mean” problem.<sup>23</sup>

More importantly, the flat tax reform itself provides a unique identification opportunity. Since all people face the same marginal tax rate, the flat rate cannot be correlated with the after-reform reported income. By applying the pre-reform rates to the post-reform income (or counterfactual rates), we can avoid the problem of reverse causality and consistently estimate the effect of reduced tax rates on tax evasion.

There are at least two more reasons why the post-reform income should be used to identify the treatment effect. Even without tax evasion, using pre-reform current income can contaminate the control group with those whose productivity increased due to reduced marginal tax rates.<sup>24</sup> But in the presence of tax evasion, the question of which earnings to use (pre-reform or post-reform) to identify the treatment effect becomes even more crucial. The treatment and control groups defined on the basis of pre-reform earnings will be misspecified since the people who avoid paying taxes prior to the reform are likely to be just below the threshold and would be improperly included into the control group.

We can present this point formally by re-writing equation (4) in first differences and assuming two periods,  $t-1$  and  $t$ , before and after the reform. We have dropped the subscript  $h$  to simplify exposition.

$$\Delta \ln C_t - \Delta \ln Y_t^R = \gamma \Delta S_t + \beta \Delta X_t + \alpha I(\tau_t < \tau_{t-1}) + \Delta \varepsilon_t, \quad (5)$$

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<sup>23</sup> Contractual earnings are defined as the average monthly earnings after taxes over the last 12 months that the employee is supposed to receive regardless of whether or not it was paid on time. Thus, contractual earnings also help to deal with the problem of irregularity of payments and wage arrears. The coefficient  $\alpha$  might be negative if the reform period coincided with a smaller volatility in actual earnings (wage arrears, which were quite prevalent in the earlier years of the transition, started to fall after 1998).

<sup>24</sup> For example, let’s consider a marginal person who earned and reported 50,000 rubles prior to the reform, with 50,000 rubles being a threshold for the lower bracket. This person might have earned more (let say 51,000 rubles) but decided not do so because of higher pre-reform tax rates. With lower rates after the reform, she has incentives to work more and earn 51,000 rubles. Despite the received treatment by the tax reform, this person would be classified as the control group on the basis of pre-reform reported earnings.

where  $\tau_t$  is the flat tax rate in year  $t$  that is independent of income and  $\tau_{t-1}$  is the pre-reform marginal tax rate as an increasing step function of current (reported and hidden) income  $Y^*$ . The relevant treatment group  $I(\cdot)$  consists of households experiencing a decline in the rate that they face (not the rate they decide to pay), defined on the basis of their total after-reform income that is  $\tau_{t-1}(Y_t^*) - \tau_t(Y_t^*) > 0$ . If the flat tax reform has reduced tax evasion, then  $\alpha$  should be negative, *ceteris paribus*.

Because  $Y_t^*$  is not observable, suppose we use the pre-reform reported income to identify treatment and control groups. In this case,

$$\begin{aligned}
\tau_{t-1}(Y_{t-1}^R) - \tau_t(Y_{t-1}^R) &\stackrel{(A)}{=} \tau_{t-1}(Y_{t-1}^R) - \tau_t(Y_t^*) \\
&= \underbrace{\left[ \tau_{t-1}(Y_t^*) - \tau_t(Y_t^*) \right]}_{\text{true treatment}} - \underbrace{\left[ \tau_{t-1}(Y_t^*) - \tau_{t-1}(Y_{t-1}^R) \right]}_{\text{bias}(t-1)} \\
&= \underbrace{\left[ \tau_{t-1}(Y_t^*) - \tau_t(Y_t^*) \right]}_{\text{true treatment}} - \underbrace{\left[ \tau_{t-1}(Y_t^*) - \tau_{t-1}(Y_{t-1}^R) \right]}_{\text{productivity bias}} - \underbrace{\left[ \tau_{t-1}(Y_{t-1}^R) - \tau_{t-1}(Y_{t-1}^R) \right]}_{\text{tax evasion bias}},
\end{aligned} \tag{6}$$

where equality (A) follows from the flat tax in the post-reform period. As equation (5) shows, the treatment group based on pre-reform reported income excludes wage earners that increase productivity and pass the threshold (i.e.,  $\tau_{t-1}(Y_t^*) - \tau_{t-1}(Y_{t-1}^R) \geq 0$ ). In addition, the treatment group also excludes households whose current income is in the upper brackets while the reported income is in the lower bracket (i.e.,  $\tau_{t-1}(Y_{t-1}^R) - \tau_{t-1}(Y_{t-1}^R) \geq 0$ ). These are the households who are most likely to be “treated” by the reduced tax rate. Since the response of the control group is contaminated with the response of the treated group, the difference between control and treatment groups is going to be smaller. As a result, such misspecification will produce an

upward bias in the estimate of  $\alpha$ , implying that the effect of the flat tax reform on tax evasion is less likely to be found.<sup>25</sup>

Now suppose we use the post-reform reported income to identify treatment and control groups. In this case,

$$\begin{aligned} \tau_{t-1}(Y_t^R) - \tau_t(Y_t^R) &\stackrel{(A)}{=} \tau_{t-1}(Y_t^R) - \tau_t(Y_t^*) \\ &= \underbrace{\left[ \tau_{t-1}(Y_t^*) - \tau_t(Y_t^*) \right]}_{\text{true treatment}} - \underbrace{\left[ \tau_{t-1}(Y_t^*) - \tau_{t-1}(Y_t^R) \right]}_{\text{bias}(t)=\text{tax evasion bias}}, \end{aligned} \quad (7)$$

where equality (A) again follows from the flat tax. Note that if we assume that post-reform income is fully revealed (i.e.  $Y_t^R = Y_t^*$ ), then using post-reform income to identify the treatment effect (and treatment/control groups) yields unbiased estimates. In any case, the overall bias in defining the treatment group is smaller when the post-reform income is used:

$$\text{bias}(t-1) - \text{bias}(t) = \left[ \tau_{t-1}(Y_t^*) - \tau_{t-1}(Y_{t-1}^R) \right] - \left[ \tau_{t-1}(Y_t^*) - \tau_{t-1}(Y_t^R) \right] = \tau_{t-1}(Y_t^R) - \tau_{t-1}(Y_{t-1}^R) > 0.$$

Furthermore there should be fewer people affected by the tax evasion bias in year  $t$  because there are no longer incentives for households to cluster just below the threshold, and therefore there would be fewer people whose true current income is above the threshold while their reported income is just below the threshold. All in all the estimate of  $\alpha$  is likely to be upward biased so that even when we use post-reform reported income we *underestimate* the effect of the tax reform.

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<sup>25</sup> To understand the sign of the bias, consider the following hypothetical case. Suppose there is an individual who receives 60,000 rubles before and after the reform (there is no productivity effect), and the reform reduces the marginal tax rate for people with more than 50,000 rubles in annual income. Before the reform, the individual evades taxes and reports only 40,000 rubles in earnings. After the reform, he reports 60,000 rubles. Also, assume that the genuine response of the control group is zero, that is, actual and reported income does not increase for this group because they continue to face the same tax rate. If the pre-reform reported income is used to identify the treatment group, then an individual would fall into the control group. In this case, the response of the control group would be large because taxpayers choose to underreport their income before the reform. It follows that holding everything else constant, the estimated treatment effect would be small because the response of the control group is large.

In our empirical work, we define the treatment group as households whose heads earned more than 3,625 rubles (net of tax and after 1% contributions to the pension fund) last month from all reported jobs at least once after the tax reform. This amount is equivalent to 50,000 rubles of gross annual earnings - an upper threshold for the 12% bracket under the 2000 annual budget law. We report selected statistics describing the treatment and control groups in Appendix Table A1. In short, households in the treatment group are larger and have more children, and the heads of those households are younger, more educated, and more likely to be married and employed than households in the control group. Working heads of households in the treatment group also have less experience with the same employer and tend to work in the private sector and larger firms.

Having defined the treatment and control groups, and having considered possible biases, we estimate equation (4) and report results in Table 4 and Appendix Table A2. We find a large and significant decline in the consumption-income gap for the treatment group after 2000. The estimate of  $\alpha$  is in the range between  $-0.11$  and  $-0.09$ , suggesting that income grew by approximately 9–11% more than consumption, *ceteris paribus*. The estimate of  $\alpha$  is robust to alternative definitions of income and consumption, including the one with net savings reported in Table A2.

Table 5 shows the estimates of  $\alpha$  from several alternative specifications of the treatment group, including specifications that use contractual earnings. The estimates of  $\alpha$  based on contractual earnings are negative and statistically significant, but they are slightly smaller in magnitude than the estimates based on the actual earnings received in the last month. As follows from our earlier discussion of the reversion to the mean problem, the measures of earnings that contain a large transitory component tend to overstate in absolute terms the effect of the

treatment on the consumption-income gap. This is exactly what we find when we compare the estimates based on these two measures of earnings.

We also restrict the sample to the households whose head's implied gross annual earnings are between 4,800 and 100,000 rubles and apply the above definition of the treatment group to the restricted sample. We use the restricted sample to eliminate the differential effect of the regressive unified social tax paid by employers. For each worker in the restricted sample, employers should pay the same 35.6% rate of the unified social tax after 2000. Another benefit of the restricted sample is that the treatment group would have faced the same 20% rate if the pre-reform tax scale had remained after 2000 (the next 30% bracket begins with 150,000 rubles).

According to the earlier Russian tax law, tax brackets were not automatically adjusted for inflation, and thus, an increase in nominal wages could push taxpayers into higher tax brackets. To assess the consequences of inflation adjustment, we apply the same criteria of the restricted sample to the earnings adjusted for inflation in December 2000 prices. The treatment group is also defined after deflating the post-reform income to December 2000 prices. Finally, we add interactions between district dummies (at the county level) and year dummies to control for changes in local characteristics such as the degree of credit market development, enforcement, and other non-tax factors.

Regardless of specifications and definitions of income and consumption, the magnitudes of  $\alpha$  coefficients are large and vary from  $-0.126$  to  $-0.091$  for contractual earnings.<sup>26</sup> Even when we replace the dummy variable for the post-reform period by the post-reform time trend, we obtain a large and statistically significant decline in the consumption-income gap for the

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<sup>26</sup> Pissarides and Weber (1989) adjust their estimates for changes in the volatility of the error term because a log is a non-linear function. We do not make this adjustment because both consumption and income have minimal changes in volatility before and after the reform. For example, after controlling for factors as in (4), the standard deviation of  $\ln C1$  falls by less than 0.001 after the reform.

treatment group over time. The estimates vary from  $-0.044$  to  $-0.031$ . In summary, we find that the households experiencing a decrease in the marginal tax rate have a greater reduction in the consumption-income gap.

To verify that our results make economic sense, we also test if a decline in the consumption-income gap is larger for individuals who are more likely to switch to tax compliance after the tax reform. Only individuals with potentially legitimate labor incomes can reveal their true earnings. For example, it is unlikely that employees in the public sector will disclose the portion of their income that originates from bribes and other forms of corruption, no matter how low tax rates are. At the same time, the majority of employees in the private sector as well as the self-employed can report their earnings since there is often nothing criminal in their labor market activity. Hence, the consumption-income gap should decrease more strongly for the private sector workers than for employees in the public sector.

In addition, Russian private firms have greater incentives to compensate skilled workers who earn greater wages in ways that reduce their wages reported for tax purposes. After the reform the tax pressure is smaller, and hence the consumption-income gap should decline more for skilled than unskilled workers.

To test these two predictions, we modify the baseline specification (4) with additional interaction terms. We report results in Table 5, Panel C. Consistent with theoretical predictions, the decline in the consumption-income gap is largest for private sector employees, and in the private sector white collar workers have the largest decline.

## **6. Tax Evasion Function: Regression Discontinuity Approach**

Although the difference-in-difference approach is a very valuable tool, the estimates might be contaminated by the differential evasion response of treatment and control groups to the

various shocks and policy changes that coincided with the introduction of the flat tax (e.g., tax administration reforms, credit market development, etc). For example, it is plausible to hypothesize that a stronger tax administration and improved tax collection efforts contributed to increased income reporting in Russia. Even though we control for the local differences in tax enforcement via interacting district and year dummies, it is still possible that the negative  $\alpha$  might be attributed in part to collection efforts if tax enforcement focuses primarily on those households who are more likely to be in the treatment group (i.e., high earners). Using the Federal Tax Department archive, we have collected time-series information on tax audits and charges for tax law violations and reported these data in Table 6. The descriptive statistics show ambiguous changes in the work of the tax administration. Some measures favor the tax enforcement argument. For example, both the ratio of received to accrued additional tax payments due to tax audits and the number of blocked bank accounts for tax related violations did increase after 2000. At the same time, the number of on-site tax audits, total amount of charges, and the number of managers and entrepreneurs charged for breaching tax law have declined considerably after year 2000, which could be due, in part, to less tax evasion caused by the tax reform. Unfortunately, the factual differences in the probability and the size of penalties for tax law violations between the treatment and control groups are unknown, so we cannot control for these differences in a regression. As a result if the tax enforcement argument is valid then the difference-in-difference estimate of the flat tax effect could be overstated (in absolute terms).

In addition the difference-in-difference approach assumes that the treatment impacts subjects uniformly, while in practice the strength of the treatment effect may not be homogenous. For example, the response of upper-income households to changes in marginal tax rates can be

different from the response of middle-income households. It is also possible that the subjects are heterogeneous in the ways that are difficult to control for due to unknown specification of functional forms, unobservables, etc.

Discontinuity of marginal tax rates at the known threshold values of income provides an opportunity to use the regression discontinuity (RD) design to assess and validate our results from the difference-in-difference approach. Under certain, relatively mild assumptions this alternative approach can address the issues we discuss above, and provide a consistent estimate of the treatment effect at the point of discontinuity (threshold income). Since subjects just below and just above the threshold as applied to the post-reform income are likely to be similar (e.g., they should have the same probability of being subjected to the tax audit), the treatment effect is less likely to be confounded with other factors. When the subjects are drawn from the same part of the income distribution, and they are minimally different along the dimension that determines whether a subject is treated or not, then one can consider the assignment of treatment as if it is random.

There are several ways one can implement RD estimation. We follow Imbens and Lemieux (2007) and estimate a local kernel regression similar to equation (4). Specifically, we estimate parameters by minimizing

$$\sum_{h=1}^N \omega_{hp} \left\{ \ln C_{ht} - \ln Y_{ht}^R - \gamma S_{ht} - \beta X_{ht} - \mu d_{ht}^{treat} - \alpha (d_{ht}^{treat} \cdot D_p) - u_h - \varepsilon_{ht} \right\}^2, \quad (8)$$

where  $\omega_{hp}$  is a fixed household-specific weight calculated on the post-reform income. For any

year  $t$  in the post-reform period  $p$ , the weight is calculated as  $K\left(\frac{\ln Y_{ht}^R - \ln Y_t^\#}{b}\right) / \sum_{s=1}^N K\left(\frac{\ln Y_{st}^R - \ln Y_t^\#}{b}\right)$ ,

where  $K(\cdot)$  is the Gaussian kernel,  $Y_t^\#$  is the threshold income at which marginal tax rate

changes, and  $b$  is the optimal “plug-in” bandwidth for the Gaussian kernel. The weight is a

function of the distance between the individual post-reform income and the pre-reform threshold value with higher weights given to the observations that are closer to the threshold.

This approach to estimating RD has a number of advantages. First, although we put a small weight on observations distant from the threshold, we can use more information contained in the sample.<sup>27</sup> Second, estimation and inference are straightforward since one can use the standard method of weighted least squares. Third, we can easily control for other factors to further ensure that just-below and just-above samples are balanced along dimensions other than income.

Again, for the same reasons discussed in Section 5, we use the post-reform income in identifying the treatment group and calculating the weights. It is especially important for the RD estimates, which are based on the assumption that the running variable (income) should not have jumps at points where a marginal tax rate changes. This is not the case with the pre-reform income. Figure 1 reveals that reported contractual earnings are clustered just below the threshold value (vertical line) in year 2000, but not in 2001.<sup>28</sup> This clustering prior to the reform could happen because households face the kink in the slope of their after tax income, and their optimal labor supply is a corner solution. In addition, and perhaps more importantly, households may choose to earn more income (above the threshold) but report less just to be located at the point where their reported income is taxed at the minimum rate. In this case we cannot use RD when the treatment/control groups defined on the basis of pre-reform income as the density of the running variable is not continuous.

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<sup>27</sup> Given an optimal bandwidth, taxpayers with income 43% below or above the threshold gross income of 50,000 rubles receive a weight less than 0.01.

<sup>28</sup> Respondents tend to report rounded figures for their incomes, and this can explain spikes in histograms.

We report results in Table 7.<sup>29</sup> Generally, the RD estimates of  $|\alpha|$  are slightly larger than the difference-in-difference (DID) estimates, although the difference between the estimates is not statistically significant. Factors that could have pushed RD estimates up or down relative to DID estimates approximately cancel out. On the one hand, an estimate of  $|\alpha|$  is likely be smaller in RD than in DID if the households that are further away from the threshold (e.g., upper-income taxpayers experiencing the largest drop in the marginal tax rate) are more sensitive to changes in the marginal tax rate. On the other hand, an estimate of  $|\alpha|$  should be bigger in RD if upper-income households respond less strongly than households closer to the threshold. For example, households with high incomes may continue to find it imprudent to report all income as the risk of expropriation by the government or criminals could be so significant that it outweighs the benefits of switching to tax compliance. The net effect of these forces is roughly zero as RD and DID estimates are close to each other.

Similar to the difference-in-difference estimates, the RD estimates based on contractual earnings are somewhat smaller than the estimates based on earnings actually received in the last month. Overall, the RD estimates strongly support our earlier finding that the consumption-income gap fell for the treatment group after 2000.

## **7. Is There a Productivity Effect of Flat Tax?**

Our findings so far indicate a positive effect of the Russian flat tax reform on income reporting relative to consumption. The next question we would like to raise is whether the

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<sup>29</sup> We perform a number of specification checks to verify that assumptions underlying RD are satisfied. The running variable (post-reform income) does not exhibit jumps at points where marginal tax rate changes. The density of post-reform income is continuous in the relevant range. The estimated effect is fairly insensitive to the choice of bandwidth. The estimate of the effect somewhat decreases in absolute value as we shrink the bandwidth. We find little evidence that the consumption-income gap has jumps at the levels of income not associated with changes in marginal tax rates (that is, we do not observe changes in the consumption-income gap at points of income that are not associated with changes in the marginal tax rates).

reform had any real effect on labor productivity.<sup>30</sup> In the presence of tax evasion we cannot answer this question by simply estimating the earnings or earnings growth functions – a common tool for measuring the productivity response of numerous tax reforms in developed countries (e.g., Feldstein 1995, Aarbu and Thoresen 2001). An observed increase in earnings could be due to an actual increase in labor productivity as well as due to better reporting and compliance.

To separate these two effects we look at the consumption side. Given the permanent income hypothesis, changes in consumption should reflect changes in permanent income and hence permanent productivity. After controlling for the windfall gains due to lower taxes the response of consumption to tax changes can capture to what extent people choose to increase their income by supplying more labor services. This would be a genuine effect of the tax reform on the real side of the economy.

In contrast to changes in consumption, changes in reported income consist of the productivity and tax evasion effects. By subtracting the effect of the tax reform on consumption from the effect of the tax reform on reported income we obtain an estimate of how much tax evasion changes.

To control for the unobservables that affect both income and consumption, we estimate income and consumption equations simultaneously using the seemingly unrelated regression (SUR) method. We use the same set of control variables as in equation (4) to make the results comparable to the estimates provided in previous sections. Again, our key parameter is the coefficient on the interaction term between the treatment group and a dummy for the post-reform period. As follows from the SUR properties, if we subtract the estimate of this coefficient in the consumption equation from the one in the income equation we should obtain exactly the estimate

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<sup>30</sup> The productivity response to tax rates is not limited to changes in measurable hours of work but also includes changes in efforts, job reallocation, occupational mobility, etc. (Feldstein 1995).

of  $\alpha$  in the consumption-income gap function shown in Tables 4 and 5. Thus, we can link and compare the previously estimated tax evasion effect with the new estimates of the reform-induced productivity effect.

Table 8 reports the treatment effect estimates from the two systems of simultaneous equations:  $\ln Y_1$  and  $\ln C_1$  as one system, and  $\ln Y_2$  and  $\ln C_2$  as another one.<sup>31</sup> Other combinations of income and consumption equations produce similar results (not reported). The DID estimates provided in Table 8 indicate a large increase in reported income (18–19%) for the treatment group following the tax reform, but there is also a significant (although smaller) increase in consumption (8–9%). As we have explained above, the difference between income and consumption responses provides an estimate of the tax evasion effect, which is about 10–11% according to our full sample estimates (also shown in Table 5). Given these estimates, we reach an immediate, important conclusion that about 55% of the increase in reported after-tax income in the treatment group is explained by the reduced tax evasion.

The RD estimates, however, are smaller for income (10–13%) and close to zero for consumption. Thus, DID and RD methods give a similar estimate of the tax evasion effect but produce different results with respect to consumption gains. We will explain below why there is a discrepancy between the RD and DID estimates.

A decrease in the marginal tax rate creates windfall consumption gains since households will receive more resources simply by paying lower taxes. However, the size of these consumption gains is larger for the average treatment recipient (DID) than for a taxpayer who is near the threshold (RD). Using simple algebra and data on contractual earnings we can calculate

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<sup>31</sup> The full specification of the income and consumption equations,  $\ln Y_1$  and  $\ln C_1$ , is provided in Appendix Table A3.

the size of these gains.<sup>32</sup> The average gain is 4.5% for all taxpayers experiencing a tax cut. Thus, consumption could increase by 4.5% simply because reduced tax rates raise after-tax income even if before-tax income is fixed. After subtracting windfall gains from the consumption response in the DID estimates, we obtain an average 4% response in consumption due to the productivity effect. Interestingly, when we augment the baseline SUR model with the differentiated response of taxpayers in the middle (20%) and top (30%) brackets (Table A4), the response of consumption is approximately 6–7% for the middle bracket and 15–16% for the top bracket (in the case of contractual earnings). After subtracting windfall gains, which are 3.3% in the middle and 10.5% in the top tax brackets, the response of consumption due to increased productivity is between 2.7% and 5.5%.

At the same time, the windfall gains are approximately zero for households who are close to the threshold of 50,000 rubles. For example, the windfall gain for a taxpayer with 50,001 rubles is  $\frac{(50,001-50,000) \cdot 7\%}{50,001} \approx 0.001\%$ . Hence, consumption for these taxpayers can respond only to productivity changes. Our RD estimates of the consumption response have large standard errors, and we cannot reject the hypothesis that the productivity effect is either zero or 4%, which is in agreement with the DID estimates. In our view both RD and DID estimates convey the same message that the productivity effect is quite small while the windfall gains could be the main factor behind increased consumption.

A small productivity effect is consistent with a low elasticity of labor supply which is often estimated to fall between 0.1 and 0.5 for males and between 0.4 and 1.0 for females. If we assume that the elasticity of labor supply is approximately 0.3 and there is a fixed wage rate (i.e.,

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<sup>32</sup> Specifically, we apply the pre-reform tax schedule to the post-reform contractual earnings and compute the counterfactual after-tax earnings. The difference between this counterfactual measure and observed after-tax contractual earnings is the windfall gain. After dividing the windfall gain by the after-tax earnings, we obtain a percentage windfall gain.

wage rate does not vary with labor supply or effort), the implied increase in earnings in the middle bracket should be approximately  $0.3 \cdot 7\% \approx 2.1\%$ . This estimate is in the ball park of the estimates we obtain in the DID and RD analyses.<sup>33</sup>

In summary, the response of after-tax income can be decomposed into windfall gains (4–5%), productivity effect (0–4%), and tax evasion effect (10–11%). Although the reform provided more resources to households and could have increased labor supply, the main effect was improved tax compliance. The government lost some revenue due to lower tax rates, but it gained substantially more revenue from enhanced reporting of income.

## 8. Conclusions

The 2001 Russian tax reform is often considered a landmark success story. Policymakers credit the reform with increased tax revenues and an improved business climate. Indeed, the reform was so triumphant that it was replicated in a number of countries. In this paper we focus on how the implementation of the flat marginal tax rate affected tax evasion, which was, and continues to be, a major problem in Russia as well as many other transition and developing countries. We argue that the reform was instrumental in decreasing tax evasion and that, to a certain extent, greater fiscal revenues are associated with increased tax compliance and reporting.

Since by its nature tax evasion is not directly observable, we use indirect techniques to measure the dynamics of tax evasion. Specifically, we use consumption-income data and economic theory to estimate the effect of the tax reform on tax evasion. The core theoretical

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<sup>33</sup> If we apply a higher elasticity of labor supply, the productivity response would be greater than we observe in our estimates. To reconcile this potential discrepancy, we note that since tax evasion involves a possibility of being caught and punished, households switching to tax compliance can trade a higher tax liability for a lower probability of prosecution. In this situation, households would face lower consumption if they hold income and labor supply fixed. However, they can match the previous level of consumption by supplying more labor services to the market. Consequently, the response of consumption may understate the productivity effect by the amount of consumption that households trade for an “easy life” of tax compliance. It is difficult to come by a precise estimate of this amount, but casual observations of the behavior of Russian households suggest that this amount is likely to be small.

input to this exercise is the permanent income hypothesis under which consumption should be equal to permanent income. Provided that consumption expenditures are fully reported, the discrepancy between the log of consumption and log of income, which we call the consumption-income gap, indicates that households receive unreported income. We employ a variety of econometric techniques and eclectic pieces of evidence to show that the estimates of the consumption-income gap function are in accordance with common tax evasion determinants. More importantly, we find that the consumption-income gap fell considerably after the tax reform.

In attempting to separate the tax evasion effect of flat tax from other factors, we use the difference-in-difference approach and regression discontinuity analysis in various specifications. Regardless of the applied definitions and methods, we show that *ceteris paribus* the consumption-income gap decreased by about 9–12% more for households that experienced a reduction in marginal tax rates. In other words, the treatment effect of decreased marginal tax rates was the increased reporting of income. The flat tax reform had a clear positive effect on compliance.

We also find that the productivity effect of the tax reform is relatively small when compared with the tax evasion effect. Specifically, the productivity effect measured by the relative increase in consumption for households that faced smaller tax rates after the reform is zero at the threshold and about 4% for the treatment group over the four year period. Obviously, this estimate is based on a relatively short sample of four years, and the long run response could be larger. However, in the short run, the gains seem to be concentrated in increased tax compliance.

These results have critically important policy implications. Introducing a flat tax schedule may not lead to significant increases in the tax revenue as labor supply appears to be fairly inelastic (at least for the Russian case). Thus, tax revenues may fall or increase depending on elasticities. However, if the economy is plagued by ubiquitous tax evasion (as was the case in Russia) then the short term fiscal gains from the reform can be substantial enough that the reform can be self-financing (i.e., the government does not have to borrow to cover a possible decline in revenue).

The paper also offers several contributions to the tax evasion literature. First, we provide strong evidence of the relationship between (lower) tax rates and (lower) tax evasion. Until now, this has been an ambiguous issue in the tax evasion literature. Second, the paper offers an empirical methodology of estimating the response of income tax evasion and productivity to changes in tax rates. This methodology can be replicated in many other countries as long as a longitudinal household budget survey is available, and there have been significant changes in the tax structure.

We do not analyze the effect of the flat tax reform on inequality. Although this is a highly important issue, it will require much more space than is available in this paper. Here we simply note that measures of income and consumption inequality have exhibited a downward trend since the flat tax reform of 2001. We leave this and other issues for future research.

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**Table 1: Russian Economy Before and After the Tax Reform**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Nominal GDP, bln.	1585.0	2200.2	2585.9	2741	4767	7302	9041	10830.5	13243.2	16966.4	21598.0
real growth, %	-4.1	-3.5	0.8	-4.9	5.4	9.0	5.0	4.7	7.3	7.2	6.4
Budget deficit (-), bln.	-49.1	-94.2	-127.9	-155	-44	138	265	97	174	760	1759
Nominal tax revenues, bln.	353.3	464.3	593.4	524.8	891.4	1481.9	1955.8	2331.0	2671.9	3299.6	4627.2
real growth, %	...	-9.9	11.1	-25.4	-1.5	20.7	13.3	3.0	0.6	4.7	15.7
Nominal tax revenues from PIT, bln.	36.7	56.7	75.6	72.2	117.1	174.3	255.5	357.8	455.3	574.2	706.6
real growth, %	...	6.0	15.9	-19.4	-5.9	8.1	25.8	21.1	11.7	6.9	1.6
% of tax revenues	10.4	12.2	12.7	13.8	13.1	11.8	13.1	15.3	17.0	17.4	15.3
Top marginal PIT rate	30	35	35	35	45	30	13	13	13	13	13

**Sources:** Finances in Russia 2000, Russian Statistical Yearbook (2004), Federal Tax Department website ([www.nalog.ru](http://www.nalog.ru)).

**Notes:** All tax revenues are for the consolidated budget and exclude non-budgetary funds. Real growth of GDP and tax revenues is calculated using a GDP deflator.

**Table 2: Tax Evasion Function, FE**

	<b>lnC1-lnY1</b>	<b>lnC2-lnY1</b>	<b>lnC1-lnY2</b>	<b>lnC2-lnY2</b>
<i>Panel A</i>				
N of HH members	-0.010 (0.013)	-0.033** (0.013)	0.018 (0.013)	-0.005 (0.013)
N of senior HH members, 60+	-0.210*** (0.021)	-0.200*** (0.021)	-0.180*** (0.021)	-0.169*** (0.022)
N of children in HH, 18-	0.088*** (0.022)	0.076*** (0.021)	0.034 (0.021)	0.023 (0.021)
Year = 1998	-0.026 (0.021)	-0.025 (0.021)	-0.026 (0.021)	-0.025 (0.021)
Year = 2001	-0.142*** (0.018)	-0.139*** (0.018)	-0.140*** (0.018)	-0.137*** (0.018)
Year = 2002	-0.221*** (0.018)	-0.213*** (0.018)	-0.216*** (0.018)	-0.208*** (0.018)
Year = 2003	-0.208*** (0.018)	-0.203*** (0.018)	-0.217*** (0.018)	-0.213*** (0.018)
Year = 2004	-0.268*** (0.018)	-0.262*** (0.018)	-0.265*** (0.018)	-0.260*** (0.019)
<i>HH head characteristics</i>				
Age	-0.004*** (0.001)	-0.004*** (0.001)	-0.002** (0.001)	-0.001* (0.001)
Years of schooling	-0.006 (0.004)	-0.004 (0.004)	-0.007* (0.004)	-0.005 (0.004)
Married	-0.093*** (0.023)	-0.087*** (0.023)	-0.060*** (0.023)	-0.053** (0.022)
Currently works	-0.298*** (0.052)	-0.278*** (0.052)	-0.151*** (0.050)	-0.130*** (0.050)
Years of tenure	0.003** (0.001)	0.003*** (0.001)	0.002* (0.001)	0.002** (0.001)
Works at enterprise	-0.076* (0.044)	-0.083* (0.044)	-0.081* (0.042)	-0.089** (0.043)
Works in private sector	-0.105*** (0.021)	-0.105*** (0.021)	-0.085*** (0.021)	-0.084*** (0.021)
Log (firm size)	-0.020*** (0.006)	-0.019*** (0.006)	-0.016*** (0.006)	-0.015*** (0.006)
N observations (households)	24129 (6135)	24129 (6135)	24723 (6202)	24723 (6202)
R <sup>2</sup> overall	0.05	0.04	0.03	0.03
<i>Panel B</i>				
After reform trend (2001=1)	-0.067*** (0.005)	-0.066*** (0.005)	-0.066*** (0.005)	-0.065*** (0.005)

**Notes:** Robust standard errors are in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%; omitted categories are the year 2000 and the state sector. HH denotes household. Household head is the person with the largest income. The dependent variable - consumption-income gap - is defined in the text. Besides the after-reform trend, the model estimated in Panel B includes the same set of covariates as in Panel A. Two dummy variables for missing sector and firm size are included but not shown here.

**Table 3: Consumption-Income Gap and Attitudes toward Taxes, 1998 and 2002**

	<b>lnC1-lnY1</b>	<b>lnC2-lnY1</b>	<b>lnC1-lnY2</b>	<b>lnC2-lnY2</b>
Perception of tax payments (at the district level)	0.266*** (0.102)	0.254** (0.101)	0.359*** (0.101)	0.348*** (0.101)
Year = 2002	-0.172*** (0.021)	-0.161*** (0.021)	-0.170*** (0.021)	-0.160*** (0.021)
N observations	7539	7539	7806	7806
R <sup>2</sup>	0.09	0.07	0.05	0.04

**Notes:** Robust standard errors are in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Household head is the person with the largest income. The dependent variable - consumption-income gap - is defined in the text. Perception of tax payments is a district-level measure for the share of individuals who believe that most people don't pay taxes or pay taxes on less than half of their income. Besides perception of tax payments, the model includes the same set of covariates as in Table 2.

**Table 4: Tax Evasion Function: Difference-in-Difference Approach, FE**

	<b>lnC1-lnY1</b>	<b>lnC2-lnY1</b>	<b>lnC1-lnY2</b>	<b>lnC2-lnY2</b>
N of HH members	-0.016 (0.014)	-0.037*** (0.014)	0.014 (0.014)	-0.007 (0.014)
N of senior HH members, 60+	-0.181*** (0.026)	-0.173*** (0.026)	-0.159*** (0.025)	-0.152*** (0.026)
N of children in HH, 18-	0.087*** (0.022)	0.077*** (0.022)	0.034 (0.022)	0.024 (0.022)
Year = 1998	-0.020 (0.026)	-0.016 (0.026)	-0.028 (0.026)	-0.025 (0.026)
Year = 2002	-0.073*** (0.021)	-0.068*** (0.021)	-0.072*** (0.020)	-0.066*** (0.020)
Year = 2003	-0.076*** (0.020)	-0.073*** (0.020)	-0.080*** (0.020)	-0.077*** (0.020)
Year = 2004	-0.136*** (0.021)	-0.129*** (0.021)	-0.128*** (0.020)	-0.120*** (0.020)
<i>HH head characteristics</i>				
Age	-0.004*** (0.001)	-0.003*** (0.001)	-0.002** (0.001)	-0.001 (0.001)
Years of schooling	-0.007 (0.005)	-0.006 (0.005)	-0.010** (0.005)	-0.009* (0.005)
Married	-0.070*** (0.026)	-0.071*** (0.026)	-0.031 (0.025)	-0.030 (0.025)
Currently works	-0.293*** (0.053)	-0.277*** (0.053)	-0.158*** (0.051)	-0.142*** (0.051)
Years of tenure	0.002* (0.001)	0.002* (0.001)	0.001 (0.001)	0.002 (0.001)
Works at enterprise	-0.083* (0.044)	-0.084* (0.044)	-0.081* (0.042)	-0.083* (0.043)
Works in private sector	-0.100*** (0.021)	-0.099*** (0.021)	-0.085*** (0.021)	-0.083*** (0.021)
Log (firm size)	-0.019*** (0.006)	-0.018*** (0.006)	-0.014** (0.006)	-0.013** (0.006)
After reform dummy ( $D_p$ )	-0.103*** (0.031)	-0.104*** (0.031)	-0.106*** (0.031)	-0.107*** (0.030)
$d^{treat} \times D_p$	-0.109*** (0.032)	-0.108*** (0.032)	-0.105*** (0.032)	-0.102*** (0.032)
N observations (households)	17081 (4174)	17081 (4174)	17444 (4184)	17444 (4184)
R <sup>2</sup> overall	0.06	0.05	0.04	0.04

**Notes:** Robust standard errors are in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%; omitted categories are the year 2000 and the state sector. HH denotes household. Household head is the person with the largest income. The dependent variable - consumption-income gap - is defined in the text. The treatment group is defined on the basis of post-reform unadjusted for inflation monthly earnings received in the last month. The sample includes households whose head is a wage earner (in contrast to Table 2 that is based on the full sample). Two dummy variables for missing sector and firm size are included but not shown here.

**Table 5: Treatment Effect in the Difference-in-Difference Approach**

Alternative Specifications	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
<i>Panel A. Upper brackets × after reform dummy (<math>D_p=1</math> if 2001-2004)</i>				
Actually received earnings				
Full sample	-0.109*** (0.032) [17081]	-0.108*** (0.032) [17081]	-0.105*** (0.032) [17444]	-0.102*** (0.032) [17444]
Restricted sample in current prices	-0.104*** (0.033) [15672]	-0.103*** (0.033) [15672]	-0.097*** (0.032) [15998]	-0.095*** (0.032) [15998]
Contractual earnings				
Full sample	-0.095*** (0.032) [17287]	-0.091*** (0.032) [17287]	-0.101*** (0.031) [17684]	-0.096*** (0.031) [17684]
Restricted sample in current prices	-0.102*** (0.032) [16068]	-0.098*** (0.032) [16068]	-0.100*** (0.031) [16434]	-0.095*** (0.031) [16434]
Restricted sample in fixed prices	-0.124*** (0.031) [16610]	-0.126*** (0.031) [16610]	-0.116*** (0.031) [16984]	-0.116*** (0.031) [16984]
Restricted sample with <i>district × year</i> interactions	-0.114*** (0.033) [16068]	-0.105*** (0.033) [16068]	-0.101*** (0.033) [16434]	-0.092*** (0.033) [16434]
<i>Panel B. Upper brackets × after reform time trend (<math>t_p=1</math> if 2001)</i>				
Actually received earnings				
Full sample	-0.038*** (0.010)	-0.036*** (0.010)	-0.034*** (0.010)	-0.032*** (0.010)
Restricted sample in current prices	-0.039*** (0.010)	-0.037*** (0.010)	-0.034*** (0.010)	-0.032*** (0.010)
Contractual earnings				
Full sample	-0.033*** (0.010)	-0.031*** (0.010)	-0.034*** (0.009)	-0.032*** (0.009)
Restricted sample in current prices	-0.038*** (0.010)	-0.035*** (0.010)	-0.035*** (0.009)	-0.033*** (0.009)
Restricted sample in fixed prices	-0.041*** (0.009)	-0.040*** (0.009)	-0.036*** (0.009)	-0.035*** (0.009)
Restricted sample with <i>district × year</i> interactions	-0.044*** (0.010)	-0.039*** (0.010)	-0.039*** (0.010)	-0.035*** (0.010)
<i>Panel C. Upper brackets × after reform dummy (<math>D_p=1</math> if 2001-2004) × Sector (contractual earnings, full sample)</i>				
$d^{treat} \times D_p$ (State sector is omitted)	0.001 (0.053)	-0.017 (0.053)	-0.014 (0.051)	-0.030 (0.052)
$d^{treat} \times D_p \times$ Private	-0.229*** (0.081)	-0.192** (0.081)	-0.236*** (0.079)	-0.201** (0.079)
$d^{treat} \times D_p \times$ Private (Blue collar workers are omitted)	-0.111 (0.104)	-0.073 (0.105)	-0.133 (0.102)	-0.097 (0.102)
$d^{treat} \times D_p \times$ Private × White collar	-0.302** (0.126)	-0.308** (0.127)	-0.295** (0.125)	-0.297** (0.125)

**Notes:** Robust standard errors are in parentheses and the number of observations is in brackets; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. The dependent variable - consumption-income gap - is defined in the text. Reported are the estimated coefficients on the interaction term between the treatment group (upper brackets) and a post-reform dummy (or trend in Panel B) using different measures of earnings and samples. All specifications are estimated with household fixed effects and include the same set of variables as in equation (4) and Table 4. The number of observations in panels B and C is the same as in Panel A.

**Table 6: Tax Enforcement in Russia Before and After the Tax Reform**

	1999	2000	2001	2002	2003
<i>Tax Audits</i>					
Accrued tax revenues from tax audits and sanctions, bln. Rubles	189 <sup>c</sup>	283	274	220.6	261
Of which received, bln. rubles	30.5	41.6	59.7	68.7	NA
Number of on-site audits, thousands	796	690	605	468.2	331.9
Number of on-site audits of individual entrepreneurs, thousands	759 <sup>c</sup>	664	415	222.9	124.1
Accrued tax revenues from on-site audits, bln rubles	49.7	75	68.4	NA	47.7
of which received, bln rubles	20.3	21	17.8	NA	NA
<i>Charges for Tax Law Violations</i>					
Administrative charges against enterprise managers, thousands people	329	350	312	186	NA
Administrative charges against individual entrepreneurs, thousands people	480	510	289	96	NA
Total amount of charges, millions rubles	195	247	255	150	NA
Number of blocked bank accounts, thousands	172	256	344	408	NA
Number of cases sent to the tax police for further investigation, thousands	NA	14.4	17	13.4	9.5
Of which number of criminal cases opened, thousands	1.3	3.2	4	2.6	1.1

**Source:** Federal Tax Department archive ([www.nalog.ru](http://www.nalog.ru)); c – calculated from percentage changes reported in 2000.

**Table 7: Treatment Effect in the Regression Discontinuity Approach**

Alternative specifications	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
Actually received earnings	-0.120** (0.048)	-0.120** (0.048)	-0.123*** (0.048)	-0.123** (0.048)
N observations (weighted)	16909	16909	17261	17261
R <sup>2</sup> overall	0.11	0.11	0.09	0.08
Contractual earnings	-0.098** (0.047)	-0.095** (0.047)	-0.109** (0.046)	-0.108** (0.045)
N observations (weighted)	17180	17180	17571	17571
R <sup>2</sup> overall	0.11	0.10	0.08	0.07

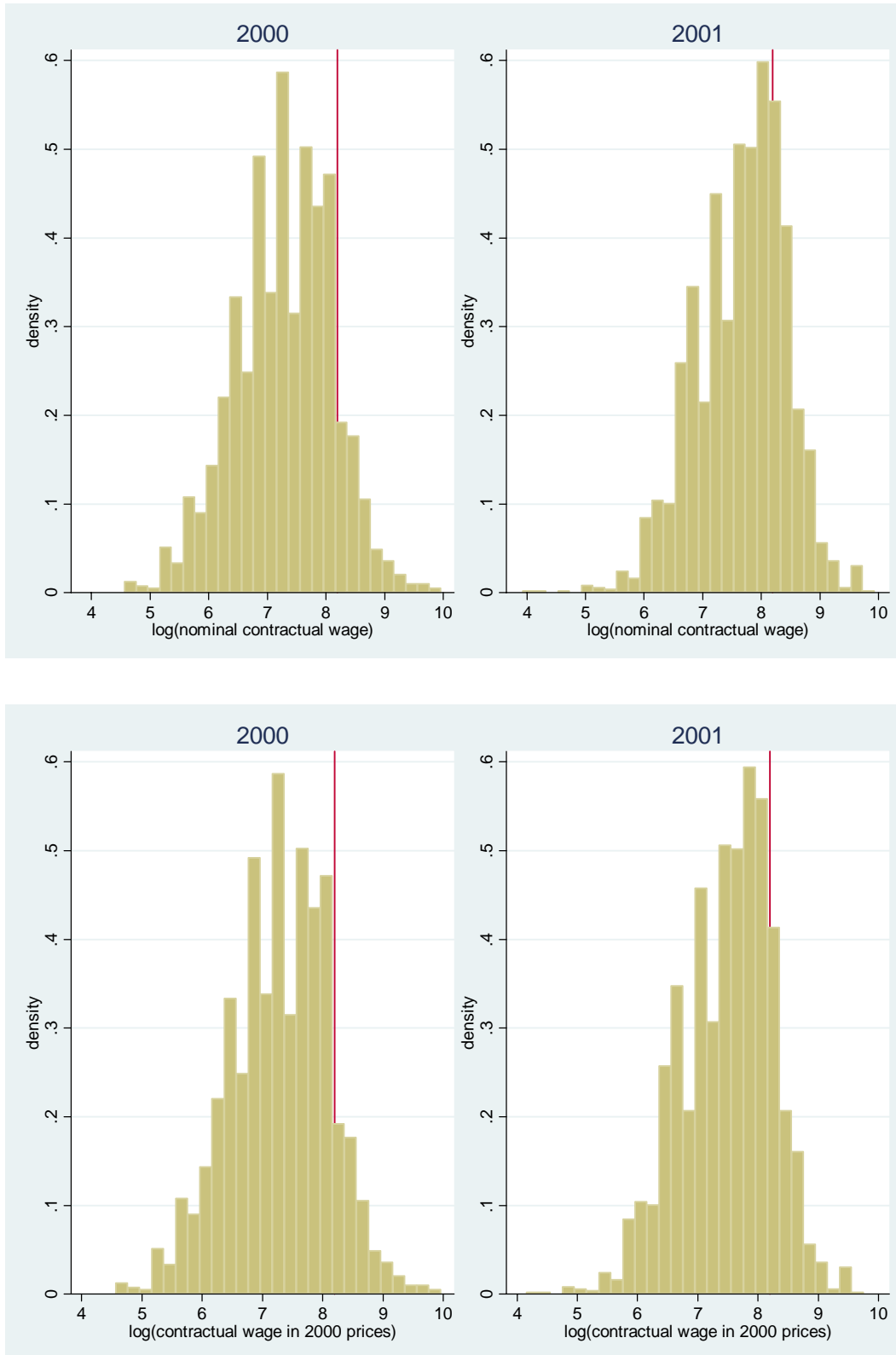
**Notes:** Robust standard errors are in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. The dependent variable - consumption-income gap - is defined in the text. Reported are the estimated coefficients on the interaction term between the treatment group (upper brackets) and a post-reform dummy. All specifications are estimated by weighted least squares with household fixed effects, and include the same set of variables as in equation (4) and Table 4. The RD approach produces the same estimates for both full and restricted samples because observations beyond the restricted sample have zero weights.

**Table 8: Tax Evasion vs. Productivity Effects**

Alternative specifications	lnY1	lnC1	lnY2	lnC2
	<i>Difference-in-difference</i>			
Actually received earnings	0.189*** (0.024)	0.080*** (0.017)	0.188*** (0.023)	0.087*** (0.017)
N observations	17081	17081	17444	17444
R <sup>2</sup> overall	0.23	0.18	0.21	0.17
Contractual earnings	0.175*** (0.023)	0.080*** (0.017)	0.184*** (0.023)	0.088*** (0.017)
N observations	17287	17287	17684	17684
R <sup>2</sup> overall	0.22	0.18	0.21	0.17
	<i>Regression discontinuity</i>			
Actually received earnings	0.101*** (0.025)	-0.019 (0.019)	0.106*** (0.024)	-0.017 (0.019)
N observations	16909	16909	17261	17261
R <sup>2</sup> overall	0.25	0.20	0.24	0.19
Contractual earnings	0.117*** (0.023)	0.018 (0.018)	0.130*** (0.023)	0.022 (0.018)
N observations	17180	17180	17571	17571
R <sup>2</sup> overall	0.26	0.21	0.25	0.20

**Notes:** Robust standard errors are in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Reported are the estimated coefficients on the interaction term between the treatment group (upper brackets) and a post-reform dummy. All specifications are estimated on the full sample with household fixed effects and include the same set of variables as in equation (4) and Table 4. The estimates are obtained from the two systems of simultaneous equations: a) lnY1 and lnC1 and b) lnY2 and lnC2.

**Figure 1: Income Distribution Below and Above the Threshold**



**Table A1: Summary Statistics**

	All	Treatment Group	Control Group
C1	6459 (5990)	7494 (6198)	4299 (4871)
C2	6918 (6738)	8025 (7088)	4610 (5240)
C3	6226 (13275)	7192 (15302)	4210 (7027)
Y1	6439 (7131)	7858 (8066)	3479 (2868)
Y2	7313 (12382)	8839 (14479)	4128 (4560)
N of HH members	3.089 (1.323)	3.182 (1.288)	2.894 (1.373)
N of senior HH members, 60+	0.331 (0.611)	0.291 (0.579)	0.416 (0.664)
N of children in HH, 18-	0.829 (0.862)	0.859 (0.845)	0.767 (0.892)
Age	42.261 (14.115)	40.834 (13.065)	45.238 (15.673)
Years of schooling	11.864 (2.638)	12.227 (2.466)	11.107 (2.820)
Married	0.583 (0.493)	0.615 (0.487)	0.515 (0.500)
Currently works	0.832 (0.374)	0.881 (0.324)	0.731 (0.444)
N1	17081	5535	11546
Years of tenure	8.074 (9.373)	7.766 (9.069)	8.850 (10.058)
Works at enterprise	0.930 (0.255)	0.929 (0.256)	0.933 (0.251)
Works in state sector	0.439 (0.496)	0.398 (0.489)	0.542 (0.498)
Works in private sector	0.449 (0.497)	0.493 (0.500)	0.337 (0.473)
Log (firm size)	3.354 (2.749)	3.501 (2.823)	2.986 (2.517)
N2	14218	4045	10173

**Notes:** All income and consumption measures are in December 2002 prices. HH denotes household. Household head is the person with largest earnings. N1 includes the same households as in column 1 of Table 4 whose head was employed at least once after the reform. N2 includes only those households whose head is currently employed in any given year.

**Table A2: Tax Evasion Function with Net Savings: Difference-in-Difference Approach, FE**

	<b>lnC3-lnY1</b>	<b>lnC3-lnY2</b>
N of HH members	-0.046*** (0.015)	-0.011 (0.015)
N of senior HH members, 60+	-0.139*** (0.028)	-0.121*** (0.027)
N of children in HH, 18-	0.075*** (0.024)	0.020 (0.024)
Year = 1998	-0.036 (0.027)	-0.045* (0.027)
Year = 2002	-0.053** (0.022)	-0.049** (0.022)
Year = 2003	-0.041* (0.022)	-0.043* (0.022)
Year = 2004	-0.094*** (0.022)	-0.085*** (0.022)
<i>HH head characteristics</i>		
Age	-0.004*** (0.001)	-0.001 (0.001)
Years of schooling	-0.008 (0.005)	-0.010** (0.005)
Married	-0.046* (0.028)	-0.002 (0.027)
Currently works	-0.266*** (0.057)	-0.130** (0.055)
Years of tenure	0.003** (0.001)	0.002 (0.001)
Works at enterprise	-0.052 (0.048)	-0.057 (0.046)
Works in private sector	-0.070*** (0.023)	-0.053** (0.023)
Log (firm size)	-0.022*** (0.006)	-0.017*** (0.006)
After reform dummy ( $D_p$ )	-0.112*** (0.033)	-0.108*** (0.032)
Upper brackets* $D_p$	-0.089*** (0.034)	-0.090*** (0.034)
N observations (households)	16640 (4153)	16783 (4163)
R <sup>2</sup> overall	0.04	0.02

**Notes:** Robust standard errors are in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%; omitted categories are the year 2000 and the state sector. HH denotes household. Household head is the person with the largest income. The dependent variable - consumption-income gap - is defined in the text. The treatment group is defined on the basis of post-reform unadjusted for inflation monthly earnings received in the last month. The sample includes households whose head is a wage earner (in contrast to Table 2 that is based on the full sample). Two dummy variables for missing sector and firm size are included but not shown here. C3 includes consumption of non-durables, transfer payments, and net changes in financial worth (net savings).

**Table A3: Tax Evasion vs. Productivity Effects, Full Specification**

	Difference-in-difference		Regression discontinuity	
	lnY1	lnC1	lnY1	lnC1
N of HH members	0.214*** (0.010)	0.198*** (0.007)	0.242*** (0.010)	0.204*** (0.007)
N of senior HH members, 60+	0.069*** (0.020)	-0.110*** (0.015)	0.045** (0.019)	-0.121*** (0.015)
N of children in HH, 18-	-0.140*** (0.016)	-0.047*** (0.012)	-0.174*** (0.015)	-0.062*** (0.011)
Year = 1998	-0.224*** (0.019)	-0.245*** (0.014)	-0.238*** (0.017)	-0.292*** (0.013)
Year = 2001	0.154*** (0.016)	0.077*** (0.012)	0.130*** (0.015)	0.100*** (0.011)
Year = 2002	0.239*** (0.016)	0.159*** (0.012)	0.223*** (0.015)	0.167*** (0.011)
Year = 2003	0.344*** (0.016)	0.203*** (0.012)	0.317*** (0.015)	0.217*** (0.012)
<i>HH head characteristics</i>				
Age	0.002*** (0.001)	-0.002*** (0.000)	0.003*** (0.001)	-0.002*** (0.000)
Years of schooling	0.009*** (0.004)	0.002 (0.003)	0.009*** (0.003)	0.005* (0.002)
Married	0.182*** (0.019)	0.105*** (0.014)	0.158*** (0.018)	0.116*** (0.013)
Currently works	0.434*** (0.038)	0.144*** (0.027)	0.447*** (0.036)	0.195*** (0.027)
Years of tenure	-0.002** (0.001)	-0.000 (0.001)	-0.002** (0.001)	-0.000 (0.001)
Works at enterprise	0.054* (0.032)	-0.031 (0.023)	0.115*** (0.030)	-0.021 (0.023)
Works in private sector	0.150*** (0.017)	0.055*** (0.012)	0.137*** (0.016)	0.028** (0.012)
Log (firm size)	0.026*** (0.005)	0.007** (0.003)	0.023*** (0.004)	0.010*** (0.003)
After reform dummy ( $D_p$ )	0.153*** (0.022)	0.041** (0.016)	0.172*** (0.023)	0.041** (0.018)
Upper brackets* $D_p$	0.175*** (0.023)	0.080*** (0.017)	0.117*** (0.023)	0.018 (0.018)
N observations (households)	17287	17287	17180	17180
R <sup>2</sup> overall	0.22	0.18	0.26	0.21

**Notes:** Robust standard errors are in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. All specifications are estimated on the full sample with household fixed effects and include the same set of variables as in equation (4) and Table 4. The estimates are obtained from the system of two simultaneous equations lnY1 and lnC1. Two dummy variables for missing sector and firm size are included but not shown here. The treatment group is defined on the basis of post-reform, unadjusted for inflation contractual earnings.

**Table A4: Tax Evasion vs. Productivity Effects**

Alternative specifications	lnY1	lnC1	lnY2	lnC2
	<i>Actually received earnings</i>			
Upper brackets* $D_p$	0.139*** (0.025)	0.052*** (0.018)	0.136*** (0.025)	0.059*** (0.018)
30% top bracket* $D_p$	0.212*** (0.033)	0.120*** (0.024)	0.225*** (0.032)	0.119*** (0.024)
N observations	17081	17081	17444	17444
R <sup>2</sup> overall	0.23	0.18	0.21	0.17
	<i>Contractual earnings</i>			
Upper brackets* $D_p$	0.141*** (0.024)	0.063*** (0.018)	0.145*** (0.024)	0.070*** (0.018)
30% top bracket* $D_p$	0.182*** (0.036)	0.091*** (0.026)	0.207*** (0.036)	0.093*** (0.027)
N observations	17287	17287	17684	17684
R <sup>2</sup> overall	0.23	0.18	0.21	0.17

**Notes:** Robust standard errors are in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Reported are the estimated coefficients on the interaction of a post-reform dummy with the two upper brackets and the 30% top bracket. All specifications are estimated on the full sample with household fixed effects and include the same set of variables as in equation (4) and Table 4. The estimates are obtained from the two systems of simultaneous equations: a) lnY1 and lnC1 and b) lnY2 and lnC2.